Handbooks of Sociology and Social Research

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# Handbook of Environmental Sociology

Springer

# Handbooks of Sociology and Social Research

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# Handbook of Environmental Sociology

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# Introduction: A Twenty-First Century Public Environmental Sociology

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Beth Schaefer Caniglia, Andrew Jorgenson, Stephanie A. Malin, Lori Peek, and David N. Pellow

Welcome to the *Handbook of Environmental Sociology*. This volume offers a comprehensive overview of environmental sociology, while also endeavoring to expand the public relevance of the field. Given the fundamental and timely lessons of environmental sociology, we are excited to share the major findings of leading scholars working in this area. As a whole, their research provides a roadmap to help us navigate this moment of great global uncertainty, marked by climate change and disaster, natural resource depletion, pandemic, and record levels of economic inequality. The chapters presented here focus on communicating the major insights of environmental sociology, while also setting a future research agenda and an action-oriented approach to inform readers how to use environmental sociology's major lessons to help support pathways to more sustainable, just, and democratic futures. This work is relevant for public policy, people's lives, and the well-being of all species.

Formally established in 1976 with the creation of the American Sociological Association (ASA) Section on Environmental Sociology, the subdiscipline has matured and evolved over the decades (for overviews see, Buttel, 1987; Catton & Dunlap, 1978; Dietz et al., 2020; Dunlap & Michelson, 2001; Pellow & Brehm, 2013). Environmental sociology has grown from a series of conversations and debates among a relatively small group of scholars in the U.S. to its present status as a diverse and vibrant global community producing new knowledge, training new generations of students and professionals, and inspiring action across multiple scales (Legun et al., 2020a, 2020b; Redclift & Woodgate, 2010; White, 2004). Through the years, the subfield has increasingly influenced researchers, policy makers, and civil society on every continent and in every sector (Laska, 1993).

Environmental sociology has grown by leaps and bounds, with scholars producing impactful research that appears in leading generalist and interdisciplinary journals and as research monographs published by prestigious university presses. The subdiscipline has experienced remarkable internal growth, while simultaneously

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creating and strengthening bridges with other subfields within sociology such as criminology, sociology of development, women and gender studies, racial and ethnic studies, collective behavior and social movements, and global and transnational sociology. Equally important, great strides have been made to bring environmental sociology into interdisciplinary conversations concerning the study of socio-environmental relationships—aligning environmental sociologists with scholars and researchers working in public health, epidemiology, climate science, political science, geography, anthropology, urban planning, law, civil engineering, and various other scientific and applied disciplines and fields (Jorgenson et al., 2019).

Environmental sociology courses are now regularly taught at the undergraduate and graduate level at colleges and universities around the world as part of disciplinary curricula. They are also offered as foundational courses for interdisciplinary programs, such as environmental studies and sustainability studies. As global and regional environmental crises continue to unfold, and youth take a leading role in advocating for climate justice, demand for these classes only continues to rise.

## Broader Contributions

This *Handbook of Environmental Sociology* brings together a spectrum of emerging scholars and leading thinkers in the field to present chapters that define the contours and further push the boundaries of environmental sociology. As editors, we asked the contributors to provide historical, theoretical, and methodological context for their chapters. This means that we encouraged authors to look to the past to help identify what is already well established. This process has clarified gaps and allowed the authors to envision what issues, questions, and needs will be most pressing in the future.

We convened a group of contributors whose work and outlooks are broad and deep to ensure that each chapter provides a thorough, yet concise, overview of the selected topic, along with a richly textured understanding of the nuances of the subject area. In this way, this volume will serve as an overview and introduction for students of the field, as well as an insightful treatment that experts can use in their own research and publications.

In working with the authors to develop their chapters, we were especially interested in advancing areas of environmental sociology that offer the most generative frameworks for explaining and responding to today's pressing socio-environmental problems. What sets this volume apart from most environmental sociology collections is our emphasis on much-needed interventions that respond to the environmental impacts of social inequalities. To achieve this goal, authors have identified various social fault lines—such as those based on race, class, gender, and geographic location—that often translate into environmental conflict and deepen pre-existing injustices. From there, many of the contributors have begun to advance what Prasad (2018) refers to as a vision for problem-solving sociology.

From the outset, our collective goal has been to provide an overview of environmental sociology that takes significant heed of the nexus of environmental degradation and structural inequality. The importance of inequality and power is a central theme across much of the discipline of sociology. However, environmental sociology has tended to relegate attention to inequality to the subfield to environmental justice or the study of disasters or climate change. In this volume, we have endeavored to unify scholarship that examines the role of inequality at multiple scales across the realm of environmental sociology. As such, readers will find chapters that focus not only on the ways that racial, ethnic, gender, and other positionalities predict personal environmental outcomes, but also on how organizations, institutions, and socio-ecological systems channel environmental harms and benefits. This emphasis is intentional, and we hope this collection will provide guidance to public and private sector decision-makers who wish to foster justice and equity—which are necessary to advance sustainability goals—in the communities and organizations that they lead. We also believe

these chapters will be helpful to members of the public who are engaged in these issues, or who wish to become so.

This collection is further distinguished by its emphasis on the implications and elements of praxis that can lessen or resolve environmental problems through addressing their biophysical, political-economic, and socio-cultural causes and outcomes. In that regard, this book reflects our commitment not only to policy-relevant sociology, but to *public sociology*. When he was President of the ASA, Michael Burawoy et al. (2004: 104) defined public sociology as a "sociology that seeks to bring sociology to publics beyond the academy, promoting a dialogue about issues that affect the fate of society, placing the values to which we adhere under a microscope." Three decades earlier, Alfred McClung Lee served as the ASA President and wrote that "The great challenge of social science is the development and wide dissemination of social wisdom. . ." (Lee, 1973: 6). Given the enormity of what is at stake for humankind and the Earth—with regard to anthropogenic climate change in particular and environmental risks across a wide spectrum—the importance of sharing sociological knowledge with the public is paramount to all of our survival. The recent global COVID-19 pandemic and the asymmetric social impacts has brought that point into sharp and deadly relief.

Extending Burawoy and Lee's ideas, one of our goals with this volume is to help promote a new form of public environmental sociology. While environmental sociology has experienced measured success in influencing policy makers and within academic circles, we aim for this volume to begin making the sub-field even more accessible to members of the public, so that the research can influence public discourses and inform policy (also see Jorgenson, 2018; Picou, 2008). Why not see environmental sociologists consulted on the nightly news alongside economists and legal analysts, for example? Or consider, why aren't environmental sociologists tapped to lead major environmental agencies? Sociologists have the methodological skill sets, theoretical lenses, and institutional knowledge that could help inform public opinion and shape broader policy making. If we are to move toward more resilient futures, this century will need to see not just more scholarly publications from environmental sociologists, but more scholarly leadership in major social and institutional spheres of influence. The work included in this volume can facilitate reasoned and evidence-informed choices that can advance collective social and environmental well-being.

This volume also features writings that will appeal to a multidisciplinary audience. While almost all of the authors are sociologists by training, most of them have extensive experience working across disciplinary borders with scholars from a range of other fields both within and outside the social sciences. Many of the environmental issues identified in this *Handbook* require the collaboration of multidisciplinary or interdisciplinary teams working from a convergence research framework to fully characterize and respond to the threats at hand (Peek et al., 2020b). Another hallmark of this book is that we have brought together scholars who are used to traversing a wide range of epistemologies, methodologies, and ontologies which is also a hallmark of sociology and the social sciences more broadly (Frailing & Brown, 2020; Peek et al., 2020a). In other words, we've assembled a group of scholars whose contributions reflect a rich diversity of concepts, theories, ways of knowing, and research approaches.

The author lineup purposely includes a mix of more seasoned academics as well as rising next generation scholars in the field. Regardless of career stage, however, all have made important contributions in their particular area, or areas, of environmental sociology. The chapters in this volume were peer-reviewed by leading experts, and one or more editors helped to shepherd each chapter through the process. In the end, many people contributed generously to the content in this volume.

## Major Themes Across Chapters

The *Handbook* speaks to several themes in sociology that are of enduring interest and part of

emerging areas of scholarship. We grouped the chapters into four thematic areas: (1) Inequality, Political Economy, and Justice; (2) Climate, Energy, and Health; (3) Culture, the State, and Institutions; and (4) Population, Place, and Possibilities. We offer an overview of each of these themes, in turn, below. It is important to note, however, that while these themes provide an organizational framework for the edited volume, they are certainly not mutually exclusive. Rather, they are meant to be broad and cross-cutting, since many of the chapters transcend multiple themes. All, however, exist at the nexus of sociology and the study of the environment.

## Part I: Inequality, Political Economy, and Justice

The first section offers theoretical and methodological alternatives to explore drivers and impacts of environmental issues that remain under examined. Traditionally, much environmental studies scholarship has focused on the ways individual choices and behaviors, combined with cultural practices, produce strains on our ecosystems. While those factors clearly play a role in environmental outcomes and change, they often overlook the importance of *sociological systems* and especially the ways that *social and structural inequality* play foundational roles in shaping environmental harms, environmental injustices, and potential solutions. This section considers such systems and inequalities while also exploring markets, states, and other political-economic structures that condition environmental outcomes as well as considerations of just transitions.

In this section the chapters consider, for example, how indigeneity, race, class, gender, and other social categories place individuals and entire groups of people at greater risk of exposure to a range of environmental threats. The chapters also interrogate how global political-economic conditions and structural relationships between societies can lead to the unequal distribution of environmental harms. Moreover, the chapters highlight methodological approaches that have allowed for rich micro-interactional as well as macro-structural analyses of the environment (also see Marquart-Pyatt et al., 2015).

In their Intersectionality and the Environment chapter, Ergas, McKinney, and Bell weave together major lessons from across social science perspectives, including critical race theory, feminist political ecology, and Indigenous studies, to showcase "the myriad ways in which social location, privilege, and disadvantage intersect to create very different effects on and experiences of the natural environment within society." They advocate for future sociological scholarship to more meaningfully recognize intersecting forms of inequality.

In their chapter on Environmental Justice, Maung and Pellow review the field's rich history of multidisciplinary scholarship; its consistent links to advocacy research, community-based research methods, and grounded activism and action; and the multiple threads of equity that comprise environmental justice. The authors identify how the field can become even more inclusive, intersectional, and critical through nuanced analyses of power, social inequality, and social difference. They also argue that change will be made possible through stronger linkages to a range of social and racial justice movements.

Givens and Huang, in their chapter on Ecologically Unequal Exchange and Environmental Load Displacement, provide a systematic overview of how global production and trade networks can create and maintain substantial environmental inequalities between nations. In addition to summarizing past theoretical and empirical work, they highlight future directions for research that could enrich these perspectives while leading to a greater understanding of the complex relationships between the world-economy and vast socio-environmental inequities.

In their chapter on Consumption, Rieger and Schor explore the value and implications of centering consumption in environmental sociology, which has generally placed far greater emphasis on the effects of industrial production and government activity on the environment. They report on a wide range of studies that reveal the numerous ways in which unequal household

consumption patterns around the globe produce harm to ecosystems, and they consider the evidence concerning pathways toward sustainable consumption.

In their chapter on corporations and the roles they play in environmental degradation, Pulver and Manski chart a course that pushes beyond the Treadmill of Production and Ecological Modernization approaches, which remain two dominant frameworks within environmental sociology. Findings from organizational theory, political sociology, and economic sociology suggest that corporations' impacts on the environment are augmented by states, markets, and societal dynamics that define the limits and freedoms accorded to corporations—which, importantly, vary widely in their contributions to environmental degradation.

In their chapter on Just Transitions, Kojola and Agyeman provide an historical overview of the demand for equity in the transition to more sustainable economies. An emerging consensus observes that the green economy transition favors the existing capitalist class and stands to perpetuate and potentially deepen existing inequalities without intentional interventions. The authors conclude by examining these issues in the questionable likelihood of achieving an equitable "Green New Deal."

## Part II: Energy, Climate, and Health

The second section features chapters that tackle a range of pressing issues related to energy access, risk and disaster, and health disparities rooted in environmental disparities. Contributors engage with the ways that myriad sources of energy and other material inputs to industrial systems and societies impact ecosystems and people—often in highly uneven ways. Our bodies, institutions, communities, economies, nation-states, and the world-system are all reliant on sources of energy that are taxed and distributed unsustainably and unjustly. These processes result in vastly uneven environmental and human health costs and impacts on local and global ecosystems. As with all sections of this *Handbook*, social inequalities play a significant role in the distribution of harms and privileges associated with political-economic systems. Fortunately, those inequalities also offer opportunities for scholars, policymakers, and members of the public to think more productively about how to center the experiences of economically and socially marginalized groups when addressing 'wicked problems' like global climate change that drive increased risk and more disaster losses.

Malin, Mayer, and Harrison call for a formal Sociology of Energy in their chapter, observing that the absence of a coherent sociological approach to the study of energy is paradoxical given energy's central role in our societies and lives. This chapter ties together energy-related topics interspersed through the environmental sociology literature. The authors focus on issues of power and inequality in studies of fossil fuels and nuclear energy systems, as well as renewables.

Cordner's chapter on Risk distills major definitions of risk, theoretical approaches, and policy-related outcomes—all while recognizing that risk is socially constructed and deeply contested. Cordner argues that definitions of risk mirror society's power dynamics, wherein institutions that generate risks often control the very definitions of what is, and is not, "safe." The chapter envisions how environmental sociologists can more meaningfully incorporate social and environmental justice concerns into research on risk by attending to questions of scale, welcoming transdisciplinary scholarship, and focusing on social responses to risk.

After providing a thorough review of sociology's contributions to understanding socio-cultural dynamics of climate change, Falzon, Roberts, and Brulle elaborate on the need for further analyses of just transitions, the role of multi-level governance, and the impacts of social movements and other non-state actors in the climate change and energy policy arenas. They call for a more intentional public environmental sociology, which supports tenure and promotion policies that recognize public sociology and reward scholars for building collaborative relationships with policymakers as well as

practitioners in non-governmental organizations (NGOs), think tanks, and other relevant institutions.

Sociologists have been systematically researching the root causes and social consequences of disasters since the late 1940s. In their chapter on the Sociology of Disasters, Peek, Wachtendorf, and Meyer describe why sociologists study extreme events, what this work has revealed regarding human behavior during times of crisis and collective upheaval, and how disasters reflect the existing social order but also may serve to change it. They conclude by offering recommendations for advancing the field of disaster research in an ever more turbulent and unequal world.

In their chapter on Environmental Factors in Health, Wilder and Brown illustrate how health is multi-level, multi-scalar, and deeply tied to social disparities and power dynamics. They focus on major threads of environmental health research related to chemical exposures and identify paths forward for environmental sociologists to more systematically incorporate environmental health and public sociology goals.

Taylor, in her chapter on Food Insecurity, suggests that researchers need to examine the innovative places where people find food in order to understand community agency, assets, and strengths. While food insecurity is associated with access to traditional food sources, such as grocery stores, Taylor shows how schools, community gardens, foodbanks, and many other sources of daily food intake have been overlooked in current food security research.

## Part III: Culture, the State, and Institutions

In the third section, the contributors grapple with questions related to structure and agency, culture, and institutions. While these chapters engage with contemporary issues and modern social problems, they also reach deep into the roots of the discipline to inform their arguments regarding long-standing issues in terms of human-environment connections and broader social structural conditions. Three of the founders of sociology—Karl Marx, Emile Durkheim, and Max Weber—had much to say about conflicts and functions related to religion, crime, organizations, and capitalism in shaping and reflecting social values, hierarchies, and opportunities for societal stability versus transformation. The chapters in this section build on foundational theoretical debates and push us into radically different territory through their careful consideration of the environment. Indeed, the contributors offer compelling ways to rethink these core sociological topics from an environmental perspective, while reflecting the diverse conceptual, theoretical, and methodological advances of twenty-first century environmental sociology.

Kalof and Whitley, in their chapter on Animals in Environmental Sociology, ask readers to engage with a perspective of "thinking from the animal," an orientation that invites others to consider the ever-present significance of nonhumans in human society. While environmental sociology has emphasized relationships between humans and the 'natural' world—and even worked to problematize that division—until recently, limited work has extended that examination to more-than-human animals. This chapter serves as an important corrective.

From the time the discipline was established, sociologists have focused on social facts and struggled to make sociological sense of how humans generate meaning, values, and beliefs about the sacred and the profane. Hempel, in her chapter on Religion and the Environment, illuminates this area of inquiry through her exploration of religious worldviews, practices, and expressions and their intersections with social and ecological systems. Her chapter illustrates the powerful role that multiple religious traditions have played in shaping contemporary environmental action and, in turn, how environmentalism has influenced faith communities.

In their chapter on Environmental Governance, Fisher, Jasny, Redmond, and Heaume tackle the longstanding question regarding the role of the state in lessening environmental degradation while expanding access to environmental benefits. Drawing on their extensive research in

this area, their chapter offers new methodological approaches for studying the role of the state in shaping environmental outcomes.

Lynch, Stretesky, and Long illustrate the power of merging two major sociological subdisciplines—environmental sociology and criminology—in their chapter on Green Criminology. Their work extends an invitation to environmental sociologists to consider how political-economic and class structures shape the legal system's responses, or lack thereof, to ecologically destructive activity.

In their chapter on War and the Environment, Lengefeld, Hooks, and Smith trace environmental sociologists' interrogations of links between environmental destruction, inequity, and acts of war and other large-scale organized violence over time. They invite more rigorous scholarship going forward, identifying gaps in this area of research and especially places where sociologists can examine internal logics or variations in how war is organized. They also invite readers to consider war's socio-ecological outcomes across space and time.

## Part IV: Population, Place, and Possibilities

The book's fourth and final section highlights scholarship that is revolutionizing the way social scientists think about pivotal concepts and debates in the field. These chapters are concerned with changing population dynamics, and spatial and temporal relationships between humans and our varied political-economic systems. They also consider the social and ecological implications of technological and scientific changes, and interrogate the complexities inherent in how governments and civil society organizations address environmental challenges. The work represented in this section has been critical to the growth and influence of environmental sociology, and the discipline of sociology more generally. These chapters, as with several of the others in the volume, represent the power and possibility of multi- and interdisciplinary approaches to problem generation, theory, and method. They also highlight how the groups often most susceptible to environmental harms have responded to risk and chronic disaster through activism meant to advance more ecologically resilient and socially equitable futures.

In their chapter on Environmental Demography, Hunter and Simon focus on three core demographic processes—fertility, mortality, and migration. They illustrate how human population dynamics are both key drivers and outcomes of environmental change. Throughout, they offer poignant examples of the utility of the sociological perspective regarding issues of inequality, sociocultural context, and environmental perceptions in shaping population-environment connections.

Rudel details the most important land use changes of the past century in his chapter on Land Use and Land Use Change. Drawing extensively from Polanyi's foundational writings on double movements, Rudel illustrates how the turmoil and environmental abuse from various land use changes led to a countervailing set of changes aimed at protecting landscapes, both in remote frontier forests of the Global South and in peri-urban settings in the Global North.

In their chapter on Structural Human Ecology (SHE), Dietz and York provide a far-reaching summary of this 'evolving theory group', or network of linked papers and scholars who share common concerns. The chapter summarizes six themes within SHE: advancing evolutionary thinking, connecting the micro and the macro, using risk as a framework for considering environmental and sustainability issues, examining the tension between reform and transformation, thinking about all drivers of change in consort, and taking account of non-humans.

In their chapter on Environmental Science and Technology Studies, Frickel and Arancibia identify common ground between two subdisciplines often marked by tensions and rifts: environmental sociology and science and technology studies. The authors aim to strengthen materialist frameworks for understanding the interactions between human societies and the more-than-human world.

In their chapter, Toward an Indigenous Environmental Sociology, Norgaard and Fenelon offer a bold and ambitious proposal to move environmental sociology toward a deeper, more direct, and ethical engagement with the field of Indigenous Studies. The authors contend that this will only be possible through directly confronting our scholarly and institutional entanglements with histories and contemporary practices associated with genocide, colonialism, and conquest of Indigenous people.

Johnson and Burke's chapter on Environmental Movements in the United States considers the historical origins and evolution of environmental movements in the nation's history. The authors delve into the broad sociological significance of these movements with respect to their influence on the state, markets, culture, and environmental outcomes.

In the book's final chapter, Caniglia and Mayer review three frameworks where systems approaches can advance environment, equity, and economic prosperity. They review the scholarship on sustainability, resilience building, and regenerative approaches and argue that, without a systems approach, all three are likely to fail to achieve their proposed goals.

## Insights and Intended Impacts

This collection advances environmental sociology by identifying new theoretical lenses for understanding social processes that influence environmental outcomes, new methodological approaches for studying the environment, and new frontiers for exploration. Throughout, the chapters focus attention on the effects of power and inequality in shaping socio-environmental problems and solutions. They also demonstrate that as the field of environmental sociology has expanded, so too has its theoretical and methodological pluralism.

Each chapter draws on the cumulative knowledge generated through the work of environmental sociologists across various areas of inquiry. The authors in this volume assess where key paths forward exist and highlight the bridges that need to be built or traversed. The chapters also help advance a vision of public environmental sociology by identifying the ways the subdiscipline can contribute to ongoing policy debates and public discourses. In this way, we invite readers to actively engage with the scientific knowledge and prescriptions offered in every chapter.

Ultimately, we hope this volume illuminates the rich science conducted by environmental sociologists and that this information can be utilized to deepen and expand our field's evidence base and public presence (Blau & Iyall Smith, 2006; Piven, 2007). Environmental sociologists and their collaborators have generated knowledge that can inform everything from local land use planning to global climate adaptation strategies. With each new human-caused environmental disaster, the public is reminded of just how high the stakes are when multiple, layered socio-environmental risks are not attended to in a timely and just manner.

The collective findings of environmental sociology, highlighted so thoughtfully by the authors in this volume, suggest that structural changes over time have accumulated advantage toward traditionally privileged groups, leaving Indigenous people, communities of color, children, the elderly, single women, and people of the global South to bear the burden of environmental pollution, pandemics, climate change, and disasters.

The data suggest that local and regional policies have great potential to correct these inequities, due to the sense of community and common destiny shared at the state and local levels (Agyeman, 2008; Caniglia, 2018; Warner, 2002). Local authorities have emerged as significant leaders in efforts to develop equitable and sustainable climate policies, often going beyond ecological solutions to incorporate initiatives that address broader urban and peri-urban infrastructure such as transit-oriented development, affordable housing, access to health care, public green spaces and the importance of rural spaces. As the chapters illustrate, environmental sociologists can and should provide guidance to local leaders in their efforts to create communities that are not only sustainable, but desirable and equitable

places to live (Agger, 2007; Burawoy et al., 2004; Burawoy, 2005; Gans, 1989; Nickel, 2013). This is the promise and possibility of a public environmental sociology that is problem-focused and solutions-based.

Yet, even in light of their importance, for many and varied reasons, such discussions have typically remained within the confines of journals, conferences, and academic debates that include mostly environmental sociologists. Part of making sociology more relevant to the public involves offering rigorous and firm assessments about where to go next and how to use our scientific findings. This can feel risky, particularly for social scientists trained to make prescriptions sparingly (Fox, 2018), especially when they involve highly charged and politicized topics. The findings from environmental sociology, however, implicate our current economic, political, and cultural systems in creating, or at least helping to sustain, some of the most serious social and environmental problems in contemporary societies (Pellow, 2019), from massive economic inequality, to political instability, to existential crises such as global climate change and lack of biodiversity (Ciplet et al., 2015; Kolbert, 2015). We have a moral and ethical responsibility to share environmental sociology's insights—they are critical for informing and institutionalizing change during this moment of planetary peril.

Suggesting changes to our current inequitable political and economic systems remains perhaps the most difficult terrain to explore. Still, one theme echoed across multiple chapters is that our current society is designed in a way that puts human and natural capital in service to the prevailing economic system. An important assumption that justifies the dominance of the market system is that the market will favor functional system-wide outcomes, including outcomes that support human and ecological wellbeing (see Caniglia & Frank, 2017; Malin, 2015). That assumption has consistently proven itself incorrect (Dietz et al., 2012; Jorgenson, 2014; Mazur & Rosa, 1974; Roberts et al., 2020), and the resulting market prominence has in fact increased human and ecological suffering—as many chapters in this volume showcase.

Economic, environmental, and social injustices are powerfully linked through common structural dimensions of society, and are often experienced by individuals and entire groups, further concentrating privilege and disadvantage throughout the lifecourse and across generations (Fothergill & Peek, 2015; King & McCarthy, 2009; Korgen et al., 2011; Nyden et al., 2012; Pellow, 2017, 2019). Put plainly, environmental sociologists should use our rigorous findings to challenge the current economic status quo and the suffering experienced each day by billions of people globally (Piven, 2007). This problem-focused and action-oriented convergence approach to research (Peek et al., 2020b) is as relevant as ever, as proposals emerge for sweeping changes amidst the global pandemic, uprisings over racial and economic injustice, global climate change, and the necessary just transitions begin from fossil fuel-based economies. Public environmental sociology can help express and amplify the most equitable and resilient paths for just transitions, macro-level responses to catastrophes such as the COVID-19 pandemic, large-scale economic impacts of global climate change, and increasingly intense disasters.

Part of this next big step involves advocacy research and scholar-activist models where we can retain our scientific legitimacy while also creating a robust environmental public sociology. As environmental justice scholar Shrader-Frechette (2002) reminds us, we can be objective without being neutral in the face of deep injustices.

We see environmental sociologists standing at a crossroads with different paths that we could follow: We can help put out the flames of a world on fire. We can stand there counting the rate at which the fire burns. Or we can prevent the fire from starting in the first place. In the fleeting time we have left to build more equitable and just social systems, we strongly advocate for the third path. We would prefer to use our robust

and rigorous science to prevent the flames, using the tools of our social science to become the mitigation practitioners who help to avert the crisis in the first place and to ultimately build something better. This is why we suggest so strongly the need for public environmental sociology. This book will be a core part of our toolkit for change.

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# Part I

# Inequality, Political Economy, and Justice

# Intersectionality and the Environment

2

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## Introduction: What Is Intersectionality?

Given the breadth, depth, and duration of prominent developments in intersectionality scholarship and its relevance to themes of environmental inequality, it is encouraging that intersectional analyses are becoming more widely used by environmental sociologists. Over the past several decades, rich empirical work has demonstrated the connections between social inequalities and ecological degradation, making clear the importance of analyzing environmental problems through an intersectional lens (e.g., Bullard, 1990; Mohai et al., 2009; Morello-Frosch & Lopez, 2006; Pellow, 2018). Although intersectionality research did not originally center on human-and-environment relations, in recent years, scholars have begun to weave together environmental justice and gender-and-environment frameworks to create deeply intersectional socioecological theory (Gaard, 2017; Malin & Ryder, 2018; Pellow, 2018). Taken together, this diverse body of work illustrates the myriad ways in which social location, privilege, and disadvantage intersect to create very different effects on and experiences of the natural environment within society.

An intersectionality framework generally considers interlocking systems of oppression, such as—but not limited to—race, gender, class, sexuality, ethnicity, nationality, indigeneity, ability, religion, species, scale, and rural/urban as well as Global South/North divides. Since the term *intersectionality* was coined by legal scholar Kimberlé Crenshaw in 1989, intersectional analyses have been incorporated into many different disciplines and subdisciplines. Intersectionality is widely understood to be one of the most central theories to feminist traditions and has even been described as women's studies' "most important contribution" to date (McCall, 2005: 1771), though it emerged from both feminist and critical race traditions (Luft & Ward, 2009). As defined by Davis (2008), intersectionality is the "interaction between gender, race, and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power" (p. 68). Kimberlé Crenshaw's seminal works on Black women's employment experiences (Crenshaw, 1989) and violence against women of color (Crenshaw, 1991)

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articulated how women of color are "erased" when the focus of inquiry takes place along a "single categorical axis," such as race *or* gender *or* class (Crenshaw, 1989: 140). When examining gender discrimination, for instance, the focus tends to be on race-privileged (white) and class-privileged (middle-to-upper income) women. Likewise, when the inquiry is targeting racial discrimination, the focus is typically on gender-privileged (men) and class-privileged people of color (Ibid). Such analyses are incomplete and inaccurate, because they ignore the significant differences in the experiences of those who are "multiply-burdened" by race, gender, and class inequalities (Ibid).

Since Crenshaw's original conceptualization, the theory of intersectionality has expanded to examine and articulate the varied experiences of power and oppression from different social locations beyond—but still including—race, gender, and class. By examining the numerous other "axes" of difference (Yuval-Davis, 2006), scholars have sought to understand the disparate ways that inequality and privilege can "intersect" in individuals' lives to create very different vulnerabilities, opportunities, and outcomes within the same political, economic, and environmental circumstances. In other words, intersectional approaches to scholarship reveal how "inequalities do not act independently of one another" (Pellow, 2018: 37). Furthermore, systems of power and privilege can also intersect to reinforce each other. As Pellow (2018) argues, "racism, heteropatriarchy, classism, nativism, ableism, ageism, [and] speciesism (the belief that one species is superior to another)" intersect in ways that maintain and strengthen "systems of individual and collective power, privilege, and subordination" (2018: 19).

The importance of intersectionality to understanding the causes and consequences of environmental problems can be seen in a number of bodies of literature, including gender and development, ecofeminism, feminist political ecology, postcolonial feminism, Indigenous studies, and research on environmental justice. These linking theoretical traditions share the perspective that environmental practices cannot be separated from social relationships and inequities. Although there are some differing research considerations and preferred methods among these scholarly strands, the prominent divisions appear mostly as matters of theoretical lineage and emphasis. For example, environmental justice work has its origins in civil rights and environmental movement frames (Čapek, 1993; Taylor, 2000) and tends to emphasize race and class. Postcolonial studies, on the other hand, center on Global North and South asymmetry and power differences among nations, while ecofeminists tend to place gender oppression at the center of analysis. These divisions are eroding; however, we feel it is important to acknowledge the ways in which these foundational perspectives have contributed to a robust intersectional scholarship on the environment.

In the sections that follow, we first present the trajectories and insights of each of these foundational theoretical perspectives. Next, we turn to a discussion of why intersectional analyses are important for studying the causes and consequences of environmental problems. Then, we include some thoughts about areas ripe for expansion, as the field would benefit from a deeper incorporation of marginalized perspectives. Finally, we examine the theory-driven methodological considerations of intersectional research on the environment. We conclude by acknowledging the challenges in doing intersectional research.

## Intersectional Socioecological Theoretical Traditions

### Gender and Development

Within the environment and development literature, an emphasis on gender emerged in the late twentieth century and has continued to gain prominence (see e.g., Boserup, 1970; Resurrección, 2013). Women's involvement in environmental conservation (such as the Chipko movement by peasant women in India to protect trees) gave rise to various efforts aimed at articulating women's roles in protecting the

planet. Building on the momentum of the United Nations Decade for Women, the Women's Environment and Development Organization (WEDO) sponsored the World Women's Congress for a Healthy Planet in 1991. The Women's Action Agenda 21 was created during this event in preparation for the 1992 UN Conference on Environment and Development. Frequently cited as a momentous entry-point for feminism into international discussions of environmental change, the goals articulated by Women's Agenda 21 have received inconsistent recognition in subsequent initiatives.

In particular, the most transformative recommendations—such as addressing the roots of environmental degradation within the capitalist, militaristic, and industrial impulses of the global economy—have been neglected. Dilution of these larger visions within the "women, environment, and development" framework has resulted in a narrow focus on individuals, rather than systems, and has been critiqued for its essentialist tendencies and failure to scrutinize the structural underpinnings of gendered environmental discourse. The role of feminism in discussions surrounding global environmental change has since evolved to more recent iterations of ecofeminism and feminist political ecology. This shift was accompanied by a broader focus on gender as an institution and social system that structures power relations as well as new emphases on the macro- (e.g., globalization, colonization) and micro-level (e.g., environmental management, local institutions) processes that shape women's experiences with the environment (Gaard, 2015).

## Ecofeminism and Feminist Political Ecology

Spanning a wide range of disciplines as well as scholarly, practitioner, and activist realms, ecofeminism and feminist political ecology are important frameworks for understanding the connections between gender, environment, and development. With origins in geography, feminist political ecology scholars are interested in how geopolitics and political-economic contexts shape local peoples' gendered access to natural resources, land tenure, property rights, and collective action (Elmhirst, 2011; Rocheleau, 2015; Rocheleau et al., 1996). Ecofeminist research engages similar concerns but developed from different origins. Work in the ecofeminist and feminist political ecology traditions are inherently intersectional—insofar as they identify differences across women who are shaped by gendered and racialized histories of colonialism and imperialism—and have made notable contributions to intersectional scholarship (Elmhirst, 2011; Gaard, 2015; York & Ergas, 2011). However, the formal incorporation of intersectionality as a theoretical and analytical tool has only blossomed in recent years (see e.g., Godfrey, 2012). Incorporating an intersectionality lens is a powerful addition as it explicitly theorizes the interconnectedness of heteropatriarchal, class-elite, and white-supremacist power structures linking the domination of women and Indigenous peoples to the domination of nature, while also acknowledging the differential effects generated at the intersections of the multiple axes of inequality discussed above. In doing so, intersectional analyses avoid a "one size fits all" approach to addressing environmental crises by bringing attention to the particular political, economic, cultural, and social contexts in which they are embedded.

Originating in the 1970s, ecofeminism emerged from the intersection of feminist, environmental, and activist thought. The term itself was coined by the French writer Françoise d'Eaubonne (1974) in her book *Le Féminisme ou la Mort.* At its inception, some advanced what is deemed an "essentialist" or romanticized interpretation of the linkages connecting women to nature (e.g., Daly, 1978); however, these tendencies soon gave way to a more social-constructivist perspective. There is no "one version" of ecofeminism to which all ecofeminists adhere; rather, there are a number of variants, including socialist ecofeminism, cultural ecofeminism, and radical ecofeminism (Warren, 1990). What all versions of ecofeminism *do* share is the stance that the oppression of women is deeply and

critically connected to the domination of nature and that solutions to environmental problems must incorporate feminist perspectives.

Ecofeminist scholar Vandana Shiva (1988) coined the term "maldevelopment" to emphasize the deleterious consequences of globally hegemonic, Western ideologies of progress and development. Promoted by global elites, these views exemplify unwavering faith in techno-scientific approaches to ecological management and cavalier dismissal of Indigenous and traditional expertise. Wary of techno-scientific solutions to environmental crises, ecofeminism and feminist political ecology frameworks unmask the political and economic motivations that stall progress towards sustainability. For example, the tendency for environmental crises to be cast as a "population problem" (see e.g., Ehrlich & Ehrlich, 2013) unfairly places blame on female-sexed bodies residing in poor nations, while failing to address the disproportionately greater contributions to environmental destruction stemming from capitalist production, Western patterns of consumption, and global corporate practices (Terry, 2009). Thus, an ecofeminist reading of population concerns uncovers the ways in which efforts to control women's bodies deflect attention away from the most significant culprits of environmental harm.

Others in this tradition reveal the ways in which techno-scientific solutions often exacerbate existing inequalities and generate new hazards (Mies & Shiva, 1993; Shiva, 2015). The industrialization of agriculture with its increased reliance on capital and technology-intensive practices such as fertilizers, pesticides, and genetically-modified seeds is characteristic of this framework, which is deemed rapacious by feminists who observe the companion environmental, social, and economic devastation wrought in poor nations. For example, the introduction of chemical fertilizers to address soil infertility reinforced global hierarchies and dependency dynamics the world over, while introducing localized problems of water pollution and land toxicity (i.e., agricultural runoff) that are disproportionately consequential for those at the margins of society. Similarly, Shiva (2015) argues that carbon trading schemes that apply market logic to the global atmosphere by treating it as a tradeable commodity are eco-imperialist concoctions that reinforce the global economic order, worsen worldwide gaps of inequality, and exacerbate the very climate crisis they purport to alleviate.

Some ecofeminists critique the interests of global elites as expressed through the exploitative processes of global capitalism, focusing on the relationships between natural resource extraction and Indigenous peoples' as well as women's regenerative labor (Dunaway, 2014; Salleh, 2010). Specifically, Salleh (2010) integrates the invisible and most marginalized class of laborers into a larger critique of capitalism. She emphasizes the regenerative, reproductive work that subsidizes the capitalist economy, which she terms as meta-industrial labor. This is the unpaid work from caregivers, peasants, and Indigenous gatherers that propels socioecological metabolism, has rift-healing properties, and sustains metabolic value. Gendered divisions of labor, particularly the care-work and provisioning that mostly women do in the household, perpetuate unequal relations (Ergas, 2014). Dunaway (2014) adds how the false analytic divide between reproductive and productive labor conveniently erases women from economic accounts. Anthropocentric economic measures of value, like use value (or material utility), and exchange value (or market worth), do not account for a flourishing ecosystem that is the basis of life itself. Salleh (2010) argues that debt and unequal exchange are part of capitalism's "social rift"--generating properties (p. 211). She maintains that capitalism owes a social debt to exploited workers, who experience a social rift by giving their lives and labor to capitalist production. Further, capital is ecologically indebted to global peasants and Indigenous groups who have lost their land and livelihoods in the face of industrial development (Salleh, 2010).

These facets, coupled with advances to embrace a fully intersectional understanding of the gendered nature of environmental discourse, place ecofeminism and feminist political ecology at the forefront of feminist interventions

addressing environmental crises. However, it is important to acknowledge that the theoretical development of feminist political ecology and ecofeminism is deeply indebted to the work of postcolonial feminist scholars, who have long challenged Western feminists to reflect on their Eurocentric standpoints, which discursively turned women of the Global South into unidimensional victims of globalization. It is to that formative work that we now turn.

## Postcolonial Feminism and Indigenous Studies

Postcolonial feminist scholarship centers the lingering effects of colonialism and the extant influence of Western imperialism on "racialized gender constructions within and across geopolitical locales" (Go, 2018; Minh-Ha, 1989; Narayan, 1997; Roshanravan, 2014; Spivak, 1988). In part conceptualized as a critique of Eurocentric, hegemonic, Western feminisms, feminist scholars of the Global South have noted the homogenizing and essentializing tendencies of Western feminist writings that describe women of the Global South as weak, victimized, and traditional. As Chandra Mohanty (1984, 2004) notes, through these writings, the typically Western author and referent in these cases is implicitly cast as educated, decisive, and modern. She argues that framing Global South women as victims of patriarchy, colonialism, development, and oppressive cultures and religions ironically reifies the same paternalism that Western feminists are attempting to deconstruct. This further serves to objectify women of the Global South and to deny them of their agency, and, in turn, discursively "colonizes and appropriates the pluralities of the simultaneous location of different groups of women in social class and ethnic frameworks" (Mohanty, 2004: 39). Mohanty suggests that we should combat these universalizing tendencies by decolonizing feminist scholarship. This includes engaging in a deeper intersectional analysis that situates women in their historically specific cultures and contexts; recognizes their heterogeneous intersectional identities in terms of caste, class, religion, ethnicity, and others; and acknowledges their agency as actors within local social relations and global social movements. Also as part of this work, we should confront the forces of neo-colonial, Western imperialism that continue to colonize and exacerbate oppression globally.

Similar to postcolonial studies, the field of Indigenous studies is concerned with hegemonic Western colonialism and imperialism as it pertains to place. Settler colonialism in the U.S. and elsewhere has—for centuries—negatively affected native communities' autonomy, sovereignty, health, subsistence, land, spirituality, culture, and identity. Whyte (2018) defines settler colonialism as "ecological domination, committing environmental injustice against Indigenous peoples and other groups" (p. 125).

European settlers and explorers began appearing on what is now North America in the fifteenth century (Vickery & Hunter, 2016). Since then, settlers have targeted Indigenous communities through genocide and relocation, lack of recognition of land occupancy and title, forced assimilation, and reproductive injustices (Hoover, 2018; Norgaard et al., 2011; Whyte, 2018). As a horrifying example, in 1856, the governor of California issued a bounty for Indian scalps and reimbursed bounty hunters for their ammunition. This massacre contributed to the loss of two-thirds of the Karuk tribe population (Norgaard et al., 2011). In 1852, the state legislature of California also refused to ratify the treaties that 18 tribes had negotiated in good faith with the U.S. government, thus denying them all rights, land, or protections they were promised (Ibid). Subsequently, when the U.S. government created the first national parks, federal troops were sent in to remove surviving Indigenous populations because they were thought to be incapable of protecting wild areas and conserving natural resources (Montrie, 2018). Consequently, Indigenous tribes were pushed onto reservations, and their children were forced to attend boarding schools, where they were denied their native languages and cultural practices (Norgaard et al., 2011). In another example of how settlers have targeted North America natives, the Anishinaabe peoples historically recognized multiple genders,

and women carried many leadership roles among them. Settlers introduced patriarchy and systems of sexism to disrupt trust and diplomacy with Indigenous leaders (Whyte, 2018). Today, Indigenous women continue to experience assaults to their reproductive choices and health through inadequate healthcare and environmental contamination (Hoover, 2018).

Tavakolian (2015: 327) refers to the above processes as "ethnocide," or "the forcible eradication of unique cultures." He argues globalization and development are modern versions of "environmental imperialism," whereby Western economic and political goals justify "the appropriation of the homes, forests, agricultural lands and pastures, and riverine or coastal lands of Indigenous peoples," further contributing to ethnocide (Tavakolian, 2015: 327). Ongoing notions of settlers' ownership of the land collide with the beliefs and practices of many Indigenous cultures in North America, which conceptualize land in terms of relationships, subsistence, spirituality, and cultural identities, rather than ownership (Anzaldúa, 1987; Hoover, 2018; LaDuke, 2005; Norgaard et al., 2011). Governments and corporations consistently challenge and threaten Indigenous treaties, as evidenced by the Standing Rock Sioux Tribe's battles over water and land rights. When developers decided to route the Dakota Access Pipeline under the sacred waters of the Missouri River near the Standing Rock Reservation, threatening Sioux's drinking water and subsistence livelihoods, Indigenous people from all over the world came together to declare their sovereignty and voice their outrage at governments and corporations who ignore their land rights (Steinman, 2018; Vickery & Hunter, 2016).

Furthermore, as Kimmerer (2013) argues, Indigenous knowledge—or "traditional ecological knowledge" (TEK)—of local lands is threatened by governmental regulations, Western science, and displacement and relocation of Indigenous peoples. TEK is defined as "a system of understanding one's environment" that is built over generations as people depend on the land and sea for their food, materials, and culture. This knowledge may differ by nation, locale, ecosystem, community, and gender, among other factors. After centuries of displacement, forced assimilation, and genocide, younger generations struggle to maintain their native languages, practices, and cultures. As Indigenous elders die, much of their traditional knowledge dies with them. Western scientists are increasingly recognizing TEK as integral to climate change adaptation (Kimmerer, 2013; Robbins, 2018). Despite this recognition, settler colonialism and Western environmental imperialism continue to threaten TEK, heightening the vulnerability of Indigenous peoples, particularly poor women and children, to climate change and other environmental risks.

Postcolonial feminist scholarship and Indigenous studies demonstrate the ways in which ecologies, topographies, cultural roles, and divisions of labor pattern differences in experiences and vulnerabilities for Indigenous peoples, further differentiated by gender and class. The intersectional analyses emanating from these traditions reveal important insights for current and future efforts to develop resilient communities and may also help preserve cultural knowledge. In the sections that follow, we explore specific examples of the importance of intersectional analyses to understanding environmental risks and vulnerability, environmental governance, and environmental injustice.

## Why Intersectionality Matters

### Risk and Vulnerability

The intersections of race, nationality, place, class, and gender shape environmental risks and vulnerability for people throughout the world. In their analysis of more than 4000 climate-related disasters, Roberts and Parks (2007) found that poor nations experience far higher rates of mortality and homelessness in the wake of climate-related events than do wealthy nations. However, it is important to note that the consequences of these disasters are not experienced equally within nations (see e.g., Neumayer & Plümper, 2007; Vickery, 2018). An intersectional analysis

illuminates how and why the effects of these events are disproportionately felt at certain intersecting nodes of inequality.

Poor, rural, Indigenous women and children in Global South nations are most vulnerable to climate-related disasters, such as the 1991 cyclone in Bangladesh where 90% of the 140,000 mortalities were women and children (Schmuck, 2002). As Harlan et al. (2015: 141) describe, "a number of material and moral economic factors combined to make Bangladeshi women especially vulnerable" to this deadly cyclone. Women's mobility was limited by cultural and religious norms of proper dress and behavior. Their long saris restricted their ability to move quickly, leaving them vulnerable to the storm surges (Ibid). Due to expectations of modesty, many women felt unable to seek higher ground if unrelated men were present, and for the same reasons many women also never learned to swim (Ibid). In their gendered roles as caretakers, many women had young children or infants to try to save (Ibid). In this case, gender intersected with religious beliefs, age, place, and class to create vastly different disaster consequences for a subset of those affected.

The Bangladeshi case is one example of a global trend. Low-income women the world over experience higher levels of vulnerability than men to meteorological disasters, such as flooding and drought (Nagel, 2012, 2015). This is due, in part, to many women's restricted access to the economic, cultural, and health resources that could otherwise be used to plan and prepare for disaster events. This unequal burden will worsen, as the intensity and frequency of disasters is projected to increase as climate change intensifies (Buckingham, 2010; Denton, 2002; Hemmati & Röhr, 2007; IPCC, 2007; Rocheleau et al., 1996).

Other research demonstrates that gender-based violence typically spikes in the aftermath of disasters, further compounding vulnerability to disasters for women and girls (True, 2016). The 2004 tsunami that affected 13 Asian and African nations was particularly deadly among women and girls. For those who survived, a second wave of crises struck in the form of sexual and gender-based violence. Domestic violence, rape, gang rape, physical abuse, and molestation were reported to occur during rescue operations and in relief camps (Pittaway et al., 2007). The heightened instances of harassment, rape, and violence were physically and mentally injurious to the victims, as they struggled with possibilities of unwanted pregnancies and sexually transmitted diseases on top of the trauma. Across developmental settings, researchers conclude that disasters amplify structural and physical violence against marginalized individuals. Furthermore, pre-disaster inequalities are chief determinants of post-disaster trauma, stress, mortality, insecurity, and violence (True, 2016; Vickery, 2018).

Within Global North nations, intersecting nodes of inequality also affect risk and vulnerability for certain sectors of the population in the face of environmental hazards and disasters. For instance, elderly and poor African American men were the most likely demographic to die in the 1995 Chicago heat wave (Klinenberg, 2002). General isolation meant they did not have friends or family members checking on them or helping them leave the suffocating heat of their un-air-conditioned apartments. They also tended to live in the urban core of Chicago. Due to the urban heat island effect, inner city neighborhoods can have annual mean temperatures that are 1–3 °C (1.8–5.4 °F) warmer than surrounding suburban or rural areas (EPA, 2018). The difference can be even starker at night: some urban cores can be as much as 12 °C (22 °F) hotter than surrounding areas, making it difficult for people to adequately recover from the heat of the day (Ibid).

Ability status is another node of disadvantage that creates differential disaster consequences. Disasters can lead to disabilities and do so more frequently alongside other lines of marginalization, such as class and age. Individuals with pre-existing disabilities face specific challenges before, during, and after disaster events (Jampel, 2018; Stough & Kelman, 2018). Given the wide range of disabilities (e.g., physical immobility, mental/learning disabilities, sensory impairments), it is imperative to use an intersectional lens to explore the myriad threats to health that co-occur among the disabled. In general,

individuals with poor health and mental illness are less likely to prepare for disaster events or have emergency plans in place. Disabled individuals may not be sufficiently warned of disasters; for example, evacuation orders are not always communicated in ways accessible to the deaf, blind, or those with processing or language barriers. Others who are immobile or require specialized care may find that shelters are unable to accommodate their needs. Failure to evacuate puts them at greater risk of being in harm's way when disaster strikes, which may explain, in part, the higher rates of disaster-related mortality among the disabled. Recovery is also fraught for disabled individuals, as they experience higher rates of disaster-related trauma and loss.

Insights from intersectional research also illustrate that certain social conditions—particular to nation, culture, religion, ethnicity, and class—and material conditions—such as divisions of labor, legal rights, knowledge, and natural resource and land access—influence gender roles and work. As a result of their roles, poor and working-class women are disproportionately and distinctly affected by environmental degradation and hazards (Harlan et al., 2015; Hemmati & Röhr, 2007; Rocheleau et al., 1996). Gendered divisions of labor in Global South countries often position poor women as unpaid and undervalued caregivers of children and the elderly, subsistence food producers, reproducers of life (both in terms of biological and reproductive labor), and water and fuelwood collectors (Denton, 2002). Trying to access clean water, fuelwood supplies, and fertile cropland exposes low-income women in the Global South to more direct and harsh environmental problems (Ergas & York, 2012). As an example, in countries like India, Sudan, and Tanzania where rural women use traditional biofuels for cooking and heating their homes, poor women and children suffer disproportionately from indoor air pollution (Buckingham, 2010; Shandra et al., 2008). As water collectors, poor, rural women of the Global South face exposure to malaria, which is endemic in many parts of Africa and parts of Central and South America (Denton, 2002).

Relocation due to development or climate change may force poor women of the Global South to travel farther for resources such as water and wood, increasing their exposure to life-threatening diseases (Rocheleau et al., 1996). For example, during the 1970s, rural women in Nepal were able to collect fuelwood in 2 h, but as forests were cleared throughout the next decade, their collection time increased to an entire day and involved walking through rough terrain (Shandra et al., 2008). Poor women's vulnerability to environmental degradation will worsen as a result of climate change (IPCC, 2007). However, as we discuss in the next section, emerging insights from research on poor and working-class women's empowerment and the significance of inclusive democracy are encouraging, especially in relation to socioecological improvements in local environments.

## Democracy and Government

Applying an intersectional lens to questions of environmental performance, ecofeminist and feminist political ecology scholars have also examined the ways in which working-class women and women of color are affected by, concerned about, and motivated to act against environmental degradation in ways that differ from working-class men (see Bell & Braun, 2010; McCright, 2010). Working-class women's greater concern for environmental issues relative to working-class men is theorized to stem in part from the historical forces and cultural contexts that position them as caregivers, subsistence providers, and collectors of resources needed by the household (Terry, 2009; Warren, 1990). Ecofeminist and feminist political ecology scholars emphasize not only the ways in which gender intersects with poverty, class, nationality, global North-South divides, ability, and age to amplify environmental consequences for women, but the ways in which these dynamics make some women especially well-suited to advance sustainability.

Ecofeminist perspectives offer that women, when afforded positions of power in society,

tend to promote environmental stewardship (Mies, 1998; Norgaard & York, 2005). Indeed, European and North American women express slightly stronger environmental concern and risk aversion than men in their respective nations (Sundström & McCright, 2013). Women's environmental stewardship stands in contrast to conservative, white men from the United States, who tend to deny environmental problems such as climate change (McCright & Dunlap, 2011). To the degree that women are granted formal access to and control over economic resources, their ability to address environmental crises is enhanced (Enarson, 2000; Neumayer & Plümper, 2007). Women with access to credit can use funds to protect against disasters, such as investing in irrigation systems to address drought cycles or structural improvements to homes that can withstand heavy wind and better tolerate downpours. A growing body of literature emphasizes that revenues earned by women are often used to meet needs that improve public health conditions, such as education fees, healthcare costs, and clean water and sanitation services, in comparison to wages earned by men (Agarwal, 1997; Gummerson & Schneider, 2012). Research also shows women who reside in communities with greater gender equality in economic terms tend to use their bargaining power to promote development projects that benefit their community and region (Agarwal, 1997; Kristof et al., 2009).

To illustrate, we expand on one case study of women's survival in rural Kenya as reported by Wangari and associates (1996). Kenyan land reform began in the 1950s to register land and provide loans for the production of cash crops via the application of monocropping techniques. The reforms conceived ownership as primarily resting with male heads of households, though the vast majority of women were full-time agricultural producers (Wangari et al., 1996). Without deeds, rural, Kenyan women were unable to seek loans to improve production, and many were skeptical about the consequences of monocropping techniques. In response, a group of rural women banded together to generate income by weeding for pay; the funds were used to build homes and purchase goats. The goats provided nourishment, and offspring could be sold to cover other household expenses. The women installed irrigation systems to cultivate crops for local consumption, gathered medicinal knowledge to address diseases in the area, and implemented soil and water conservation activities to check soil erosion. This is one example of the spillover benefits generated for local communities when women are able to make decisions on managing land and economic resources.

Political empowerment across gender lines is another key avenue for improving the environment (Buckingham, 2010). Researchers find that nations with higher proportions of women in parliament ratify a greater number of environmental treaties (Norgaard & York, 2005), evidence higher levels of overall sustainability (McKinney, 2014), and lower contributions to climate change (Ergas & York, 2012; McKinney & Fulkerson, 2015). Similarly, the United Nations (2007) reported that, between the years 1990 and 2004, 18 of the 70 most developed nations in the world had stabilized or reduced their carbon emission. Of these 18 nations, 14 had a greater than average percentage of women as elected representatives. Further, Shandra et al. (2008) confirm that nations with a higher proportion of women's nongovernmental organizations (NGOs) experience lower rates of deforestation. Collectively, these results indicate that when women have political power, overall environmental conditions improve. Our understanding of power, representation, and environmental sustainability could be significantly deepened by adding intersectional analyses to these studies of gender and representation. Specifically, examinations of the effects of political empowerment among ethnic and racial minorities, Indigenous people, and lower income individuals may add additional insights into the ways in which diversifying political representation affects environmental protection.

## Environmental Justice Movements

As is discussed in Chap. 3, certain groups of people—namely people of color, low-income communities, Indigenous groups, and people in

Global South nations—tend to shoulder a disproportionate burden of the pollutants and environmental hazards created by global capitalism (Bullard, 1990; Bullard et al., 2007; Čapek, 1993; Taylor, 2014). Environmental justice scholars have long recognized the importance of examining multiple nodes of social inequality to disentangle the complicated ways that race, class, nationality, indigeneity, and gender intersect to create "sacrifice zones"—places where the people and their environment are exploited so that corporations and consumers can have continued access to cheap energy and other commodities, without paying the true cost of their production (Bell, 2014, 2016; Fox, 1999; Kuletz, 1998; Scott, 2010). In addition to exposing these injustices and interrogating the reasons for the disproportionate siting of locally unwanted land uses in the communities of the least politically and economically powerful, an intersectional analysis is important for understanding both who resists these injustices and how industry responds to such challenges (Malin & Ryder, 2018).

Over the past three decades, sacrifice zone communities have been fighting back in increasing numbers. Grassroots movements resisting the environmental injustices of capitalism have sprung up across the world, from the Chemical Corridor of Louisiana to electronic waste dumping grounds in Malaysia. Many of these grassroots movements have won both small and great successes in their struggles against powerful corporations (see, for instance, Lerner, 2006, 2010; McGurty, 2009; Pellow, 2014; Reid & Taylor, 2010). One of the keys to the success of these movements is their authenticity; the personal and often shocking stories of injustice that people living in sacrifice zones endure strike a visceral blow to society's trust in elected officials, regulatory agencies, and business leaders. Local voices provide authenticity and urgency to environmental justice movements in a way that statistics often do not—and the most powerful and persistent of these local voices typically belong to working-class women and women of color (Bell, 2013; Bell & Braun, 2010; Epstein, 1995; Krauss, 1993; Taylor, 1997). Identifying these intersections of class, race, and gender reveals that throughout the innumerable struggles that have taken place against polluting and environmentally-destructive industries, working-class women, women of color, and Indigenous women have taken on, time and again, leadership roles to fight for the health and safety of their families and communities (Bell, 2013; Brown & Ferguson, 1995; Culley & Angelique, 2003; Kaplan, 1997; Krauss, 1993; Maathai, 2010; Shandra et al., 2008).

Understanding the reasons for the dominance of working-class women and women of color in these movements can be aided through examining the multiple identities and cultural expectations attributed to women and men in environmental justice communities. A large body of social science research has demonstrated that many activist-women have become involved in environmental justice struggles because of their concerns for their children's or grandchildren's well-being (Bell, 2013; Bell & Braun, 2010; Brown & Ferguson, 1995; Culley & Angelique, 2003; Krauss, 1993). The tendency of many activist-women to draw on a motherhood identity may be a strategic choice in some cases for, as Shriver, Adams, and Einwohner (2013) argue, the identity of motherhood offers a degree of protection from political and community scrutiny. Women acting on behalf of their children or grandchildren are often not seen as "activists;" they are simply being devoted mothers. Thus, women's lower social status in the gender hierarchy, particularly within some cultural, class, and ethnic contexts, ironically gives them more freedom than men to protest the power elite because they are not seen as a threat.

While there are numerous social factors that pull working-class women *into* environmental justice movements, there are also a number of reasons for working-class men's much lower rates of involvement, beyond simple employment loyalties. As Bell and Braun (2010) found in their study of environmental justice activism in rural Central Appalachian coal-mining communities, for instance, the coal-related hegemonic masculinity of the region caused many local men—even those who did not work for the coal industry—to

be unwilling to speak out against coal-related injustices. This "silencing effect" on coalfield men had been made even more extreme because of the fivefold reduction in coal-mining jobs since the 1950s, a result of technological advances in coal mining that have drastically reduced the number of workers needed to mine coal (Bell, 2016; Bell & York, 2010). Due to the strong link between the coal-related "Community Economic Identity" (Bell & York, 2010) of Appalachian coal-mining towns and the white, heterosexual, working-class masculinity that is hegemonic in the region, threats to mining employment are also seen as a threat to masculine privilege, regardless of employment status.

Research suggests that polluting industries are keenly aware of the ways in which intersecting identities and inequalities can be manipulated to their benefit (Bell, 2016; Bell & York, 2010; Malin, 2015; Malin & DeMaster, 2016; Shriver et al., 2000, 2014). For instance, as Bell and York (2010) found in their study of the coal-industry-sponsored "Friends of Coal" astroturf (or faux grassroots) organization, this group actively draws on and appropriates potent masculine icons—such as football, NASCAR, the accomplished outdoorsman, and the working-class provider—that reflect the white, working-class, heterosexual hegemonic masculinity of the region. These icons serve to reinforce the coal industry's cultural connection to local men despite declines in mining employment and widespread job losses for white, working-class men throughout the Central Appalachian region. In rural, resource-dependent economies, this type of gendered, racialized, and class-based identity work on the part of dominant industries is an effort to erase class consciousness and replace it with an identification with industry. Similar processes can be seen in other rural contexts as well. For instance, in their study of the changing representations of farming masculinity within industrial agriculture, Bell, Hullinger, and Brislen (2015) find that agribusiness companies manipulate conventional farming masculinities to facilitate agricultural deskilling, a process that alienates farmers from the land and decreases the likelihood of sustainable agriculture uptake. Building on this research, Bell, Fitzgerald, and York (2019) identify and theorize an industry strategy they term "Identity Co-optation," a public relations tactic in which fossil fuel industry front groups "appropriate and organize women's voices to defend coal, natural gas, and oil in ways that mirror the rhetoric of grassroots environmental justice activist-women who are fighting against polluting industries." These authors maintain that many industry front-groups use essentialized representations of pro-fossil fuel women as caretakers of children and the environment to ease public anxieties about the environmental health risks of hydraulic fracturing and coal extraction. To counter these strategies, it is important for researchers and activists to draw scholarly and popular attention to the ways in which industry co-opts gendered, racialized, and class-based identities for the purpose of suppressing citizen resistance.

In the following section, we examine intersectional frameworks that move beyond race, class, gender, and place to incorporate less-often acknowledged nodes of inequality and privilege into analyses of the environment.

## Expanding Intersectionality and the Environment: Centering Marginalized Perspectives

Even though the intersectionality framework has considered sexuality since its inception (e.g., The Combahee River Collective, 1977), intersectionality and environment scholars have contributed less to this conversation (for a notable exception on Indigenous queer normativity see Simpson, 2017). Thus, we suggest that future research should further incorporate LGBTQ histories as they relate to the environment. In addition, intersectional analyses should further theorize the harmful effects of speciesism, or humans' assumed superiority over non-human animals and plants. In the sections that follow, we discuss how marginalized perspectives related to sexuality and species could be further integrated into intersectional analyses.

## Queer Ecology

While sexuality scholarship has long existed (e.g., Foucault, 1978), within recent decades, some queer scholars have turned to environmental theory and politics (Gaard, 1997; Sandilands, 1994). Queer ecology is a "cultural, political, and social analysis that interrogates the relations between the social organization of sexuality and ecology" (Sandilands, 2002: 131). It identifies the "ongoing relationship between sex and nature that exists institutionally, discursively, scientifically, spatially, politically, poetically, and ethically" (Mortimer-Sandilands & Erickson, 2010: 5). Queer in this formulation is used as both noun and verb, as queer ecology begins with the experiences and perceptions of non-heterosexual individuals and "calls into question heteronormativity… as part of its advocacy around issues of nature and environment—and vice versa" (Mortimer-Sandilands & Erickson, 2010: 5). Queer ecologists explore such themes as the histories and discourses that naturalize certain sexual behaviors as well as relegate urban and natural spaces based on sexuality. Queer ecologists also attempt to subvert and transform "heteronormative nature relations" (Mortimer-Sandilands & Erickson, 2010: 6). As an example of a discourse that naturalizes specific sexual behaviors, Darwin's writings on sexual selection influenced scientific and biological understandings of sexuality that privilege reproductive sex, and thus categorize nonreproductive sex as unnatural (Gaard, 1997). In terms of heterosexual spaces, city parks were built, in part, as a curative response to openly gay men in urban centers. Parks are spaces where heterosexual men can perform heteronormative forms of masculinity through athletics (Mortimer-Sandilands & Erickson, 2010).

We see potential for pushing the argument further to explore questions of how gender, race, class, and sexuality coalesce with broader social formations to contest power and accumulation regimes. To illustrate, the conceptualization of gender as social organization is closely bundled with heternormativity and compulsory monogamy (see e.g., Schippers, 2016). Possibilities for alternatives (e.g., communal/communitarian living) to disrupt accumulation processes and value relations within the system of capital are important to consider.

## Critical Animal and Plant Studies

Emerging interdisciplinary research more closely interrogates the relationships between human societies and animal and plant communities. While socioecological examinations of plants remain nascent, Peter Singer (1975) is largely credited with the founding of animal studies. Nevertheless, it is only recently that animal studies have entered official sociological consideration, as noted in Chap. 14. This is in part demonstrated by the founding of The Animals and Society section of the American Sociological Association in 2002 (ASA, 2018).

Animal studies generally examine the connections between nonhuman animals and humans (York & Longo, 2017). Animals have been almost entirely excluded from intersectional environmental analyses until recently (see Gaard, 2017; Harper, 2010; Pellow, 2014). Pellow's (2014) research on animal rights activism grapples with how animal rights are integral to the meaning of total liberation. Specifically, the animal liberation front, among other radical animal rights movements, tends to have more ecocentric (environment centered), rather than anthropocentric (human-centered), values. This framework calls for the dismantling of all hierarchies, including speciesism, classism, racism, and heterosexism. However, he exposes the seemingly ironic white, male privilege of recent radical animal rights movements and their deep ecology roots. Likely as a result of their privilege, their movement frames and imagery (e.g., comparing animals to slaves or using women's naked bodies to portray cuts of meat) have offended and proven exclusionary to many people of color and women. Historical discursive practices served to legitimize the oppression of people of color and women by comparing their "likeness" to animals, which continues to alienate some women and

people of color from radical animal movements. If radical animal rights activists were more sensitive to these histories, then perhaps they could expand their support base. Regardless, Pellow argues, if animals are liberated, then total liberation can be achieved, as animals (and perhaps plants) remain at the bottom of the socioecological hierarchy. The above observations from animal studies have helped to construct potential pathways for exploration in plant studies.

New developments in plant ecology and biology have caused social theorists to ask more penetrating questions about humans' relationships with plants. Peter Wohlleben (2016) argues that trees communicate, feel pain, and react to their environments. Plant ecologist and member of the Potawatomi Nation, Robin Kimmerer (2013), combines the TEK of her tribe and lessons from plant ecology to explore how these epistemologies understand plant communication. She notes that her tribe has been listening to plants for millennia, whereas ecology is only beginning to understand plant language. As a result, Gaard (2017) promotes a "trans-species listening theory." This theory takes lessons from intersectional research that highlights how individuals with dominant identities tend to speak while those with subordinate identities are expected to listen. This research demonstrates that "speaking is associated with power, knowledge, and dominance" (Gaard, 2017: xvii). Learning how to listen to non-human communities may provide a fruitful avenue for future research.

In the next section, we consider theoretically-informed methodologies designed to help researchers unravel complexities particular to intersecting nodes of privilege and disadvantage.

## Methodological Considerations

### Intersectional Praxis

Intersectional feminist scholarship "begins in the concrete experiences of race and sex together in the lives of real people" (MacKinnon, 2013: 1020). Politically progressive social theorists entering elite-driven institutions—such as academia—may attempt to subvert power structures by engaging in praxis, or the practical application of theory. This translates into a method designed to ground intersectional theory in practical and political considerations (Cho et al., 2013). Intersectional scholars often adopt a dialectical approach to practice and theory, whereby they interrogate how power structures based on interlocking forms of oppression and privilege create unique vulnerabilities in the lives of oppressed peoples (Davis, 1983; MacKinnon, 2013). The daily struggles of the oppressed inform research inquiry, method, and theory, which in turn inform political interventions that incorporate these insights into best practices for progressive movements. Cho, Crenshaw, and McCall (2013: 786) note that "scholars and activists illustrate how practice necessarily informs theory, and how theory ideally should inform best practices and community organizing. These concerns reflect the normative and political dimensions of intersectionality and thus embody a motivation to go beyond mere comprehension of intersectional dynamics to transform them." Part of the transformative potential in intersectionality research lies in the amplification of marginalized perspectives that serve to call into question hegemonic narratives and actions.

The normative goals in studies of the oppressed have their roots in historical epistemological, discursive, and political struggles over who embodies subjectivity, what constitutes empirical evidence, and who is able to/has the right to express or create knowledge. Specifically, from the scientific revolution and into the twentieth century, Western, elite, white men held a near monopoly on scientific inquiry, and their standpoint was taken for granted as universal. These elite scientists preferred methods that objectified research participants and emphasized parsimony at the expense of nuance (Harding, 1991). In addition, their presumed authority allowed them to engage in harmful research that generally targeted the least powerful populations (e.g., the Tuskegee syphilis experiment). Having learned lessons from these and other unethical research

programs, intersectional feminists prefer methods that minimize power disparities between the researcher and subject, parse out complexity, and do not oversimplify the experiences of a group of people. Methods must be equipped to interrogate power structures that create differences in individuals' experiences due to race, gender, class, sexuality, and citizenship status (Cho et al., 2013).

Researchers in this vein have tended to prefer qualitative research, inductive and grounded in the data, so as to allow oppressed subjects to speak for themselves and exercise agency in the research process (Bell, 2013, 2015; Gaard, 2017; Smith, 1987). Proponents of community-based participatory action research are similarly interested in breaking down researcher and participant hierarchies, and specifically seek research collaborations with marginalized community organizations in an to attempt to facilitate bi-directional knowledge flow and positive social change (Bell, 2015; Cahill et al., 2010; Lucio-Villegas, 2016). Reflexivity is an important aspect of the methods discussed above, as researchers attempt to remain aware of their power, privilege, and general standpoints in relation to research participants (Harding, 1991; Rocheleau, 2015). This awareness crosses over into other methodological approaches as well.

## Quantitative Methods

Although the bulk of intersectional research makes use of qualitative methodologies, quantitative assessments are increasingly utilized to examine broad patterns connecting people's lived experiences—examining differences along the lines of race, ethnicity, class, and gender—to environmental conditions, particularly in the cross-national context (Austin & McKinney, 2016; Ergas & York, 2012; McKinney, 2014; McKinney & Fulkerson, 2015; Shandra et al., 2008). Using national accounts from widely-available data repositories, researchers have analyzed the ways in which the status of women and ecological conditions coalesce and intertwine to influence environmental degradation (Shandra et al., 2008), health and wellbeing (McKinney & Austin, 2015), vulnerability to disasters (Austin & McKinney, 2016), and the sustainability profiles of nations (McKinney, 2014), including relative contributions to climate change (Ergas & York, 2012; McKinney & Fulkerson, 2015). Statistical techniques such as OLS regression and structural equation models have been employed to discern the unique contributions of specific features of nations—such as population, affluence, economic structure, gender equality, and governance—to the status of women and environmental performance. These analyses provide support for the premise that the status of women is deeply linked to the environment. In general, greater gender equality is associated with improved environmental performance across nations. Relatedly, gender inequality tends to co-exist with high rates of environmental destruction. Despite initial misgivings about the efficacy of quantitative methods to analyze the inherent complexity of intersectional processes (e.g., the distribution of resources across race, class, and gender), progress has been made to accommodate the unique methodological demands in meaningful ways (McCall, 2005).

## Spatial

Space is an important variable for understanding social inequality (see e.g., Lobao et al., 2007) as well as identifying and assessing spatial variability of environmental risks and hazards (Chakraborty et al., 2005; Cutter et al., 2016; Elliott & Frickel, 2013). Recently, scholars have begun to merge theorizations within human geography that emphasize the relational coalescence of society and space in the production of inequality with intersectional frameworks and feminist political ecology views that gender and nature (e.g., symbolic ideas of difference) are tightly interlinked (e.g., Anthias, 2013; Dempsey et al., 2011; Nightingale, 2011). Making use of various spatial analytic techniques (often in tandem with other methodologies), research in this vein demonstrates how the material embodiment of everyday activities in socioecological spaces

intertwines with symbolic ideologies surrounding particular spaces, bodies, and socio-natures with consequences for social and ecological processes alike (see e.g., Holifield et al., 2009; Nightingale, 2011). Attention is given to the spatial practices through which people produce relationships with each other and their environments. To be sure, intersectional dynamics constituted by myriad forms of social difference (e.g., gender, race, class) are significantly influenced by place-based differences and companion spatial processes that are rarely ecologically neutral (Holifield et al., 2009). Given the nascent state of spatial analyses of intersectionality and the environment, we are optimistic about future efforts in spatial studies of social ecologies.

## Deepening Future Intersectionality and Environment Research

Much more research is needed to uncover the depth and complexity of human and nonhuman relationships as well as the innumerable connections between inequality and environmental harm. Existing scholarship on intersectionality and the environment has an expansive genealogy that draws from intersectional feminist, environmental, and racial justice theoretical and activist frameworks to both synthesize and center the relationships among interlocking forms of oppression and environmental harm. Previously explored themes include Global North and South power asymmetries; risk and vulnerability as they relate to gender, class, nation, race, etc.; women's activism and environmental justice movements; and political empowerment and democracy. Providing rich, multifaceted analyses that disentangle the complexities in each of the above themes still requires research. Such analyses are necessary for socially just solutions to environmental problems yet are challenging to properly conduct (Malin & Ryder, 2018). Specifically, most current research on environmental injustice still treats inequity discretely, focusing on one form of inequity—related to gender, race, class, disability, among others—rather than analyzing how the multilayered and interwoven aspects of inequity create unique harms that require unique solutions. In addition, research that attempts to integrate multiple social locations often does so in an additive rather than multiplicative form (Collins, 2015). Engaging in intersectional research does present a variety of challenges that include either naive or insidious forms of misappropriation or misapplication of the term; institutionalized co-optation that ignores the central transformative elements of intersectional praxis; the essentialization and reification of categorical differences that fail to represent the socially constructed and processual nature of identity; and the difficulty of operationalization, or how to adequately measure and define intersectionality in the social world (Luft & Ward, 2009).

Malin and Ryder (2018) offer suggestions for generating deeply intersectional research that include emphasizing multiple social locations and intragroup differences; incorporating a multi-scalar lens; and identifying systems and processes of power. Similar to observations from Pellow's (2014) total liberation work and Gaard's (2017) critical ecofeminism, Malin and Ryder (2018) also advance deeply intersectional research that seeks to attain "long-term sustainability by understanding the root causes" of anthropogenic environmental harm (4). This conceptualization brings in insights from deep ecology activists who see all forms of oppression, including speciesism, as historically situated, interrelated, and mutually reinforcing. Those interested in pursuing this line of inquiry can look to Pellow's (2014) work on animal rights activism for examples on how to integrate a total liberation framework. There are many challenges for future intersectional research, not the least of which are incorporating multi-scalar, intragroup analyses that holistically interrogate historic formations of systemic matrices of power and oppression. However, the prospect of finding long-term, socially just sustainability and community resilience through deeply intersectional analyses makes the challenges worthwhile.

In recognition of the fact that intersectionality theory arose from a Black feminist epistemology, we acknowledge the potential harms that more privileged groups may cause when they attempt

to adopt (or co-opt) an intersectional framework (Collins, 2015). It is our hope that we have done the field justice; however, we as authors of this chapter recognize our privileges and social locations within matrices of power and oppression given our positionalities as a first-generation, white, Latinx woman from a working-class background; a first-generation, white woman from a working-class background; and a white woman from a middle-class background. We are humbled and honored to contribute to this important and groundbreaking work.

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# Environmental Justice

3

Rebecca Maung and David N. Pellow

## Introduction

In the 1960s, both the environmental and civil rights movements achieved important legislative goals in the United States. Mainstream environmentalism and its political precedents, however, had for a long time predominately included middle and upper-class white males (Gottlieb, 2005; Taylor, 1995, 2000). Only in the 1980s—especially after a series of high-profile protests over the siting of a polychlorinated biphenyl (PCB) dump in majority African-American Warren County, North Carolina in 1982—did scholars and media focus on racial justice activists who were also actively engaging with environmental issues, giving greater attention to environmental justice activism and the rise of environmental justice studies.

Environmental justice (EJ) is both a multidisciplinary area of scholarship and a network of grassroots social movements. Its focus is people's and communities' unequal experience of environmental harms and benefits—and their power to participate in decision-making—along the traditional discriminatory lines of race and class, and, more recently, gender, sexuality, nationality, dis/-ability, and indigeneity. *EJ movements* take action to fight those inequalities, often hand in hand with *EJ studies*, which seeks to document them and better understand their causes and effects. EJ studies also conceptualizes justice in several distinct ways. Most commonly recognized by legal institutions is *distributional justice*, or all persons and communities bearing environmental burdens equally. *Procedural justice* refers to all having a meaningful voice in policy decisions about where and how environmental harms are placed. *Recognitional justice* is the idea that populations that have been marginalized must be acknowledged as valued members of the broader community (Schlosberg, 2009). *Restorative justice* involves promoting healing, reconciliation, and (re)building relationships that seek to repair the root cause of a given injury (Van Ness & Strong, 2010); the idea here is that justice is not primarily about punishment but rather should address the underlying driving forces that produced the injustice in the first place. Finally, and perhaps most importantly, EJ scholars and activists often prioritize *social justice*, a broad and inclusive appreciation of how systems of power and inequality are intertwined with more "traditional" EJ concerns (Bullard, 2000; Kaswan, 1998; Kuehn, 2000; Schlosberg, 2004, 2009; Taylor, 2000).

In the United States, the early EJ movement built its message in conversation with mainstream environmental and anti-toxics movements,

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inequality and Indigenous rights movements, and occupational and public health movements—but primarily through the lense of the civil rights movement (Benford, 2005; Taylor, 2000). Therefore, an early conceptual frame for the field was *environmental racism*, which envisioned environmental injustice as yet another physical manifestation of institutionalized racism (Commission for Racial Justice, 1987). Scholars have since expanded this idea to *environmental inequality*—exposure to hazards along multiple social categories of difference and dimensions of privilege and power. Early EJ studies and movements addressed the siting of toxic wastes and hazardous material, but over time have become intertwined with movements and discourses surrounding food justice, climate and energy justice, and many other environmental concerns worldwide.

EJ studies have long focused on the important empirical work of recording disproportionate exposure to hazards (i.e., distributional injustice), often using epidemiological methods. This work has mostly engaged with theories of modernity and political economy, occasionally leading to debate over whether racial or economic factors better explain environmental inequality (Mohai, 2007). This work is critical to understanding the extent of environmental inequality and the production cycles that lead to it, and we profile it here. But we also want to highlight the enormously productive terrains of EJ research that have begun to deepen the field's understanding of power and space in exciting ways.

This chapter presents an examination of major studies, key concepts and frameworks, and significant developments in the expanding multidisciplinary field of EJ studies. We examine EJ's foundational research frames and social movements, the theoretical ideas it often employs to better understand environmental inequality, and consider new directions for the field. The most promising development in EJ studies has been a broader and more critical understanding of how systems of oppression and human-nature relationships are both dynamic and intersectional (for further elaboration on intersectionality, see Chap. 2 and Malin & Ryder, 2018). These new developments are highlighted in this chapter, including EJ engagements with critical race theory, feminist theory, and critical human geography. They also broaden EJ's definitions of nature and justice while expanding its political possibilities. Our main emphases center on the roles of power, social difference, and social inequalities in influencing the dynamic contours and consequences of EJ struggles.

## Environmental Justice Studies: Social Inequalities and Risk

The field of EJ studies dates back to the early 1970s and has historically been primarily concerned with the spatial inequalities involving marginalized populations and a range of environmental hazards and public health threats (Bullard, 2000; Mohai et al., 2009). Specifically, its major theoretical and methodological emphasis has been documenting and/or measuring the extent to which people of color, Indigenous, immigrant, and working-class populations have been disproportionately subjected to environmental threats and risks in the U.S. and globally (Bullard & Wright, 2012; Grineski & Collins, 2018; Harrison, 2011; Walker, 2010, 2012). Those hazards have included contaminated water and soil, polluted air, climate change, and unhealthy food sources that pose significant risks to human and ecological health. Some of these environmental harms are localized in the form of toxic waste sites and hazardous chemical manufacturing and disposal, while other globalized hazards like climate change impact certain populations earlier and worse than others. Over the last 30 years, EJ studies and the EJ movement have fundamentally argued that: (1) any understanding of social inequality must pay attention to how environmental risks disproportionately affect socially marginalized communities around the globe; and (2) any understanding of environmental crises must analyze how such crises are largely driven by processes that produce social inequalities.

These studies often analyze the social and public health impacts of waste on the land, water, and air of the workplaces and homes of

the people affected. The first studies focused on those early sites of protest—such as the burial of PCBs in poor and mostly Black Warren County, at the direction of the State of North Carolina (and approved by the EPA) in the late 1970s (Bullard, 2000). While PCBs were banned in 1978 and considered a likely human carcinogen by the EPA, the site was not decontaminated until 2003. Many studies throughout the 1990s focused on the siting of hazardous waste in poor, Black neighborhoods in Texas, West Virginia, Louisiana's "Cancer Alley" along the Mississippi river, urban areas in the American North, and other areas with high concentrations of low-income people of color (Bullard, 2000; Mohai & Bryant, 1992; Pellow, 2002; Robinson et al., 2007; Taylor, 2014; Walker, 2012).

Many EJ studies examine toxic contamination and its proximity to neighborhoods, but an increasing number of analyses looked to the workplace—sometimes close to workers' residences, sometimes not—as an important site of unequal toxic exposure. The earliest attention to this issue addressed farm workers' exposure to agricultural pesticides (Harrison, 2011; Holmes, 2013; Pena, 2005; Perfecto & Velásquez, 1992; Pulido & Pena, 1998). These workers are mostly Chicanx and Latinx, and often immigrants. Scholars have also examined the global electronics industry and exposure to dangerous chemicals—from the underpaid, majority female and immigrant labor force that actually produces technological components in Silicon Valley (Pellow & Park, 2002), to manufacturing processes elsewhere in the United States, Asia, and Latin America (Smith et al., 2006), to the threats posed by the addition of electronics to an already problematic global waste trade (Byster & Smith, 2006).

The presence of toxic waste impacts communities in various ways. For a country of such exceptional wealth and resources, the United States has staggering health disparities along racial and economic lines. Common explanations for these disparities, such as 'personal habits' like diet, activity, and substance use, can predict only a small proportion of this difference (House & Williams, 2003; Lantz et al., 1998). An increasing number of studies are looking to toxic exposures to help bridge this explanatory gap. While there is little research establishing a direct link between racialized patterns of toxic exposure and health disparities (Brulle & Pellow, 2006), it is well established that living close to these hazards increases adverse pregnancy outcomes, cancer risk, renal failure, and diabetes (Brender et al., 2011; Morello-Frosch et al., 2001). The evidence is even stronger when it comes to exposure to air pollution and asthma and other respiratory illness, often through proximity to refineries, manufacturing facilities, or other toxic emitters (Brender et al., 2011). In fact, a large body of EJ studies and related activism has coalesced around the unequal distribution of environmental disease and "contested illnesses," often utilizing "popular epidemiology," where communities and "health social movements" recognize their own disease clusters and organize to combat the cause (Brown, 2007; Brown et al., 2011; see also Chap. 12).

Throughout the 1980s and 1990s, some EJ scholars sought to identify more discrete explanations for environmental inequalities. One empirical question was whether toxics were sited in poorer communities and communities of color or whether those communities were drawn to those sites due to associated lower costs of living. Yet, evidence has overwhelmingly shown that toxics "find" these communities, and not the other way around (Bullard & Wright, 1987; Mohai & Saha, 2015; Pastor et al., 2001; Saha & Mohai, 2005). Another prominent debate focused on whether race or class can better explain disproportionate exposure to toxics, with the leading scholars in the field contending that race is the stronger predictor. While some empirical findings have found mixed results, those studies have been criticized for their methodology and, as elaborated further below, often employ a limited (and conceptually limiting) understanding of race and racism (Mohai, 2007; Mohai et al., 2009; Pulido, 1996).

While the majority of EJ scholarship is still rooted in the United States (Reed & George, 2011), discriminatory waste siting is not only a U.S. phenomenon, nor is it exclusively a national

or local one. Also due to growing concerns about toxic exposure in wealthier countries in Europe and North America, a great deal of waste originating in those countries has been outsourced to the global South—countries where, just as above, the affected populations are more likely to be poor and people of color (Faber, 2008; Jorgenson & Clark, 2009; Pellow, 2007). EJ analysis has often been used to understand patterns of toxic siting worldwide, but it has also been increasingly employed to analyze other international patterns of inequality not traditionally considered "environmental," which we shall explore later in this chapter. Both the EJ movement and EJ studies have become global, with research and campaigns focused on communities in the U.S., Australia, Canada, Latin America, Europe, the United Kingdom, New Zealand, India, Africa, and the former Soviet Union (Agyeman et al., 2003; Akese & Little, 2018; Anguelovski & Martínez-Alier, 2014; Martinez-Alier et al., 2016; Walker, 2009).

## Movements for Environmental Justice, Food Justice, and Climate Justice

As the modern environmental movement grew in the United States, increasing awareness of and concern for the health effects of industrial outputs gave rise to a series of NIMBY (Not In My Back Yard) movements. When a company or a municipality would propose a location for a waste treatment plant, whiter communities were more successful than people of color in campaigning against the toxic site, contributing in part to sites' diversion to poorer neighborhoods and neighborhoods of color (Bullard & Wright, 1987; Saha & Mohai, 2005). Since that time, toxics have been reliably placed more often in areas with higher poverty rates and more people of color (Brown, 1995; Mohai & Bryant, 1992; Mohai et al., 2009; Pellow, 2017; Ringquist, 2005; Szasz & Meuser, 1997). Research has suggested a variety of interconnected explanations for this fact, including active racial discrimination in siting practices, institutionalized racism and segregation, unequal access to information and decision-makers, and economic convenience (Mohai, 1996).

Much of the EJ studies literature is also concerned with grassroots responses to these patterns of environmental injustice, with a particular emphasis on the EJ movement. Since the 1990s, grassroots activists in the U.S. and globally have organized the EJ movement to increase the visibility of environmental inequalities and injustices and to change power and accountability dynamics among civil society, the state, and corporate institutions. This has often taken the form of campaigns to shut down or reform environmentally offensive operations or to promote ecologically sustainable and socially just practices and policies at multiple scales. One of the earliest and most important moments in this movement was the EJ Summit conference in 1991, where participants drafted what became known as the Principles of Environmental Justice, a founding document and manifesto of the movement. These Principles articulate an integration of anti-racism and ecological sustainability, and also mobilize an anti-militarist, anti-imperialist, gender justice politics that recognizes the inherent and cultural worth of non-human natures. Since that time, as the EJ movement has grown in influence and visibility, scholars have recognized that it has always been global (rather than originating in the U.S.). In the global South, many researchers use the term "environmentalism of the poor" to refer to such advocacy, focused on the defense of local spaces, cultures, and livelihoods, which are always inseparable from ecosystem health (Anguelovski & Martínez-Alier, 2014; Nixon, 2011).

### Food Justice

Food justice activism emerged around the same time as the early EJ struggles of the 1980s and 1990s. While a broad food movement towards local and/or organic consumption also became popular among wealthy and middle class white Americans in the 2000s, spurred on by popular books by Barbara Kingsolver (2007) and Michael Pollan (2006), food *justice* critiques the ways that

the dominant food system disproportionately harms low-income communities and communities of color. While EJ studies have certainly addressed issues of agriculture, they have largely centered on farm workers, often immigrants and people of color, and their exposure to toxic pesticides and fertilizers rather than an explicit emphasis on pathways for community based control and access to healthy, nutritious, affordable, and culturally appropriate foods (Harrison, 2011; Moses, 1999). Food justice scholarship has only recently been included in the EJ subfield (Alkon & Agyeman, 2011; Gottlieb, 2009). For EJ, issues of food are understood not only as disproportionate exposure to environmental harms, but disproportionate denial of environmental benefits.

Food justice studies seek to expand scholarly understandings of how food and inequality interact with national and international agricultural systems. Alongside the growth of large-scale industrial monoculture came the dispossession of Native Americans (Norgaard et al., 2011) and Black Americans (Green et al., 2011) from agricultural lands. These legacies of exclusion from the means of agricultural production fostered inequitable patterns of access to healthy, unprocessed food dictated by institutionalized racial segregation and capitalist systems, where adequate nutrition goes to populations with the monetary or political capital to demand it (Deener, 2017). The result is a reliance on food distribution systems that have increasingly catered to wealthy areas, while low-income areas and many communities of color are left without access to affordable groceries and at much higher risk of dietary disease (Dubowitz et al., 2015; Gottlieb & Joshi, 2013; Miller et al., 2016; Sbicca, 2018; Whitacre et al., 2009). Local and organic food activism also often excludes and alienates communities of color (Alkon, 2008; Pilgeram, 2012; Ramírez, 2015; Slocum, 2011). While these processes have been extensively documented in the United States, they reflect patterns in the food system worldwide.

In North America, these movements and areas of study are called food justice, and in the global South they are often referred to as food sovereignty. Often, global calls to "feed the world" have argued that the threat of mass starvation is too important to slow massive technological and agribusiness growth with concerns for justice, as in mid-century Green Revolution efforts (Cullather, 2004). But many argue that world hunger is not caused by a true shortage of food, but rather is a result of a problematic industrial agrifoods system that privileges generation of profits by large companies such as Cargill and Monsanto and creates heightened vulnerability for poor people (Friedmann, 1993; Holt-Gimenez, 2011). Food sovereignty movements thus seek to return control of food production back to governments and people, with social and state support of small-scale farming (Cadieux & Slocum, 2015; Giménez & Shattuck, 2011; Kremen et al., 2012; Lappe & McKibben, 2010). In Indigenous communities, food sovereignty also means restoring traditions marked by healthy relationships and responsibilities between people and the land (see Norgaard and Fenelon, Chap. 23 and Mihesuah & Hoover, 2019). Thus, the literature on food justice is an integral component of EJ studies (Morrell, 2018).

## Climate and Energy Justice

Especially as public and scholarly concerns over climate change have grown, EJ scholarship has increasingly addressed issues of justice with respect to who causes and suffers from the changing global climate. Since the early 2000s, the Intergovernmental Panel on Climate Change (IPCC) has raised concerns about the differential vulnerability of low- and middle-income countries to rising sea levels and increasingly volatile weather patterns (Kasperson & Kasperson, 2001), while the Congressional Black Caucus commissioned a report detailing Black Americans' disproportionate experience of the negative health effects and increased economic insecurity of climate change (though African Americans' carbon footprint had remained far below the national average) (Congressional Black Caucus, 2004). Further, the Indigenous Peoples' Global Summit on Climate Change elaborated on and responded to the uneven impacts on aboriginal communities in the Anchorage Declaration

(IPGSCC, 2009). These strains of thought received greater attention in the academic literature, however, following Hurricane Katrina, which hit the U.S. Gulf Coast in 2005. Not only was it increasingly plain to the public that poor people of color were especially vulnerable to the storm and critically underserved during rescue and recovery efforts, but EJ scholars also began to consider more closely the ways that anthropogenic climate change exacerbated already-existing environmental inequalities (Brinkley, 2007; Bullard & Wright, 2009; Dyson, 2007; Pastor et al., 2006).

Many of the difficulties in reaching meaningful or binding international climate change agreements are rooted in issues of climate justice (Roberts & Parks, 2006). Since 1850, industrial activity the United States and European Union countries has contributed the most to climate change by far. While in recent years China's total greenhouse gas output has outpaced all other countries, American output per capita is still more than twice as high as any other major emitter (Boden et al., 2017). Yet, international calls for the United States to proportionately scale back its carbon pollution have been met with complaints of an unfair burden on the massive U.S. economy, leading to weak international agreements that are often not ratified or abruptly exited by the United States, and strong mistrust of world powers by poorer nations that have other pressing quality-of-life issues to address (Roberts & Parks, 2006).

These nations, however, are often impacted the earliest and hardest by climate change. Low-income countries have fewer resources to devote to climate change adaptation and mitigation. They are also often far more ecologically susceptible to changing weather patterns and increasing "natural disasters," due in part to geographic locations such as higher-risk coastal areas (Miranda et al., 2011; Najam et al., 2003)—but also due to their disadvantaged role in global capitalist systems. Many low-income countries export inexpensive goods to be consumed by higher income countries at prices that do not account for the pollution and resource extraction that those goods' production entails, leading to an unequal ecological burden that closely maps onto colonial extraction and puts their ecosystems at greater risk of collapse (Agarwal & Narain, 1991; Bunker, 1990; Roberts & Parks, 2006, 2007). As detailed above, unequal exposure to ecological degradation within nations also puts historically marginalized groups, even within wealthy countries like the United States, at greater risk in the face of extreme weather events.

Some climate justice scholars, alongside a growing body of energy justice work, have emphasized the need to consider justice issues when conceiving of and implementing solutions to climate change—particularly balancing the needs of energy insecure populations while attempting to reduce global or national energy use or shift its source from fossil fuels to renewable sources like wind or solar (Fuller & McCauley, 2016; LaBelle, 2017; Sovacool & Dworkin, 2015; Walker & Day, 2012). These scholars note that poorer and more rural populations also experience fuel insecurity as part of already precarious living situations, due to economic poverty or uneven distribution of goods (Harrison & Popke, 2011), and that many climate change solutions making fossil fuels more expensive to encourage production shifts to renewable energy will pose an undue burden on these communities.

Thus, scholars have documented that those communities and nations that have contributed the least to anthropogenic climate change (generally the global South and Indigenous nations), bear the greatest brunt of human and ecological health costs associated with climate disruptions (Ciplet et al., 2015; Whyte, 2017). The movement for climate justice has responded with tactics and issue framing that are similar to what we have seen in EJ movements.

## Theorizing Environmental Injustice and Social Difference

### Political Economic Approaches and Class Inequalities

A great deal of EJ scholarship has focused on documenting the clear and disproportionate burden of environmental harms on marginalized

people, and rightly so. But theory has long taken a back seat to the field's empirical emphasis. Below, we outline the customary theoretical frames applied to sociological EJ scholarship—largely theorizations of the role of capitalism and late modernity in the creation of increasing environmental harms. We then explore more recent developments in the scholarship that draw on other social science and humanities fields to rigorously examine how power functions through materiality, spatial relations, and cultural politics, and to grapple with the relationships between environment and social difference across a range of social categories.

EJ work is often framed by Ulrich Beck's insight that the technological and economic developments of late modernity have created a host of new hazards to human life (Beck, 1992). While Beck's argument is that society is now oriented to the management of these risks due to the hazards they present to everyone and not only the most vulnerable, he also notes that some aspects of these risks target "lower" classes more closely. The Treadmill of Production theory, advanced by Allan Schnaiberg and other scholars out of Northwestern University, more explicitly links the human and ecological problems created by late capitalism (Gould et al., 2004; Schnaiberg, 1980). It moves environmental theorizing beyond the factors of population, affluence, and an atomistic view of technological development to theorize environmental degradation in relation to capital, labor, and the state. Following the second World War, a seeming surplus of natural resources led industry to invest capital in technological development to increase productive efficiency. With each wave of investment came greater demands on natural resources, increased consumption and pollution, a weakened labor force, and increased capital accumulation (Gould et al., 2004).

Other sociologists have examined the effects of capitalism on the environment from a more explicitly Marxist perspective. John Bellamy Foster, for instance, argues that ecology and capitalism are fundamentally opposed to one another, citing capital's expansionary logic and short-run accounting practices (2002). Foster has also revived Marx's idea of a metabolic rift between humans in industrialized systems and non-human nature. Writing about soil in the 1860s, Marx argued that industrialized agriculture had served to estrange humans from nature, subverting prior agricultural symbiosis (Marx, 1972). For Foster, capitalist systems, mediating technological development and natural conditions, are the source of this metabolic rift. Brett Clark and Richard York have since applied this interpretation to climate change, arguing that a similar rift has been caused by capitalist technological expansion in increasing carbon dioxide-emitting production practices (2005). More recently, scholars have connected the commoditization of biology and its subjection to capitalist efficiencies through genetic modification with significant ecological harm (Longo et al., 2015). Each of these theories emphasizes capitalism's positioning of environmental resources as capital, not as social and biological ecosystems critical for human survival, obscuring ecological harm in the name of economic progress.

While economic theories offer helpful insight into how and why environmental harms increase alongside greater class-based inequality, the contributions of political sociology have helped to outline why those harms tend to happen to communities facing other disadvantages. Drawing from world-systems theory (Goldfrank et al., 1999), particularly Immanuel Wallerstein's work on unequal exchange (Wallerstein, 1974 and mentioned above), and Treadmill of Production theory, many scholars have begun to theorize "ecologically unequal exchange" (Gould et al., 2008; Jorgenson & Clark, 2009; Rice, 2009). This research emphasizes industrialized nations' extraction of ecological wealth from poorer countries, as well as the use of poorer countries as ecological sinks for environmental externalities. In particular, Stephen Bunker's study of the history of extractive economies in the Amazon challenges prevailing Western ideas of value production, arguing that, in the case of the Amazon, resource extraction—not labor exploitation—produces surplus value (Bunker, 1990). His and other intranational studies have found that such extractive projects exist not only

due to coercive economic arrangements, but also because they draw their cultural legitimacy from tapping into values of masculinity, modernity, or the necessity of extraction for local economic development (Bell & Braun, 2010; Bell & Gottlieb, 2016; Malin, 2015; Malin & DeMaster, 2016).

And while those class-based theories of environmental harm are invaluable, they underemphasize important social forces like institutional racism, which has allowed the rational, *economic* decisions of business and government placement of environmental hazards to be borne more often by communities of color (Cole & Foster, 2001; Feagin & Feagin, 1986; Roberts & Toffolon-Weiss, 2001; Taylor, 2014, 2016).

## Critical Analyses of Race and Space

Many scholars argue that the unequal racial outcomes associated with environmental injustice can be attributed to more contemporary cultural systems of power (Pulido, 1996, 2000; Pulido et al., 1996) and the centuries-long brutal practices associated with racial capitalism (Pulido, 2017; Pulido et al., 2016). This line of inquiry draws its inspiration from critical race theory, critical geography, ethnic studies, and Black Marxism, which are fields that offer conceptual tools for deepening EJ scholarship's approach to excavating the roots of environmental injustices. These critiques treat such processes not as externalities of capitalist systems, but as essential tools in the exercise of power. Critically, this work revolves around the idea that racial justice struggles *are* environmental struggles, and vice versa (Nishime & Williams, 2018: 3–4). EJ studies cannot fully grasp the idea of race nor the practices, discourses, structures, experiences, embodiments, and policies around racism without paying attention to their inherently environmental character. Nor can EJ studies fully grasp the anti-environmental consequences of capitalism without recognizing and engaging its fundamentally racist core (Robinson, 1983).

The critical geographer David Harvey has famously argued that "capital never solves its crisis tendencies, it merely moves them around" (Harvey, 2010)—meaning that the "externalities" of capitalism, such as the environmental harms of industrial production, are inevitable ills that must be continually moved around in ways convenient—at least temporarily—to capital accumulation. While EJ scholarship consistently uses race in its predictive models to understand the distribution of these externalities, ironically racism is rarely discussed. When it is, it is often simplified as individual acts of malice, especially in debates over whether race or class better explains environmental inequalities where markets are assumed as rational and non-racist (Pulido, 2000). An engagement with critical race theory deepens the racial critique encompassed by EJ's traditionally epidemiological methodology, as well as explanations of environmental inequities as market outcomes. Interrogations of space and power instead examine processes of unequal hazard exposure or access to environmental amenities as functions of cultural landscapes, where racial and other dynamic power relationships are quite literally mapped onto space (Dillon, 2014; Hanafi, 2016). Here, space and materiality are not just units of analysis, but themselves vehicles of power and resistance.

While this scholarship acknowledges the institutional legacy of racial segregation in the United States, it argues that racialized space is not a relic of redlining and white flight but instead a continuous process, "constantly produced and reproduced through a sociospatial dialectic" (Tyner, 2005: 66). Similarly, George Lipsitz (2011) has theorized the way in which racialized spaces have transcended their material and institutional origins and become spatial imaginaries in which white space is occupied by moral integrity, "traditional" families, and middle class lifestyles, in opposition to Black space, perceived from the outside as a space of chaos, naturalized destitution, and degeneracy. In particular, Michael Bennett argues that the twentieth century association of inner-city urban areas with Black people has itself allowed for a deeper entrenchment of racism in our "post-racial" era (Bonilla-Silva, 2005): "[I]t was precisely because racism went underground—or, more accurately, *into* the ground through the spacialization of race—that

it became invisible and in some ways more pernicious" (Bennett, 2004: 127). These ideational regimes serve to both obscure and enable the material realities of structural racism, environmental racism included.

Fundamental to many recent studies of the role of racialized spatial imaginaries in environmental racism is the conceptual equivalence of people of color with pollution. Reasons for this association should be clear to anyone familiar with histories of colonization and enslavement—which were characterized by the following phenomena: Black bodies valued exclusively for corporeal, physical labor; anxieties over racial contamination through sex and marriage; and extreme efforts to contain bodies of color through murder or social control. The same logic enables racial disparities in environmental hazard exposure. "Since the normative body is the white body, the black body, or the unavoidable black parts of the white [body politic]—its waste products, its excreta—need to be kept out of white sight" (Mills, 2001: 87–88). These processes are not at work only between Black and white spaces, as the construction of whiteness involves continuous physical and social boundary-making between what is white and many racial others (Chou et al., 2015; Flores-González, 2017; Gill, 2000), often explicitly through connecting people of color to literal waste (Hill, 2006; Moore, 2012; Sundberg, 2008). Within this theoretical frame, communities of color experience environmental racism not only because their communities have less market value, but because they are culturally devalued. This environmental racism ranges from settler colonialism (Voyles, 2015), to hazardous waste siting, to denial of basic services in the aftermath of natural disasters (Giroux, 2006; Rhodes, 2010).

## Gender and Environmental Inequality

While the vast majority of research on EJ studies has focused on the intersection of race and/or social class with environmental quality, a smaller but growing body of EJ studies explores the ways in which environmental injustices are rooted in and shaped by ideologies and politics of gender and sexuality (Mortimer-Sandilands & Erickson, 2010; Stein, 2004), building on a long history of scholarship in ecofeminism (Gaard, 2017; Salleh, 2017). Researchers have undertaken the important task of exploring the myriad means through which gender and sexuality shape the terrain of ecological inequalities (Adamson, 2011; Bell & Braun, 2010; Brown & Ferguson, 1995; Buckingham & Kulcur, 2009; Stein, 2004; Taylor, 1997). Gender and sexuality are social categories receiving more attention in this field for a number of reasons. Gender inequalities in homes, workplaces, and various institutions produce differential exposure to environmental and climate threats (Harlan et al., 2015; Pellow & Park, 2002) and women tend to make up the vast majority of rank and file participants in EJ movements (Bell, 2013; Bell & Braun, 2010; Brown & Ferguson, 1995; Bell & York, 2010; Bell et al., 2015). Celene Krauss's (1993: 247) groundbreaking work found that many white women and women of color involved in EJ movements often draw on their roles as mothers, which served "as a resource for their resistance."

One reason for the previous omission of gender and sexuality considerations in EJ studies is likely also why environmental harms often disproportionately impact women—culturally and historically feminized spaces such as the household and the body are often conceived of as private spaces, not public ones, and thus out of view (Buckingham & Kulcur, 2009). Women have historically filled these roles. Care work done by women—either unpaid or underpaid as domestic labor—often places them more regularly into contact with environmental hazards, through cooking, cleaning, growing food, and waste disposal, and with vulnerable populations such as children and the elderly (Turner & Brownhill, 2006). Women's bodies are also utilized as tools for a greater environmental good. In western countries, a drive to live a "green lifestyle" by cooking "slow food," recycling, and practicing energy efficiency have increased the burden of women's household work (Buckingham et al., 2005; MacGregor, 2006). Moreover, through population control

mechanisms, immigrant women, Indigenous women, and women of color's reproductive capacities have been targeted by policies intended to achieve the twin aims of reducing human impacts on ecosystems and containing the growth of communities viewed as threatening to dominant cultures (Escobar, 2016; Park & Pellow, 2013). A recent emphasis in gender, feminist, and queer studies on the human body and embodiment has opened up numerous possibilities for EJ Studies to redefine and expand the definition of "environments" to include the body, particularly those bodies targeted and discriminated against for nonconforming expressions of gender and sexual norms (Stein, 2004: 2).

These works in critical race theory, human geography, and gender studies challenge assertions that environmental hazards fall where they do due primarily or exclusively to economic factors, with racial disparities arising as a secondary or residual effect of the racist social history of the U.S. Instead, examining how culture and power map onto physical bodies and space, this scholarship understands issues of EJ as inextricably linked to historical and *ongoing* structural and cultural systems of power and privilege that have significant material effects. The political possibilities suggested by an analytic frame that embraces the idea of political spatial relations are somewhat different than traditional EJ recommendations for action. Typical explanations of environmental inequalities—market forces, disproportionate influence over government, the legacies of racism—emphasize a need for redistributive justice and/or substantial change in race, class, and gender representation at all levels of political leadership. The work profiled here does not preclude these changes. But it highlights the need for bringing a far more critical orientation to traditional EJ analyses.

## New Directions and Key Emerging Concepts and Frameworks

In this section we highlight a number of concepts and frameworks that environmental sociologists and environmental studies scholars have developed in recent years. They facilitate a deepening of engagement with the themes motivating this chapter, particularly around concerns with social inequality.

One important line of inquiry has been an interrogation of the very concept of justice, which has enjoyed different usage in EJ studies, EJ movements, and mainstream environmental activism. As Jill Harrison documents, neoliberal political rationalities inform mainstream ideas of justice as linked to individual freedoms, distinct from more inclusive and collectivist EJ movement ideas of justice (Harrison, 2011, 2014; Schlosberg, 2009). Relatedly, Stephanie Malin has found that neoliberalized rationalities also inform some responses to risky industries when combined with certain local cultural and economic conditions, which can lead to acceptance of, rather than resistance to, hazardous land uses (2014, 2015). David Schlosberg has called for EJ studies to take EJ activists' and organizations' understandings of justice more seriously in its empirical and theoretical work—understanding justice as not only equity in exposure to environmental harms and benefits, but as appreciation of the diverse experiences of people confronting environmental inequality and equal participation in the decision-making that results in hazard and other siting (2004, 2009, 2013). As noted earlier, this includes several models of justice such as procedural, recognitional, and restorative justice.

The concept of *new mobilities*, which moves beyond traditional static analyses to take the movement of people, processes, and material seriously (Sheller & Urry, 2006), has also been generative for EJ studies. One relevant insight from this concept is that governments and corporations enable the unjust mobilities of toxics and other environmental harms into the communities and bodies of socially marginalized populations and that EJ movements constitute a form of just mobility since people are mobilizing ideas and bodies to challenge uneven power relations (Bullard & Wright, 2009; Bullard et al., 2008; Crowder & Downey, 2010; Mennis & Jordan, 2005; Mohai et al., 2009). This focus on environmentally harmful agents as active participants in this process also offers the opportunity to

consider the concept of *ecological justice*. Following Rob White (2008) and Avi Brisman (2007), traditional approaches to EJ center primarily around the intersection of human inequality and environmental harm, while the concept of *ecological justice* engages more deeply with the uneven relationships of human beings to the broader nonhuman world. Within this frame, we can reimagine our societies as they actually have always been: constituted by multispecies relationships and networks in which humans and nonhumans are entangled and influence one another's life chances and daily existence (Bennett, 2010; Braun & Whatmore, 2010; Robbins, 2007; Wissenburg & Schlosberg, 2014).

Additionally, recent research in EJ studies has called on scholars to distinguish between unjust and *just resilience*, the latter defined as a resilience marked by social and environmental justice (Caniglia et al., 2016). One of the defining features of states, capital markets, and dominant social institutions is that they frequently deflect, displace, absorb, incorporate, and assimilate myriad challenges from various corners of society (Ahmed, 2012; Ferguson, 2012; Piven & Cloward, 1977; Scott, 2010; Selznick, 1949). *Just resilience* builds on Agyeman et al.'s (2003) concept of *just sustainability* as a set of practices and relationships characterized by deeper commitments to equity, social, and environmental justice. One example of just resilience would be the work of community-based organizations in the wake of Hurricane Katrina to rebuild and strengthen existing grassroots groups and social networks, building marginalized populations' capacities to recover and charting a future characterized by greater democratic practices (Crow, 2011).

The charge that scholars must be aware of how deeply entrenched social inequalities are in society reflects the concept of "injustices-in-waiting" (Caniglia et al., 2016), where power imbalances produced by states, corporations, and existing social hierarchies enable greater vulnerabilities and risks for human and more-than-human populations and communities across the globe. That is, while ecological threats to various bodies and spaces are inherently dangerous, once we take into account the unequal political and social terrains that give rise to and support those threats, we become more fully aware of how multiple layers of power function to create and sustain various risks for some populations while protecting others.

Appreciation of these inequalities has involved an emerging acknowledgment of environmental privilege, or the exercise of economic, political, and cultural power that some populations experience, exercise, and enjoy, which provides them with near exclusive access to coveted environmental amenities (Park & Pellow, 2013). Environmental privilege is the flipside of environmental disadvantage, but more importantly, it is a driving force behind that disadvantage. We see the concept of environmental privilege at work in more recent studies of environmental and social conflict involving elite communities in New England (Murphy, 2016) and the super-rich (Farrell, 2020). Militarism also frequently makes intra- and international environmental privilege possible and enduring —those ideologies, polices, and practices that support institutionalized authoritarian violence that work in the service of border-making, statecraft, and racial/ethnic supremacies (see Chap. 18).

Scholars have proposed a *critical environmental justice studies* (CEJ) framework to address some limitations and tensions within EJ studies (Adamson, 2011; Pellow & Brulle, 2005). These include four interventions, the first of which is the need to examine multiple forms of inequality and their intersections. Debates over whether race or class produce environmental inequality have limited many EJ studies to atomistic understandings of inequality. The work profiled above examines cultural dimensions of racial and gendered inequality and offers crucial steps to move beyond such additive modes of inquiry and encourages intersectional approaches to EJ (Malin & Ryder, 2018; Pellow, 2017). CEJ emphasizes confronting dominance in all its forms, including heteropatriarchy, all forms of racism (not just white supremacy), ableism, speciesism/dominionism, transphobia, and colonialism (see Chap. 2 for a full review of

intersectionality and environment). The second CEJ intervention is to pay greater attention to multi-scalar approaches, allowing us to understand how environmental injustices are facilitated by decision makers who are spatially and temporally removed from communities experiencing environmental inequalities. This also assists us in observing how grassroots EJ movements draw on spatial frameworks, networks, and knowledge to make the connections between hazards in one place and harm in another.

The third intervention is to encourage EJ scholars and movements to interrogate the social institutions—often the state and its legal systems—that it often takes for granted and looks to for justice (Benford, 2005). The approach of EJ studies is often reformist rather than abolitionist, and this is concerning for scholars who view those institutions as existential threats to visions of social and environmental justice (Bullock et al., 2018; Cole & Foster, 2001; Pellow, 2017; Pulido, 2017). CEJ studies seek to push EJ analyses and actions beyond the state, beyond capital, and beyond the human via a broad anti-authoritarian perspective. CEJ's fourth and final intervention is to challenge the expendability of human and non-human populations facing threats from states, industries, and other political economic forces, much of which is discussed above. EJ studies suggest that various marginalized human populations and non-human ones are treated and viewed as inferior and less valuable to society than others (Márquez, 2014; Nixon, 2011; Pulido, 2017; Voyles, 2015). CEJ argues that marginalized populations are marked for erasure and early death, and that such ideological and institutional devaluation is linked to the more-than-human world as well. To counter this, CEJ views these threatened bodies, populations, and spaces as indispensable to building socially and environmentally just and resilient futures for us all.

## Conclusion

In this chapter, we highlighted key developments in the field of EJ studies, from within environmental sociology and inclusive of the much more expansive and multidisciplinary environmental social sciences, environmental humanities, and gender and ethnic studies scholarship. The incorporation of these fields and the resultant appreciation of social difference, social inequality, and power that they encourage, drive and shape a deeper understanding of environmental inequality as well as struggles for more creative imaginings and transformative visions of EJ. By questioning, expanding, and deepening our definitions of the concept of *justice*, EJ scholars have developed tools to promote critical thinking, discourse, and action that can facilitate and enable ecologically sustainable and socially just relationships among humans and between humans and our more-than-human relations.

Environmental justice studies has advanced the fields of environmental sociology, sociology, and the social sciences more broadly by demonstrating that environmental benefits and risks are distributed in vastly unequal ways across social and geographic terrains, *and* that social inequalities are perhaps the most important driving force in (re)producing our ecological crises. What this research reveals is an understanding that the cry for justice among communities fighting against environmental racism and inequality is not a second order ecological issue; it speaks to the root cause of the problem as well as the solution. For example, when societies enjoy greater levels of equality and democracy, they are more likely to be protective of ecosystems and when societies experience rising inequalities they are much more likely to be less attentive to ecological protection.

EJ scholarship has also benefited from influences by scholars in fields (such as critical race theory, ethnic studies, and critical geography) who are linking concerns over the anti-ecological character of capitalism to its inherently racist and patriarchal core. These scholars are therefore pushing EJ studies to consider the limits of the reformist theoretical and policy research orientation that has dominated the field and has embraced the state and capital as the primary vehicles for the development of solutions to environmental injustice. Such advances present a

major challenge not only to much of the traditional scholarship in EJ studies but also to the very scholars issuing the call for a more radical orientation. For example, how does an emergent field envision its durability and future viability in a society that generally embraces ideas that run counter to these frameworks? These are among the many risks and dilemmas facing EJ scholarship as the field expands and evolves in exciting directions.

Such analyses are already providing a much clearer picture of a critical question that has only recently been raised in EJ studies—what are the challenges to EJ mobilization? Ethnographic work exploring this topic suggests that a confluence of factors can lead to hazard acceptance, from the hope that industry will fill the void following an erosion of government services and regulation (Malin, 2014), to powerful local gendered identities tied to coal production (Bell & Braun, 2010; Bell & York, 2010). These studies underscore the importance of understanding environmental inequality not as a static product of racial or economic inequality, but as inextricably linked to ongoing processes of domination and oppression including, but certainly not limited to, the traditional sociological categories of race, class, and gender. These developments in the field also encourage EJ to critically engage with the politics of nature, which have important implications for other systems of injustice. For example, by offering analyses of how ideas of "nature" have been mobilized to enforce heteronormativity, regulate sexuality, and criminalize and marginalize persons deemed sexually transgressive, scholars have reframed "environmental studies" concerns to include an understanding of the ways that diverse sexual identities, expressions, and practices have been defined as "unnatural," thus allowing for creative ways of linking EJ studies to gender, feminist, sexuality, and queer studies (Mortimer-Sandilands & Erickson, 2010).

Fundamentally, EJ studies is at its strongest when it encompasses a critical, intersectional, and dynamic understanding of environmental inequality and the EJ movement. As the scope of EJ studies continues to widen and its analyses deepen, we look forward to even more meaningful engagement with myriad struggles for social justice.

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# Ecologically Unequal Exchange and Environmental Load Displacement

4

## Global Perspectives on Structural Inequalities and the Environment

Jennifer E. Givens and Xiaorui Huang

## Introduction

Ecologically unequal exchange theory and the concept of environmental load displacement contribute two important global, political economic approaches to environmental sociology. In this chapter, we first introduce these two concepts. We then trace the intertwined but distinct historical roots of these two ideas, which have now coalesced into a more unified body of research. Next, we discuss early foundational theoretical development and empirical research. Then we review the most current research to date, including several special issues of journals and a recently published book on these perspectives. We conclude with thoughts on future directions.

Ecologically unequal exchange theory posits that inequality in the global system shapes the unequal distribution of both economic development and environmental harms. The theory portrays a global structural relationship in which wealthier, more-powerful countries have disproportionate access to both natural resources and sink capacity—for extraction, production, and consumption-related waste products—in less-developed countries, via trade and other global dynamics. This structural relationship of unequal material flows not only results in environmental injustice, but it also has implications for development and shapes inequalities in human well-being (Hornborg, 1998b, 2009; Jorgenson, 2006; Jorgenson & Clark, 2009a, 2009b; Rice, 2007b).

Related research on environmental load displacement challenges some mainstream economic understandings of development and dematerialization. Early scholars of environmental load displacement noted that mainstream and conventional economic analysis does not adequately take into account flows of material and energy in trade, and its emphasis on "the apparent reciprocity of market prices" obscures inequalities in trade (Hornborg & Martinez-Alier, 2016: 329). Environmental load displacement refers to how the global organization of material flows allows more-developed nations to gain unequal access to resources for development while displacing the undesirable industries and associated environmental harms to less development countries; this global organization of materials flows is conditioned by mechanisms including trade, foreign direct investment, and global production networks and commodity chains (Hornborg, 2006, 2009; Jorgenson, 2010; Muradian & Martinez-Alier, 2001a; Muradian et al., 2002). In other words, the environmental burden of development is shifted across people, space, and time. Research on environmental load

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displacement demonstrates that proper accounting of sustainability must attend to the environmental harms produced by countries outside of their borders. This notion inspired early environmental load displacement scholars to use footprint-related measures to better account for the consumption-related environmental impacts of national economies (Muradian et al., 2002). Later research examines a variety of measures, including greenhouse gas emissions, organic water pollutants, and deforestation, and finds evidence of the displacement of the environmental burdens to less developed countries via the global organization of production (e.g., Jorgenson, 2007, 2010).

Ecologically unequal exchange and environmental load displacement highlight the importance of considering global relationships when assessing environmental sustainability and development. Jorgenson (2016a: 2) writes, "The disparities in environmental damages are uneven within and especially between nations. Rich nations place more stress on the global environment, while poorer nations disproportionately contend with the effects and consequences of degraded and/or stressed ecosystems" (Jorgenson, 2016a: 2). Global perspectives are a necessary complement to key theoretical perspectives in environmental sociology concerned with the environmental impacts of economic development and growth, such as ecological modernization and treadmill of production theories (Jorgenson & Clark, 2012; Mol, 1997; Mol et al., 2014; Schnaiberg, 1980; Spaargaren & Mol, 1992; see Givens et al., 2016 and Jorgenson, 2016a for reviews). These global perspectives enable scholars to ask theoretically grounded research questions about the relationships between global dynamics and environmental and social sustainability outcomes. Furthermore, although the focus is global, local and global systems co-evolve. Bunker (2019: 14), a scholar whose work is foundational to environmental sociology and the theory of ecologically unequal exchange writes, "Regardless of the degree to which exchange systems have become global, commodities can emerge only out of locally based extraction and production systems". Ecologically unequal exchange theory and the related concept of environmental load displacement allow for the bridging of the local to the global in historical and current contexts.

Many researchers, policy makers, and activists are engaged in the process of trying to improve sustainability in response to climate change and other environmental issues. Global perspectives are vital to develop an accurate understanding of how global contexts affect sustainability across multiple scales. More specifically, ecologically unequal exchange and environmental load displacement direct attention to how the structure of the world economy, the global organization of production, including extraction, production, consumption, and disposal, and globally unequal relationships in trade, foreign direct investment, production networks, and global commodity chains affect both environmental and human well-being outcomes in countries at different levels of development. The research in this tradition demonstrates that these unequal relationships create disproportionate advantages for more powerful countries and detrimental effects for development, well-being, and environmental quality in less developed countries. These are important considerations for the environment and for global social equity and justice.

## Historical Roots

Theoretical perspectives develop in historical contexts, often in contradiction to existing explanations. Ecologically unequal exchange theory has roots in development theories. A once prominent theory of development was modernization theory. This perspective portrayed development as a linear process in which countries progress through stages of development (Rostow, 1960). It provided an optimistic proscription for growth for all nations that would lead to convergence in level of development.[1] Modernization

[1] Neoliberalism, consisting of proscriptions for growth that promote the idea of free markets, may be modernization theory in "altered clothing" as it provides proscriptions for less-developed countries to catch up to more-developed ones, ignoring many of the complications pointed out by both de-pendency and world-systems theories (Wallerstein, 2000: 106).

theory was ahistorical, drew too heavily on the experience of European nations, overlooked the differing positions of nation-states in the global hierarchy, and failed to explain realities in the less-developed countries. In response, scholars developed dependency theory, which emphasized a country's historical situation, especially its colonial past, and demonstrated how the development of capitalism produced development in certain nations and underdevelopment in others (Amin, 1976; Frank, 1979; Prebisch, 1950). Wallerstein's (1974) world-systems perspective turned the ideas of dependency theory into a global perspective linked to the historical development of capitalism. Rather than portraying nation-states as developing to a point of global convergence in level of development, world-systems theory groups nation-states into one of three categories, core, semi-periphery, and periphery. Although there are many examples of countries that have been able to shift their position, and there have been several different nation-states as world leaders, termed "global hegemons" (Friedman & Chase-Dunn, 2005), the overall hierarchical structure is perceived to be relatively static, at least since the origin of capitalism as a global system until the present. To this point, Wallerstein (1974: 108) emphasizes historical context, writing, "there are no generalizations that are not historically time-bound". Contra modernization theory, the world-systems approach explores the global economic system's historical and current influence on relationships both between and within nation-states. In other words, this perspective emphasizes how nation-states and sub-national outcomes are shaped not only by dynamics within countries, but also by the global system and external forces, the impacts of which vary based on a nation's history and position in the global hierarchy (Chase-Dunn, 1998).

The theories of development described above do not emphasize environmental considerations. Bunker (1985, see also Bunker, 1984), in his *Underdeveloping the Amazon: Extraction, Unequal Exchange, and the Failure of the Modern State,* "pioneers the integration of ecology and world-system analysis" and combines Marx's labor theory of value with a natural theory of value (Hornborg, 2007: 6; see also Roberts & Grimes, 2002). Bunker's foundational text on the extractive economies of the Amazon explores the question, "why and how did none of the government programs for the development of the Amazon appear to succeed, despite the massive financial and political commitment of the government?" (Bunker, 1985: 11). He finds that the Amazon's export economies relied on "extraction of value from nature rather than on the creation of value by labor," and highlights the failings of previous development theory to consider the "impact of social and economic change on ecological systems" (Bunker, 1985: 12). Bunker builds upon Marxist emphases on modes of production and wage differentials, specifically building upon Emmanuel's (1972) notion of wage differentials as the basis of unequal exchange. Bunker's (1985: 42–43, 238–246) work in the Amazon demonstrates that such calculations must also include the laws of thermodynamics, which aid in conceptualizing embodied energy in economic and social organization, and allow for a novel approach to incorporating ecological processes into the study of development.

Bunker's (1985) key findings are the roots of the theory of ecologically unequal exchange. He finds that "human organization in the Amazon is no longer bounded by its own ecosystem" and "the ecological devastation of the Amazon started when the modes of extraction organized in response to world-system exchange opportunities focused on the single natural products for which there was greatest global demand" (Bunker, 1985: 250). Bunker (1985: 13–14) highlights differences between extractive and productive economies, "the thermodynamics of the physical dependence of production on extraction," and how each human intervention transforms the environment in ways that limit future interventions. The extractive economy of the Amazon has occurred in "response to the needs of changing productive and political relations outside of the Amazon and the opportunities for enrichment which they offered. Each of these penetrations has been effected and extended by locally dominant groups who have had power to

transform the environment of others" (Bunker, 1985: 15). Yet local elites' responses to world market opportunities "ultimately impoverished the resource base on which their own wealth and profits depended" (Bunker, 1985: 238). Bunker (1985: 253) suggests that in order for economic development and improvements in environmental quality and human well-being to occur there is a need to "slow the flow of energy to the world center." Decisions to address this, however, "can only be made at the local or regional level, which is precisely the level at which extractive sequences undermine the social power necessary to implement effective decisions to resist continued depredation" (Bunker, 1985: 247). Later comparative historical work by Bunker and Ciccantell (2005) further explores extractive and productive economies, trade dominance, finance, and the role of transport and other technologies in the material processes of economic expansion and the interplay between the local and global.

Environmental load displacement is the process by which more developed, more powerful nations, outsource their undesirable industries and environmental harms to less-developed nations and gain access to additional resources to meet their disproportionately high levels of consumption. Nations do this via mechanisms including trade, foreign direct investment, production networks, and global commodity chains. The concept of environmental load displacement, while closely related to the ideas of ecologically unequal exchange, has origins in a foundational idea in ecological economics, although below we also detail its closely related sociological origins. According to classical economic theory and David Ricardo's theory of comparative advantage, trade integration is a development strategy. The theory of comparative advantage suggests all parties, applied here to countries, can achieve welfare gains by producing the products they specialize in comparatively more efficiently and trading such products with other countries. Contra this perspective on trade and development, others argue that this proposal is unlikely to be successful because of the violence inherent in the structural and relational characteristics of the world economy. From this perspective, the vast inequality in the global system is a form of structural violence, "structural" referring to situations when there is no direct actor that commits the violence (Galtung, 1969). Economic imperialism takes the form of the ability of powerful countries to dictate asymmetric terms of trade to less powerful countries, leading to unequal patterns of trade composition, including imbalances in exports and imports of raw versus processed materials, and trade partner concentration—reliance on fewer trading partners, especially in poorer countries (Galtung, 1971).

Parallel to classical economic debates about the beneficial or negative effects of trade on development, a debate exists between environmental economics and ecological economics regarding the effect of economic growth and trade on the environment (Muradian & Martinez-Alier, 2001b). The "Netherlands Fallacy" gives name to the incorrect assumption that levels of well-being in the Netherlands are achieved without placing any environmental burdens outside of the country (Ehrlich & Holdren, 1971; Rice, 2007a). Despite this, mainstream economic models, building from neoclassical economics, do not take into account and thus cannot assess ecological structure or function (Rees, 1996). Thus, environmental economics assumes an unproblematic relationship between free trade, economic growth, and the environment; environmental problems that may arise are seen as externalities, resulting from of a lack of appropriate national policies. Free trade is portrayed as a "win-win" situation creating welfare gains and demands for environmental protection, government revenues that allow for more environmental policies, and a pollution halo (Cole et al., 2008) of green technology sharing and diffusion (for a review see Muradian & Martinez-Alier, 2001b).[2] The concept of dematerialization, an absolute reduction in the amount of natural materials used, sometimes incorrectly conceptualized as efficiency gains such as use per unit of GDP (Muradian & Martinez-Alier,

[2] There are parallels here to ecological modernization theory (e.g., Mol, 1997) from environmental sociology.

2001a), and the environmental Kuznets curve hypothesis, which posits an increasing and then decreasing environmental impact of economic growth (Grossman & Krueger, 1995), are associated concepts.

Ecological economists, on the other hand, are critical of these assumptions by environmental economists regarding trade and economic growth and subsequently economic growth, trade, and the environment. Instead, they draw attention to how trade allows more powerful nations to engage in environmental cost shifting (Muradian & Martinez-Alier, 2001b). As a result, rather than experiencing a pollution halo, some countries in pursuing their comparative advantage could become a pollution haven (Leonard, 1988). Muradian and Martinez-Allier (2002: 294, 286) point to "asymmetries in power" that challenge the logic of comparative advantage on environmental grounds, instead identifying a "specialization trap" that can occur when less-developed countries become trapped in specialization in environmentally intensive industries, such as primary sector resource extraction. Ecological economists argue that the environmental effects of national economies outside of the country's borders, termed "environmental load displacement" must be examined theoretically and empirically, in addition to being addressed in practice (Muradian & Martinez-Alier, 2001b). Some studies may incorrectly find support for dematerialization or an environmental Kuznets curve if environmental load displacement is not taken into account. Muradian and Martinez-Alier suggest looking at international trade in raw materials as a proxy to better understand how developed countries "displace the environmental costs associated with material throughput to poorer regions of the world" (Muradian & Martinez-Alier, 2001a: 171). In other work, Muradian et al. (2002) consider environmental load displacement indicators that capture global perspective on sustainable development, such as the balance of embodied emissions in trade.

Both within and beyond ecological economics, ecological footprint analysis gained traction as a way to address concerns related to environmental load displacement and sustainable development (Wackernagel & Rees, 1995, 1997). The ecological footprint is "the corresponding area of productive land and aquatic ecosystems required to produce the resources used, and to assimilate the wastes produced, by a defined population at a specified material standard of living, wherever on Earth that land may be located" (Rees, 1996: 205). It is a biophysical measure of relevant natural capital stocks and flows within the context of the economic system (Wackernagel & Rees, 1997). Ecological economists are concerned that economic rationality and trade, rather than encouraging the preservation of natural capital, actually accelerates the liquidation and depletion of natural capital stocks and undermines local and global stability (Wackernagel & Rees, 1997). "On a finite planet, ecological trade is a zero-sum game. . .and blinds us to the negative consequences of our over-consumption which often accrue in distant export regions" (Rees, 1996: 211–212). Footprint analysis allows for individual country accounting that takes consumption and environmental load displacement into account and draws attention to the global ecological deficits and thus long-term ecological constraints on the economy (Andersson & Lindroth, 2001; Moran et al., 2008; Wackernagel & Rees, 1997; Wackernagel et al., 1999). This early use of the ecological footprint approach provides empirical support that many more-developed countries appropriate carrying capacity from other countries via trade as a mechanism, and thus owe "massive unaccounted ecological deficits," leading the author to conclude that sustainability needs to account for issues of equity on a global scale (Rees, 1996: 195).

The environmental footprint measure was also employed in environmental sociology. The ecological footprint was often used as a measure of human use of or impact on the environment (e.g., Dietz et al., 2007; Jorgenson, 2003; Jorgenson & Clark, 2011; Rosa et al., 2004; York et al., 2003a, 2003b, 2004). In an early study, Jorgenson (2003) employed the ecological footprint measure in a world-systems analysis and found that world system position is a key driver of per capita consumption of natural resources.

In addition to its origins in ecological economics, environmental load displacement also has sociological origins. A large body of sociological literature on foreign direct investment or foreign investment dependence and the environment focuses explicitly on the environmental impacts of foreign direct investment and foreign investment dependence, and how such investment acts as a mechanism of environmental load displacement (e.g., Jorgenson, 2007, 2010; see Jorgenson, 2016b for a review). This literature has roots in the debated idea that attracting foreign direct investment and focusing on export-oriented production are effective development and debt-reduction strategies for less-developed nations (Gilpin, 2001; Kentor, 1998; Kentor & Boswell, 2003; McMichael, 2012). The sociological literature on foreign investment dependence and the environment critically examines this idea and draws attention to the environmental and social impacts of such strategies.

## Early Theory Development and Empirical Research

From the historical roots described above, Hornborg (1998a, 1998b), utilizing cultural anthropology and critical human ecology perspectives, builds upon both the environmental sociology of Bunker and concepts from ecological economics. In line with ecological economics, Hornborg draws upon the work of Martinez-Alier and Wackernagel and Rees and criticizes neoclassical economic conceptualizations of the market that do not allow for assessing a market relationship as unfair or taking ecological considerations into account (Hornborg, 1998a, 2013). Drawing upon Bunker, he argues that ecology is an integral part of political economic analysis (Hornborg, 1998b) and that capital accumulation requires both labor and land. This leads him to suggest that we need measures to explore Emmanuel's (1972) concept of unequal exchange that take both natural space and labor into account and that are not reduced to monetary units (Hornborg, 1998a). Hornborg (1998a, 1998b) proposes an ecological theory of unequal exchange that combines insights from world-systems theory and ecological economics. One of Hornborg's key insights draws upon Odum's (1988) concept of embodied energy and Georgescu-Roegen's (1971) work on thermodynamics and the laws of entropy, which state that matter is neither created nor destroyed but rather degraded as its inherent energy is transformed or used (Georgescu-Roegen, 1986; see also Foster & Holleman, 2014; Hornborg, 2015). In an analysis that incorporates considerations of modernity, technology, industrial production, capital accumulation, and culture, Hornborg (1998a, 1998b, see also 2001) demonstrates that unequal exchange originates in an inverse relationship between available energy for production and price; raw materials have greater productive potential, but are priced lower than processed goods. This skewed valuation of resources generates inseparable ecological destruction and global inequality (Hornborg, 1998a, 1998b). Hornborg is critical of "sustainababble" and the currently hegemonic view that sees development as a cornucopia rather than a zero sum game and presents capital accumulation in the core as unlinked to poverty and environmental problems in the Global South (Hornborg, 2003: 208).

From these historical roots and theoretical foundations, several scholars contributed to developing the theory of ecologically unequal exchange and environmental load displacement by testing these concepts empirically. Hornborg (2006) analyzes the land and labor inputs to cotton and wool production, bringing together ideas of unequal exchange, environmental load displacement, and ecological footprint analysis. He presents the industrial revolution as time-space appropriation, more global zero sum game than national cornucopia. In a major contribution to this body of work, Jorgenson (2006) observes that political economic analyses examining the impacts of trade generally ignore environmental impacts (for exceptions see Burns et al., 1994; Kick et al., 1996), and while environmental sociologists attend to environmental impacts, the theorization and empirical analysis of the environmental impacts of trade are underdeveloped. Jorgenson (2006) therefore proposes and tests a

structural theory of ecologically unequal exchange in macrosociology. In order to test the theory empirically, he constructs a unique weighted index of vertical trade. This measure includes all primary and secondary sector exports and "quantifies the relative extent to which a nation's exports are sent to more developed countries" (Jorgenson, 2006: 706). This measure, together with a measure of export intensity (i.e., the percent of GDP made up of exports), represents unequal trade relationships in the global system, in addition to unequal position overall, and this empirical advance allows for the testing and development of the theory. Using this newly constructed measure, Jorgenson (2006) then assesses the impact of such unequal trade relationships on deforestation rates, and finds that the weighted export flows lead to higher deforestation in less developed countries, which confirms hypotheses derived from the theory. This helps to further explain the consumption/degradation paradox in which more-developed countries consume more resources yet experience less environmental degradation within their borders (Jorgenson, 2003; Jorgenson et al., 2009). As Muradian and Martinez-Alier (2001a) note, this paradox can result in fewer challenges to the status quo because people and nations with high levels of consumption and large environmental impacts are less likely to feel the environmental costs of their actions (see also Givens & Jorgenson, 2011).

Jorgenson's (2006) early article in macro comparative environmental sociology marks the beginning of the development of a body of research using multiple iterations of weighted exports flow measures and finding support for the theory of ecologically unequal exchange (for detailed reviews see Jorgenson, 2016a, 2016b). These studies examine the impact of ecologically unequal exchange on multiple environmental outcomes including ecological footprints (Jorgenson & Rice, 2005), industrial organic water pollution (Shandra et al., 2009b), deforestation (Jorgenson, 2010; Jorgenson et al., 2010), biodiversity (Shandra et al., 2009a) and anthropogenic carbon dioxide emissions (Jorgenson, 2011, 2012; Roberts & Parks, 2007b). Some analyses look at weighted export flows in general, while others examine export flows in certain sectors. As the research progresses, scholars are able to implement more statistically rigorous considerations of time (e.g., Jorgenson, 2009c; Jorgenson et al., 2009) and to detect for greenhouse gas emissions in particular, that relationships between more- and less-developed countries have become increasingly unequal through time (Jorgenson, 2012).

Research also demonstrates that, in addition to creating environmental injustices, ecologically unequal exchange has human well-being implications. The vertical flow of material value suppresses resource consumption within populations of less-developed countries (Jorgenson, 2009c; Jorgenson & Clark, 2009a; Jorgenson & Rice, 2005; Rice, 2007b, 2008). This under-consumption can lead to negative health outcomes such as increased maternal mortality (Rice, 2008), and infant mortality linked to water pollution (Jorgenson, 2009b), perpetuating a lack of development in lower income countries (Jorgenson, 2012).

Further research integrates the theory of ecologically unequal exchange with other theories and theoretical debates within environmental sociology, including the treadmill of production and the treadmill of destruction (Jorgenson & Clark, 2009b) and the treadmill of production and ecological modernization (Jorgenson & Clark, 2012; see also Givens et al., 2016). The theory of ecologically unequal exchange and the concept of environmental load displacement adds an important global and development perspective to environmental sociology. Writing on the treadmill of production, Gould et al. (2008: 32) observe, "it seems apparent that more of human activities throughout the world fall under the influence of the treadmill institutions and logic than was true in 1980." The ecologically unequal exchange perspective with roots in world-systems theory helps us see that while the capitalist world-system with its treadmill logic affects the whole planet, the effects play out differently in different areas, framing the structure of global inequality. Ecologically unequal exchange and

environmental load displacement are historical and ongoing processes that create and perpetuate our current context of global inequality.

The increasing scholarly interests in ecologically unequal exchange and environmental load displacement led to the first special journal issue on these perspectives in 2009, edited by Jorgenson and Clark (2009a).[3] In this special issue, Rice (2009) describes how the treadmill of production logic has expanded to create the transnational organization of production, facilitating capital accumulation in the Global North to the detriment of the environment and human well-being in the Global South (see also Bunker, 2005). Hornborg (2009: 237) argues that it is an illusion to assume that sustainable development can be achieved via consensus, and he criticizes sustainability and resilience discourses for failing to take into account the "distributive, political, and cultural dimensions of global environmental problems" that ecologically unequal exchange and environmental load displacement highlight. Also contributing to a focus on equity issues, Roberts and Parks (2009) discuss how the research in this area informs the global climate regime, encouraging less-developed countries to claim they are owed an ecological debt and shaping calls for climate justice, in an era when development will be increasingly constrained by climate change. Ciccantell and Smith (2009) argue for utilizing insights from ecologically unequal exchange to improve the global commodity chain approach such as by lengthening the chains to examine resource extraction and looking at tightly integrated social and natural processes across industries. Clark and Foster (2009) provide an historical account of the guano/nitrates trade, and find the social metabolism of capitalism inherently drives ecological imperialism. Several quantitative empirical articles find support for the theory in the context of deforestation and the per capita ecological footprint (Jorgenson et al., 2009), in the context of energy use and emissions (Lawrence, 2009), and in the context of biodiversity loss (Shandra et al., 2009a). The articles in this special issue provide a wealth of directions for research that scholars continue to explore.

Scholars working on environmental load displacement in the form of foreign investment dependence and the environment also found empirical support for the idea that foreign investment is a mechanism by which more developed countries externalize their environmental impacts to less developed nations in the world economy. These scholars tend to note the importance of looking at the effects of sector-specific foreign direct investment. In terms of secondary sector, manufacturing investment, scholars find that foreign direct investment in this sector is a mechanism by which more developed countries outsource polluting industries and components of production processes to less developed countries. Secondary sector foreign direct investment is associated with elevated carbon emissions (Grimes & Kentor, 2003; Jorgenson, 2007, 2009d; Jorgenson et al., 2011), per capita noxious gas emissions (Jorgenson et al., 2007), deforestation (Jorgenson, 2010), and organic water pollution in less developed countries (Jorgenson, 2007, 2009d; Jorgenson et al., 2011). Foreign investment in the primary sector, which includes natural resource extraction such as mining, forestry, and agriculture, is associated with increased deforestation (Jorgenson et al., 2011) pesticide and fertilizer use (Jorgenson & Kuykendall, 2008), and nitrous oxide emissions (Dick & Jorgenson, 2010) in less developed countries. While some scholars do find evidence of the ability of environmental organizations to mitigate the detrimental environmental effects of foreign investment dependence (Jorgenson, 2009a; Jorgenson et al., 2011) the overall harmful environmental effect of primary and secondary sector foreign investment has much empirical support.

## Current Research

Whether it is a result of ongoing forces of globalization, or an increasing awareness of global problems such as climate change, there seems to be a resurgence of global perspectives. Two

[3] *The International Journal of Comparative Sociology,* 2009, v50, issue 3–4, Jorgenson and Clark, (Eds.).

special issues and a book on ecologically unequal exchange have come out since 2016 (Frey et al., 2019).[4] In addition, multiple other recently published articles utilize the concept of environmental load displacement and ecologically unequal exchange theory. Here, we briefly review some of the key themes of these works.

There is growing body of empirical research on ecologically unequal exchange and environmental load displacement in specific industries in which the material extraction and production occur in the Global South but the products are primarily exported to and consumed in the Global North. For example, Noble (2017) finds that export concentration in cocoa is associated with more intense deforestation after 2009 but not in earlier periods, suggesting that while traditional cocoa cultivation did not drive deforestation, recent increases in the demands from the Global North have pressured growers to adopt more spatially expansive and unsustainable cultivation methods. Similarly, Sommer et al. (2019) find that political repression exacerbates ecologically unequal relationships; flows of mining exports are associated with increased deforestation in politically repressive countries in the Global South. Concerning natural resource extraction in general, Long et al. (2017) find that total stocks of foreign direct investment is associated with greater forest, mineral, and overall natural resource depletion in the Global South.

In addition to the quantitative studies mentioned above, several qualitative empirical studies dive more deeply into regional and local nuances of the impacts of ecologically unequal relationships and highlight mechanisms that shape ecologically unequal relationships. Austin (2017) documents that export-oriented coffee cultivation in Uganda causes deforestation and adversely affects the health, gender dynamics, and economic stability of local communities, noting that while short-term material benefits may accrue to some, this is at the expense of longer-term stability, community well-being including gender relations, and environmental quality. Drawing from the tragedy of the commodity thesis (Longo et al., 2015), which points to the commodification of resources as central to their depletion, Clark et al. (2019) examine ecologically and economically unequal exchange in global marine fisheries. The authors detail the labor exploitation and fish stock depletion in Southeast Asian fishing and seafood processing industries, whose products are consumed in the Global North. In an exploration of case studies from the automobile industry, Bonds and Downey (2012) find that the applications of "green" technology in the Global North often require raw materials extracted from the Global South that are associated with environmental degradation and human right violations (see also Hornborg, 2013, 2014). Ciccantell (2019: 50) notes that an important challenge for countries pursuing economic growth is to "acquire growing volumes of raw materials at lower costs and in greater and more secure volumes than other competing economies." To better illuminate the hidden dynamics of global inequality in material relationships, Ciccantell (2019) proposes an integrated approach that combines ecologically unequal exchange theory with the "raw materialist lengthened global commodity chains" model. This research focuses on raw materials-based industries and incorporates into the analysis economic activities and sociopolitical dynamics that occur at local levels at the upstream ends of commodity chains.

Another group of studies illustrates unequal exchange dynamics by examining the monetary and biophysical characteristics of countries' material flows. Dorninger and Eisenmenger (2016) focus on Argentina, Bolivia, and Brazil, and find that these countries' exports to Global North countries feature high concentrations of unprocessed materials, low unit prices, and disadvantageous money trade balances. These characteristics are not observed in the exports to Global South countries. The overall results exemplify ecologically unequal exchange processes

[4] Special section of *the Journal of Political Ecology*, 2016, v23, pp. 328–491, Hornborg and Martinez-Alier (Eds.); *The Journal of World-Systems Research*, 2017, v23, issue 2, Gellert, Frey, and Dahms (Eds.); Ecologically Unequal Exchange: Environmental Injustice in Comparative and Historical Perspective, 2019, Frey, Gellert, and Dahms (Eds.).

between the Global North and the three countries of interest. Likewise, Martinez-Alier et al. (2016a) compare the physical trade balances and domestic material extractions in South America and India, and observe in the former ecologically unequal exchange via international trade and in the latter a pattern of ecological internal colonialism where some Indian states appropriate raw materials from other states for economic development.

Multiple studies explore the failure of global civil society and various legal, political, and economic institutions to mediate the processes of ecologically unequal exchange and environmental load displacement. Jaria i Manzano et al. (2016) argue that the existing global governance institutions, particularly the international legal system, perpetuates the existent uneven relationship between countries, at various scales and in varying contexts. Oulu (2016) assesses the European Union's Raw Materials Initiative as an example of mainstream economic policies, and finds they fail to address issues identified in ecologically unequal exchange research. Oulu (2016: 460) argues that conventional policies "resemble ad hoc humanitarianism which mobilizes empathy rather than recognize the rights and root causes, hence only superficially address the contradictions and inequalities of our world." Kill (2016) studies the Forest Stewardship Council's certification of Brazilian industrial tree plantations, finding such voluntary product certification programs, supposedly authenticating the social and environmental sustainability of the production of certified goods, could adversely affect the social and ecological well-being of the local communities. In an examination of the impacts of humanitarian aid to India after the 2004 Tsunami, Swamy (2017) finds that post-disaster aid from Global North to Global South countries allow the governments and elites in the latter to advance commercial, infrastructural, and natural resources development projects that disproportionally benefit local elites and the Global North at the expense of marginalized local communities.

Some current studies, especially at the macro scale, find support for both ecologically unequal exchange and the mediating effects of civil society connections, in line with some previous research at similar levels of analysis (Jorgenson et al., 2011). For example, Givens and Jorgenson (2014) find that Global South countries' integration into the world society alleviates the impacts of the vertical flow of exports on increasing carbon dioxide emissions. Likewise, Henderson and Shorette (2017) find a similar effect of world society connection on deforestation in 15 palm oil producing countries in the Global South.

Building upon earlier work (e.g., Jorgenson, 2012; Roberts & Parks, 2007b), researchers further explore the implications of ecologically unequal exchange and environmental load displacement for global climate change. Warlenius (2016) argues that the unequal appropriation of global carbon sinks among countries, an important aspect of global climate injustice, can be better integrated into ecologically unequal exchange theory through a flow-stock approach: ecologically unequal exchanges via both trade and non-trade mechanisms are conceptualized as flows that contribute to the cumulative stocks of ecological debts. Prell and Sun (2015) find that the most- and least-developed countries are typically net importers of carbon dioxide emissions embedded in traded goods, while countries with medium level of economic development tend to be net exporters of embedded carbon, indicating an unequal structure of trade where emerging economies undertake polluting manufacturing for the consumption in Global North. Givens (2018) finds evidence of ecologically unequal exchange in the context of both social well-being and ecological sustainability as it pertains to climate change. Trade within the Global North reduces the carbon intensity of well-being (CIWB) of the exporting countries, whereas the vertical flows of exports from the Global South to the Global North are associated with higher CIWB in the exporters, a dynamic that increases in magnitude over time.[5] Huang (2018) finds that

[5] CIWB is operationalized as the ratio of carbon dioxide emissions per capita and average life expectancy. A higher CIWB suggests more resources are used to produce human well-being.

U.S. economic recessions mediate the effect of the vertical flows of exports to the United States on increasing carbon dioxide emissions in Global South countries, suggesting that economic recessions in the Global North may affect the unequal exchange dynamics and in turn affect carbon emissions in the Global South. Highlighting the worsening global water scarcity due to climate change, Fitzgerald and Auerbach (2016) find that Global North countries are able to reduce their water footprint through trade with Global North countries, whereas this beneficial effect of the vertical flow of exports is unobserved for Global South countries.[6] Bradford and Stoner (2017) incorporate considerations of ecologically unequal exchange into their analysis of military spending and carbon emissions. Although they do not find strong support for the theory specifically, their study demonstrates that military power both causes and further enables countries to disproportionately displace environmental "bads" to the global commons (Gellert et al., 2017).

In the context of global climate change politics, Ciplet and Roberts (2017, 2019) draw attention to the "splintering South" and the role of the semi-periphery in the world-system. They observe that semi-periphery and periphery countries with vastly different interests form precarious alliances in order to pressure the Global North for various climate change actions. They argue that research on ecologically unequal exchange should transcend the North-South divide and consider the reproduction of unequal relationships between semi-peripheral economies and their more peripheral neighbors. Periphery countries are often forced to ally with countries of the semi-periphery in climate change politics and forgo the demand for more radical climate actions from both core and semi-periphery countries (Ciplet & Roberts, 2017, 2019). Also interested in the semi-periphery, Frame (2019) finds land development in Cambodia is driven by interests in neighboring emerging economies, providing evidence for a pattern of "recursive exploitation" (Burns et al., 2003) where natural resources in more peripheral countries are exploited by the semi-periphery to fuel production to be exported to the Global North.

A number of authors focus on China's role in the global economic system. Ciccantell's (2019) analysis of coal and commodity chains, mentioned above, emphasizes the importance of China. Yu et al. (2014) document China's involvement in global ecologically unequal exchange as both the exploited, by the Global North, and as the exploiter of environment and resources in more peripheral countries (see also Peng et al., 2016), in line with the attention to the semi-periphery advocated by Ciplet and Roberts (2017, 2019) and Frame (2019). Wu (2019) highlights the geographical conditions and historical contingency that shape China's position in these unequal relationships. Zhang et al. (2018) observe an internal unequal exchange in China where more-developed coastal provinces receive most of the economic benefits from the export-oriented economy while the majority of environmental harms occur in less-developed regions in central and western China.

An important observation in the literature on ecologically unequal exchange and environmental load displacement is that "ecologically unequal exchange is an underlying source of most environmental distribution conflicts in our time" (Hornborg & Martinez-Alier, 2016: 329). Ecologically unequal exchange and environmental load displacement processes cause disproportionally severe environmental degradation and resources depletion in the Global South, which in turn undermines subsequent economic development (McKinney, 2019). Research also suggests that ecological unequal relationships represented by the vertical flow of exports from less-developed countries is associated with increased environmental concern (Jorgenson & Givens, 2014).

The observed unequal ecological effects described above have promoted growing concern with environmental justice issues associated with ecologically unequal exchange and environmental load displacement. Scholars, environmental

[6] Water footprint measures the volume of local water resources used in the production of goods and services in a country (Water Footprint Network http://waterfootprint.org/en/water-footprint/national-water-footprint/).

justice activists, and other members of frontline communities in the Global South have long resisted the environmental and social harms brought by global unequal exchange relationships, with various degrees of success (Martinez-Alier et al., 2016b; Smith & Patterson, 2019). These groups have increasingly argued that citizens of the Global South are owed an "ecological debt" (Hornborg & Martinez-Alier, 2016; Martinez-Alier, 2003; Martinez-Alier et al., 2016a; Roberts & Parks, 2007a, 2007b; Warlenius, 2016). The concept of ecological debt grew out of both academic discussions, including those in ecological economics and environmental world-systems analysis, and from grassroots environmental justice organizations and discourses (Warlenius et al., 2015). Ongoing collaborations between academics and activists can improve both the research on and action to address this debt. For example, the Environmental Justice Organizations, Liabilities, and Trade (EJOLT) project brought together academics and activists for environmental justice, resulting in multiple projects including the EJAtlas (www.ejatlas.org) (Hornborg & Martinez-Alier, 2016; Martinez-Alier et al., 2016a, 2016b). Such work provides valuable insights for addressing the structural social and environmental inequalities in the current world-system.[7]

## Future Directions

Research to date on ecologically unequal exchange and environmental load displacement inspires many directions for future work in environmental sociology that takes a global, structural, and political economic approach. Early research: examined specific environmental and human well-being issues; attempted to identify forces that could mediate the detrimental effects of ecologically unequal exchange; took historical approaches; examined commodity chains to develop understanding of the world-system; linked to other theoretical perspectives within and outside of sociology including the treadmill of production and research on resilience and sustainability; and made connections to environmental justice. Current work continues to: develop and empirically test this theoretical perspective using both qualitative and quantitative methods; explore linked environmental and human well-being issues; examine material flows, specific industries, and specific issues, including climate change which is arguably one of the major social and environmental problems of our time; and examine how social movements, activists, civil society, and political and legal institutions do or do not address global inequities.

In addition to ongoing work in these areas that explores the concepts across multiple scales and in different contexts, promising areas for future work include: further lengthening commodity chains across space and time and examining consumption in the Global North and waste disposal in the Global South, continuing to explore the role of the semi-periphery and the case of individual countries in the world-system such as China, looking more closely at the internal dynamics within countries in line with Bunker (1985), and studying the role of elites and elite-controlled institutions within the system (Downey, 2015). Other promising directions include: strengthening the ties between environmental sociology and the sociology of development (Givens et al., 2016), incorporating insights from other areas in sociology such as those focused on gender (Kennedy & Dzialo, 2015) and technology (Hornborg, 2014), and events such as recessions (Huang, 2018) and disasters. There are also opportunities to work in interdisciplinary and transdisciplinary contexts (Givens et al., 2018; Hornborg, 2009, 2013), providing opportunities for theoretical insights about inequality and power to inform research approaches in other disciplines such as environmental and conservation science. Ongoing needs include bringing more diverse voices to the discussion and continuing to partner with those

[7] Research in this area also addresses distributional conflicts by building on the materials flow analysis of Fischer-Kowalski (1998). For example, Temper (2016) uses a socio-ecological indicator from systems ecology to examine biomass flow appropriated by human activity versus what is left in the ecosystems for other species (see also Martinez-Alier et al., 2016a; Mayer & Haas, 2016; Warlenius, 2016).

outside of academia engaged in the environmental justice movement (Hornborg & Martinez-Alier, 2016). Future work has the potential to increase our understanding in order to lead to more evidence-based policies and effective change.

## Conclusion

This chapter summarizes the literature on the theory of ecologically unequal exchange and environmental load displacement. This body of work employs a variety of methods and contributes to research in environmental sociology with a global, political economic approach. Ecologically unequal exchange and environmental load displacement both emphasize the structural inequalities in the global system and the resulting uneven distributions of the developmental benefits and associated environmental and social harms, both between and within countries. The theory posits that the unequal global trade structure and related governance systems grant wealthier, more powerful countries disproportionate access to natural resources and sink capacity in Global South countries. This structural relationship of unequal material flows cause both environmental and developmental injustice to the detriment of Global South countries and the underprivileged communities within. Closely linked to the ecologically unequal exchange relationships are the environmental load displacement processes, via mechanisms such as foreign direct investment, through which Global North countries gain unequal access to resources and the ability to outsource their undesirable industries and environmental harms to countries of the Global South.

In an era when raw material extraction, product manufacturing, consumption, and waste disposal are spread across the globe, the body of literature on ecologically unequal exchange and environmental load displacement offer important insights into the distributive (in)justice of the world system. These global approaches also contribute to key theoretical perspectives in environmental sociology that are concerned with the environmental impacts of development, such as ecological modernization and treadmill of production. Bunker emphasizes, "local modes of extraction are organized in response to world-system demands" (Frey et al., 2019: 4). He also observes that, "The power to exploit the natural environment and the power to exploit other humans are closely related" (Bunker, 1985: 14). This body of literature highlights the historically contingent co-evolution of local and global systems and contributes to environmental justice dialogs and movements by connecting local struggles for environmental justice with uneven global structures and processes. Overall, ecologically unequal exchange and environmental load displacement perspectives inform researchers, policy makers, and activists to take into account the global context in the effort to improve sustainability at various scales in the face of global environmental change.

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# Consumption

5

Annika Rieger and Juliet B. Schor

## Introduction

Consumption is a major contributor to environmental degradation and change. However, it was not until 1992—at the United Nations Conference on Environment and Development—that consumption was seriously addressed by the global community. The consensus that emerged was that the global South had a "population" problem and the global North had a "consumption," or more correctly, an "overconsumption" problem. It proved to be a durable formulation. Within environmental sociology, the prominence of the IPAT (Impact = Population × Affluence × Technology) equation (Ehrlich & Holdren, 1971) has contributed to this framing of the environment/consumption relation, although the rise of a global middle class suggests that consumption is increasingly a global concern, particularly with respect to climate change. The implication of consumption as a central problem has led to the application of sociological theories of the "drivers" of consumption, a robust literature on "sustainable consumption," and sectoral studies of particular types of consumption. Given the variety of topics within the field of consumption, this review is not comprehensive. We have omitted some major environmental concerns such as toxics, water, and food, which are covered elsewhere in the volume. In this paper we focus on incorporating consumption theory into environmental sociology. While environmental sociologists have made considerable progress toward understanding consumption in recent years, the field has historically been more oriented to studying production and the state, as its major theories focus on those areas. However, the recent expansion of research in the sociology of consumption more generally is productive for advancing this area within the sub-field.

We begin with the question of how consumption is implicated in environmental degradation, and in particular the reasons for ecologically-destructive levels of consumption in the global North. We then ask whether the global South is following the same path. And finally, we address the possibilities for a "sustainable consumption" system. In the latter, we pay particular attention to Information and Communication Technology (ICT), energy, and transportation, and how these factors relate to climate change.

## Consumption and Environmental Degradation

### Consumption and Ecological Overshoot

In the 1970s, scholars began developing models that suggested economic activity was putting unsustainable stresses on the planet. The

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"World" model of Meadow and Meadows, popularized in their 1972 book, *Limits to Growth*, (Meadows, 1972) predicted that the planet would shift into "overshoot," or unsustainable rates of growth in the early twenty-first century. While population was clearly an important element of their model, the model's focus on industrial production put consumption squarely at the center of what became a lively debate about overshoot. By the 1990s, analysts undertaking this type of macro analysis developed the concept of the "ecological footprint," a measure of the demand from economic activity (Wackernagel & Rees, 1995). The ecological footprint measures the land and shallow sea water necessary to support the annual consumption of a nation, city, household, business, or any other unit with well-defined consumption. It includes the amount of forest area needed to sequester the $CO_2$ emitted from economic activity. And unlike many other ecological metrics, such as official $CO_2$ emissions, the ecological footprint is consumption-based, meaning it includes imports and excludes exports. Footprint analysis suggests that the planet went into overshoot in 1970 and that the gap between bio-capacity (the sustainable level of consumption) and footprint has continued to widen (Global Footprint Network, n.d.-a). In 2016, the latest year for which data is available, the global footprint stood at 1.69 "earths," meaning that humanity consumed 70% more annually than is compatible with the reproduction of the planet's bio-capacity. That year, the per capita footprint of the world was 2.75 global hectares (gha), in comparison to a bio-capacity of 1.63.

Consumption is highly unequal across the globe. The per capita footprint of North America is particularly high, at 8.07 gha, or almost five times the sustainable level. The average footprint for Europe is 4.56 gha. East Asia and Latin America and the Caribbean have lower, but still unsustainable per capita footprints of 3.73 gha and 2.59 gha, respectively. By contrast, South Asia and Africa are still below the sustainable global footprint at 1.19 gha and 1.36 gha, respectively.

The carbon portion of the ecological footprint varies considerably across the world as well. North America and East Asia have the most carbon-intensive footprints, with roughly 70% of their total impact attributable to carbon. In Europe carbon counts for over half at 60%, in South Asia carbon accounts for about half, and in South America and Africa the fraction made up of carbon is 34% and 30%, respectively. These differences in carbon footprints suggest that consumption patterns differ considerably around the world, and that more highly industrialized regions are more reliant on carbon to reproduce their lifestyles, a finding that accords with a considerable literature on the drivers of carbon emissions (Global Footprint Network, n.d.-b).

A large literature within environmental sociology analyzes the drivers of ecological footprints, and related measures such as carbon emissions, carbon footprints (a consumption, rather than territorial based measure), and deforestation. The most common formulation is a version of the well-known IPAT accounting (Impact = Population × Affluence × Technology). Sociologists use a stochastic version (STIRPAT) of this identity (York et al., 2003). The main findings of this research are that population and "affluence" (measured as GDP) are key drivers of environmental outcomes. Other variables such as industrial structure and urbanization are also typically included. This literature is discussed in Chaps. 19 and 21. For the purposes of this chapter, the key variable is Affluence. While sociologists have used the IPAT formulation to develop a large literature on the drivers of multiple environmental outcomes (e.g., forests, carbon emissions, eco-footprints), there is also a literature which is critical of its focus on population. The "population bomb" discourse of the 1960s and 1970s, promoted by IPAT author Paul Ehrlich, has been tied to state violence against global South and marginalized global North populations, particularly women (Hartmann, 1995).

## Patterns of U.S. Household Consumption and Carbon Emissions

We move now to the household scale, as most approaches to consumption limit their focus to households. We note that government and

business also contribute to consumption, but most business activity is accounted for under investment, and government consumption is typically studied separately as well—an artefact of national accounting conventions. For reasons of space, we will confine ourselves to measures of U.S. households. Most of the household based accounting of environmental impact in recent years has considered carbon emissions, rather than broader measures such as eco-footprints (Jones & Kammen, 2011, Fig. 1. See also Weber & Matthews, 2008 for similar findings.) Households are estimated to directly contribute 38% of all U.S. $CO_2$ emissions (Gardner & Stern, 2008).

Jones and Kammen (2011) have produced one of the most comprehensive and influential studies of household carbon emissions, combining data from the Consumer Expenditure Survey with production side data from input-output tables that analyze the carbon used to produce goods and services. This approach allows for the calculation of both direct emissions (such as household fuel use) and indirect emissions (carbon embodied in the manufacture of products). In 2005, the average U.S. household produced a total of 48 tons of $CO_2$ per year. On a per capita basis that is about 20 tons per year. The largest portion of the total is transportation, which accounts for 32%, with motor vehicle fuel representing more than half of the more than 15 tons emitted. The second largest category is housing, at 28% (or roughly 13 tons), and within housing, electricity is the largest contributor. Food is the third largest category, at 15%, with meat and dairy responsible for roughly 3 tons per year. Goods and services each lead to roughly 6 tons, or 12% and 13%, respectively. Within those categories, the largest components are entertainment, clothing and health care. According to Weber and Matthews (2008), roughly 30% of the U.S. household carbon footprint is accounted for by imports.

These are national averages. There are considerable differences across a variety of metrics, including location, household size, and income. The highest metropolitan area carbon footprint is from Minneapolis, which exceeds 50 tons, largely on account of the need to use more heat in the cold winters. Transportation emissions are especially high in California cities (Los Angeles, San Francisco and San Diego). Densely populated urban areas in the Northeast have some of the lowest carbon footprints (New York, Philadelphia, and Boston), as do cities in warm climates (Tampa, Honolulu). Household size also matters, as expected, with larger households emitting more carbon. However, the effects are not proportional, with the jump from one to two persons leading to a much larger increase than for additional persons above two, indicating economies of scale. For example, two single person households have the same emissions as a typical family of two adults and two children. Weber and Matthews (2008) find that beyond a household size of three, the emissions do not increase, on account of shifts in expenditure type and the fact that transportation emissions do not rise for households larger than three persons.

Income levels are an important determinant of emissions. Jones and Kammen (2011, Fig. 2) find a doubling of emissions with an increase from their lowest category (<$10,000) to their highest (>$120,000). Weber and Matthews (2008) find an even larger spread across the income scale. They also find that lower income households generate more of their emissions from "necessities" (food, housing, utilities and transportation) and higher-income groups emit more by purchasing furnishings, clothing and footwear, goods (including electronics), and personal services. As with other studies of the importance of disproportionality in environmental outcomes (Freudenburg, 2005; Jorgenson et al., 2016), researchers are beginning to explore consumption disproportionality at the household level. For example, one study of food consumption found that the top 20% of consumers accounted for 27% of meat, and 28% of dairy consumption respectively. Overall, the top quintile was responsible for 7.9 times the emissions of the bottom quintile (Heller et al., 2018).

These differences across households are one reason that some researchers are critical of the IPAT formulation, which typically considers only national averages. When income inequality

is high, as it is in many countries, IPAT can lead to policy approaches that focus on all households, rather than high emitters (Chakravarty et al., 2009). At the global level, the disproportionality in impacts is most extreme. Chancel and Piketty (2015) find that the top 10% of carbon emitters are responsible for 45% of global emissions, while the bottom 50% contributed only 13%. Income is the most important determinant of this distribution. Among all countries, the top 1% of U.S. emitters, who earn considerably more than half a million Euros per year, have the highest levels—318.3 tons of $CO_2$ per capita. This is 50 times the world average of 6.2, and also far above high emitters from other countries.

On all the major categories of U.S. household consumption, expenditures, and typically, environmental impacts, have risen over time, especially if we consider the post-World War II period which environmental scholars have termed the "Great Acceleration." In 1961 the U.S. footprint stood at 8.05 gha. It rose to a high of 11.11 in 1973 gha, and hovered in the 9–10 gha range until the financial crisis and recession that began in 2008, after which it began to fall to its current level of 8.1 gha. The major components of the household footprint also rose over this period (see Ehrhardt-Martinez & Schor, 2015 for sources). Residential energy use rose by nearly four times between 1950 and 2010. For much of this period, personal transportation metrics—cars per person, miles driven per car, and fuel consumption per passenger vehicle—also rose. The environmentally most damaging parts of diets—meat and dairy—also increased significantly after WWII, with the former increasing 80% since 1950. Goods purchased also increased substantially, which can be seen in overall expenditure data, but also in calculations of units and weight in consumer items (Schor, 2010, Chap. 2). Between 1991 and 2007, Americans doubled their annual purchases of new apparel from 34 per year to 67. More recently, some observers have argued that the U.S. has reached "peak" oil, peak driving, peak meat, and perhaps peak consumption (Pearce, 2012). How much of the current slowdown in these activities and products is due to the recent slow growth in incomes and GDP, and how much is being driven by other factors remains to be seen.

## Incorporating Households into Environmental Sociology

Within environmental sociology, the role of household consumption as a driver of environmental impacts has traditionally been neglected. The two dominant approaches in the sub-field—the treadmill of production (Gould et al., 2008) and ecological modernization theory (Mol et al., 2009)—both focus on corporations and government, rather than households. Environmental drivers are thought to be structural, as in the cases of systemically-induced output growth, or growth-driven state policy. Households have traditionally been thought to play a relatively passive role in a system in which structures of production and the market determine environmental outcomes. While ecological modernization theory has addressed its early neglect of consumers, much of the analysis of "consumption" has been done at the macro level, with formulations such as SITRPAT. One influential approach (Szasz, 2007) takes an explicitly anti-consumer view, arguing that focusing on consumers' role is counter-productive. Szasz claims that when consumers act *qua* consumers, purchasing environmentally positive products in order to avoid hazards and toxins, they engage in an "inverted quarantine." He believes this purchasing behavior undermines people's willingness to engage in collective action to address environmental problems. Because solutions require state action and systemic change, consumers become the problem, rather than part of the solution. There are, of course, exceptions to the focus on corporations and the state. There is a sociological literature on household energy consumption. Environmental sociologists have also considered individuals as participants in social movements (Brulle, 2000). An influential contribution by Dietz et al. (2009) estimated that relatively easy efforts to reshape household decisions and practices could reduce carbon emissions by at least 7.4%. And more recently, scholars who are

interested in sustainable consumption, and attempts to move societies in that direction, have focused more on households.

Sociologists approach the study of consumption differently than economists and most psychologists, two social sciences that are prominent in environmental policymaking. The latter two disciplines take a more individualist approach. By contrast, sociology, and sister disciplines anthropology and history do not ignore individuals but focus considerable attention on the larger context in which people live—including culture, history and the social and economic structure. Thus, sociologists understand that individuals and households are embedded within contexts that may reduce their ability to act independently, or that may have strong impacts on their preferences and actions.

As an example of these disciplinary differences, consider the question of mobility. The economic approach focuses on the costs and benefits to an individual of alternative models of mobility, reasoning that if people are driving private cars it is because they "prefer" them, and have the money to enact those preferences. Economists' most common policy response to discourage car use is to make the cost of private automobiles more expensive, to alter the cost-benefit calculus and reduce car ownership and use. One exception is behavioral economics, originally developed by psychologists (Kahneman, 2011), which argues that humans have innate predispositions, such as loss aversion, fairness norms, status quo bias, threshold effects, and other non-rational responses to how situations are framed. Behavioral economists advocate incorporating these features of human action into policy design, although they have not been much deployed in environmental policy. Psychologists tend to focus on values and attitudes and attempt to understand why stated values and attitudes are not consistent with behaviors—a phenomenon termed the attitude-behavior gap (Ehrhardt-Martinez, 2009). Education and attempts to transform values are common policy responses within psychology. By contrast, sociologists look at the use of automobiles within the larger context, identifying either the symbolic meanings of these consumer items, or more recently, the "practices" that people enact with autos. They focus on connections among individuals, and especially peer, or network effects, in contrast especially to economics, which has traditionally modelled consumers as isolated individuals. Sociologists believe that historical experience is important for understanding consumers' actions, as well as the socio-technical and natural systems in which people are embedded. More generally, sociologists attempt to incorporate both "structure" and "agency" in their approaches to consumption, although they often lean toward one or the other. In the case of mobility, sociologists look at issues such as the post-WWII highway infrastructure and suburban development (Rudel, 2009), the status value of cars and their role in identity construction, the connection between masculinity and the automobile, and the culture of freedom and individualism. Practice theorists, who focus on "practices" that people engage in, rather than the people themselves, study the emergence of routines of car use, emphasizing convenience. Efforts to reduce automobile use are directed at constructing alternative infrastructures to encourage trips without cars, the promotion of public transit and attempts to change the social meanings of private autos, and frequently take the form of using social networks to induce behavioral change. Summing up this perspective, and the gap between pro-environmental attitudes and behaviors, Michael Bell writes in his influential environmental sociology textbook: "One of the main reasons people find their attitudes at odds with their behaviors . . . is social structure. We do not have complete choice in what we do. Our lives are socially organized" (Bell, 2012: 225).

## Explaining Consumption Upscaling

### Social Status and Peer Influences

Within sociology, approaches that emphasize the role of status motives in consumer actions have a long and influential history. In 1899 Thorstein Veblen published his classic book *Theory of the*

*Leisure Class* (1899), which painted a picture of elites who vied for position and prestige through publicly visible consumer goods, such as mansions, carriages, apparel, and accessories. The visibility of consumer patterns, or what Veblen termed conspicuous consumption, is key to this system as it "puts in evidence" the wealth underlying the conspicuous lifestyle. Status theories predict ongoing competition as income grows, and because status is positional, or "relative," income growth creates a persistent pressure to keep up. This "treadmill of consumption" can be exacerbated by increased inequality, advertising and marketing, or cultural messages that stress consumption (Bell, 2012, Chap. 2; Schor, 1997). While there is not a large explicit literature on the relation between status consumption and environmental outcomes, the growth of home size, automobile age and weight, long distance travel, and the rarity of personal adornment items (e.g., jewelry) all have heavy ecological impacts. Consumption competitions also diffuse products that have historically been luxuries on account of their high (ecological) cost into mass produced items. These include products such as shrimp, cashmere, leather, and precious gems, and all of which are ecologically intensive (Schor, 2010). Indeed, a key dynamic of contemporary consumerism is the transformation of ecologically expensive luxuries into unsustainable commodities. Here the dynamic is less elite consumption than mass purchasing. A related dynamic has been the speed-up of the fashion cycle in manufactured goods (Schor, 2010). From the early 1990s until the Great Recession, consumers in the U.S. and elsewhere increasingly acquired cheap goods. The build-up of consumers' inventories led to increased discard and purchase of new items. This cycle of purchase and discard has heavy ecological and carbon impacts. Schor (2010, 2013) has argued that this fast fashion culture leads to the "social death" of products as their symbolic value declines more quickly than their functionality. This in turn raises the ecological intensity of consumption, as the demand for new products increases. Other researchers have identified planned obsolescence as another cause of frequent purchases.

Theories of status and competitive consumption provide an explanation for the attitude-behavior gap that has been a major focus of psychologically-oriented researchers of environmental behavior. These approaches suggest that personal values do not motivate consumer action so much as the desire to keep up with consumption trends and norms within the social strata an individual is attempting to belong to. Work on reference groups and peer influence (Cialdini, 2003; Schor, 1997) finds that these social effects are a strong influence on behavior. Individuals may tell surveyors they care about the environment but if their social reference group is engaging in a high-impact lifestyle, this approach predicts that will be a more important determinant of consumer behavior.

There are relatively few studies that explicitly test the importance of Veblenian status competitions on environmental behaviors. One implication of status theories is that consumers will spend more per purchase and purchase more when goods are used publicly. Chao and Schor (1998) found that women are more likely to buy expensive lipsticks (which are taken out in public) than other cosmetics whose use is confined to the home, even when lipstick brands are functionally equivalent. In a study of Scandinavian consumers, Pedersen (2000) found that people are more likely to choose low-impact food, energy, and other environmentally significant items when they are socially visible, as well as tangible (Pedersen, 2000). Mau et al. (2008) studied the diffusion of hybrid vehicles and found that in neighborhoods, there was a demonstration effect which encouraged additional purchases. The importance of status in the consumption of environmentally beneficial products was also studied by Griskevicius et al. (2010) using lab experiments. They found that after consumers were primed for status considerations, they were more willing to purchase green products, but that this effect did not hold for products that were only consumed in private.

Social psychologist Robert Cialdini and his collaborators have studied environmental behaviors in the context of peer influence. Although they do not take into account

sociological variables such as class, which are key to status theories, their approach is conceptually close to that done by sociologists. Cialdini and associates find that energy use is influenced by information about the ways social others are consuming (Schultz et al., 2007). Based on this research, Cialdini helped develop a nationwide effort to reduce gas and electricity energy consumption through tailored messages to households in which they are sent information about how their consumption compares to others. Researchers found that those with higher than average consumption reduced their levels, however households with lower than average consumption increased their use after seeing the comparison. Over time, messages have been adjusted to try and induce conservation by all groups, using new tactics, such as emoticons, and multiple reference groups (e.g., consumers with low usage get comparisons to other low usage consumers). Cialdini and his collaborators have also studied hotel programs to encourage towels and sheet reuse and find that messages that inform guests that other guests have used the programs lead to considerably larger uptake, in comparison to standard communication that does not include references to social others (Goldstein et al., 2008).

Veblenian status theory uses a one-dimensional economic model in which higher-priced goods yield more status, and social ordering is determined by wealth. In his study of lifestyles, French sociologist Pierre Bourdieu (1984) added another dimension, which he termed cultural capital. The mix of economic and cultural capital informs the habitus, or the ingrained set of tastes, demeanors and dispositions each person has. This perspective has informed studies of the class character of environmental choices. In contrast to studies from the 1970s and 1980s, which found that pro-environmental values are common across all social classes, more recent research finds that environmental concern and "green" products are socially coded as associated with higher socioeconomic status. Laidley's (2013) qualitative research in a Northeastern urban area found that across his mixed-income sample, people articulated the "Maslovian" trope that the environment is a concern for the well-to-do, who can afford to worry about it, while low-income people are too preoccupied with economic survival. One study found that eco-products were thought to be for the "rich and elite" (Bennett & Williams, 2011). Similarly, an analysis of U.S. Hummer drivers by consumer researchers found that they characterize Prius drivers as elite and un-American (Luedicke et al., 2010). A paradoxical dimension of the coding of green products and practices as "elite" is that many of the most sustainable ways of living describe the lifestyles of poor and low income households, in both the global North and South. These include examples such as using bicycles rather than cars, growing and preparing one's own food, air drying of clothing, using public transportation, and diets low in meat consumption and high in grains and legumes. Wealthier households have higher eco- and carbon-footprints, yet the foregoing research suggests that they are more likely to be seen as environmentalists.

One reason for the popular association between elite status and environmental concern may be the rise of a particular pro-environmental cultural outlook. Carfagna et al. (2014) have found that those who are high in cultural capital have developed an "an eco-habitus," in which ecological values are a key structuring principle of consumer tastes. (See also Elliott, 2013 who finds a positive association between "green" consumption and education.) There is now a considerable growth in (and literature about) "sustainable consumption" (see below) which can be interpreted through the lens of the eco-habitus. Carfagna et al. (2014) argue that the habitus includes values such as the desire to eat locally (to avoid food miles) and to eat organic food, respect for the materiality of products, and a preference for home-made and DIY consumption. Perhaps paradoxically, having an eco-habitus does not necessarily entail having a low eco- or carbon footprint, as there are aspects of this high cultural capital lifestyle that are ecologically intensive, such as long distance travel. However, the eco-habitus does represent an altered

rationality to consumption, along the lines of what ecological modernization theorists predicted.

## Habits, Routines and Practice Theory

Postwar British sociology was heavily influenced by Anthony Giddens, who rejected class based approaches, such as those of Veblen and Bourdieu, in favor of explanations of behavior that were rooted in an analysis of stages of capitalist society (Giddens, 1991). Giddens argued that the contemporary period, which he termed "high modernity," was characterized by individualized behavior, rooted in personal narrative and reflexivity. One influential study of environmental consumption using these insights suggested that people were hampered by the uncertainties associated with their consumer decisions, and reflexive complexity of the consumer choices they are routinely faced with (Connolly & Prothero, 2008). In the 1990s, British sociologist Elizabeth Shove and her collaborators began studying environmentally important consumption by rejecting status and class based theories, and focusing on more Giddensian ideas of everyday life. These researchers began by looking at "inconspicuous" consumption, which entailed a shift from studying consumer goods to household systems, such as the use of energy and water (Gronow & Warde, 2001; Shove & Warde, 2002). They focused on motives such as comfort, cleanliness and convenience to explain rising water and energy use in British households (Shove, 2003). In a series of studies, they chronicled changing habits among the U.K. population. Three influential studies looked at the shift to daily bathing (Hand et al., 2005), the rising prevalence of freestanding freezers (Hand & Shove, 2007), and changing norms of heating and cooling to a more constant year-round temperature, and with it, higher energy use (Shove, 2003). These accounts, which are largely descriptive, identify economic trends such as rising incomes, daily life stresses of time use, and changing leisure patterns as key to the increase in resource use among Britons.

An animating feature of this literature was the rejection of the individualist, rational model of consumer behavior. Shove, Southerton, and collaborators argued that people are not driven by conscious, deliberate choice, but by habit, social norms and ingrained routines. Hence, the dominant policy approaches, which focus on price and information, are misguided, which is what accounts for their failure to reduce the volume and ecological intensity of consumption (Shove, 2010). The rejection of the causal model of attitudes and value driving consumption led this group of researchers to embrace practice theory (Schatzki et al., 2001), an approach that takes as its unit of analysis not the individual but a social practice. They began to study how the combination of technology, material artefacts, and skill results in practices which have environmental consequences (Shove et al., 2012). While this approach became quite popular in Europe, and to a lesser extent in the U.S., its insights for achieving sustainable consumption have been modest. One study of Japanese offices found that employees were better able to adapt to reduced energy use when a more casual dress code was introduced that allowed them to forego suits and ties for hot weather appropriate apparel (Southerton et al., 2011). However, one promising area is the timing of energy demands. If social practices, or structures dictate when resource-intensive consumption occurs, then attempts to shift consumption away from peak demand may not be successful, even with price incentives. Furthermore, time stress may reduce the prevalence of more sustainable, but time-consuming practices and activities. Focusing on practices also reveals that achieving sustainability in consumption will typically require significant change in the organization of daily life. In this way both practice-based and status approaches recognize the strong role that social structures play in determining consumption patterns and trends. They share a rejection of the individualist approach.

## The Global Middle Class

Our discussion so far has focused mainly on the U.S. and the global North, in line with the 1992 formulation associated with the UN Conference on Environment and Development. However, since then, consumption in the global South has increased dramatically, as has the environmental impact of global South nations. India, China and Brazil particularly have seen increased footprints in terms of energy use and deforestation. Although global trade is a big part of this footprint, dramatic growth of a global middle class is one of the most important developments since 1992 in the area of consumption and environment.

By many accounts, a global middle class is rising to fill the gap between the poor and the wealthy, leading to an overall decline in poverty rates (Edward, 2006). Some figures put the middle class at 3.2 billion people worldwide at the end of 2016 (Kharas, 2017). What constitutes the cut-offs for this group is contested, especially regarding the emerging middle classes in developing nations. One way to define the middle class that takes into account these variations is to count households with per capita incomes of $10–100 per day, in terms of purchasing power parity (Kharas, 2017). This group constitutes a new base of consumers, for the products of multinational corporations especially. This consumption poses a problem for the environment, especially considering that the current consumption levels of Western middle classes is unsustainable (Krishna, 2015). Middle class lifestyles are associated with higher carbon emissions and increased resource consumption. However, the middle class also represents a hallmark of modernization and is seen as beneficial to developing nations, as well as an essential element of their continued development (Lama & Sened, 2018). Other aspects of a growing middle class such as increased urbanization and shrinking family sizes, could mitigate some of the potential environmental impacts (Kharas, 2017).

Particular consumption habits separate the middle classes from the poor, and these habits all come with a large environmental impact. The consumption of cars and meat, which are both highly resource intensive, increases with the rise of the middle class in developing nations (Myers & Kent, 2004). Cars contribute to carbon emissions, poor air quality in many large cities in the global South, and gridlock. Meat consumption requires large amounts of grain to raise livestock, which strains an already limited and important source of food for the poor, in addition to environmental impacts. Livestock production is also water intensive, and creates high levels of methane, a potent greenhouse gas. Other consumption patterns of the global middle classes include increased spending on entertainment, the purchase or rent of larger homes, and an overall focus on spending to improve the quality of life rather than to maintain it (Banerjee & Duflo, 2008).

Despite similarities, researchers have also noted variation in middle classes, especially in developing nations. However, theories of consumption have been grounded in Western contexts, and little consideration has been given to how they might vary in global South nations (Üstüner & Holt, 2010). A study of conspicuous consumption in Turkey showed that lower cultural capital consumers focused their consumption field locally, while high cultural capital consumers pursued the tastes and practices of the West through numerous (carbon intensive) foreign trips, rather than simply via the accumulation of Western goods (Üstüner & Holt, 2010). This diverges from the prediction that consumers in the global South merely copy the consumption patterns of global North nations. Instead, they are pursuing capital accumulation strategies that vary by their amounts of cultural capital: either delimiting the field of status competition to the local, or attempting to attain a form of delocalized, international cultural capital. In another variation of conspicuous consumption, one study in South Korea demonstrated that education was commodified and provided an important avenue for distinction (Koo, 2016). Middle class Korean parents spent time, effort, and money to send their children to high quality private schools, and later to American universities, a carbon intensive practice.

The focus on conspicuous consumption ignores the fact that the global middle classes also incorporate ethical considerations into their consumption practices. A study in South Africa found that thrift was an important ethical consideration for the middle class, as thrift was framed as taking the needs of others into consideration by not "wasting" money (McEwan et al., 2015). However, saving money was a larger motivator than concern about wasting material commodities. Despite assumptions that the global middle classes will follow the path set by Western consumers, there is growing evidence of the possibility that divergence from Western consumption patterns could lead to new, more sustainable lifestyles.

## A Future for Sustainable Consumption?

### Technology and Consumption

Technology, especially Information and Communication Technologies (ICTs), has become increasingly integrated into daily routines of households, especially since the beginning of the twenty-first century. In 2000, just over 50% of US adults used the internet; in 2016, that figure was 88%. In 2016, 73% of US adults had broadband internet at home, compared to 1% in 2000. New consumer electronics have also been quickly adopted: in 2016, 77% of US adults owned a smart phone, up from 35% in 2011, and 51% owned a tablet, up from 3% in 2010 (Smith, 2017). The increased consumption of technology means that daily practices are increasingly intertwined with ICT usage. Examples include the usage of ICTs during "dead time," such as commuting on public transportation, to check email and social media, as well as the increase in multitasking by engaging in activities on multiple devices, both of which can lead to increased energy usage (Røpke & Christensen, 2012). ICT usage can delocalize practices, making them more energy efficient; for example, computers have enabled many people to work from home, eliminating the need to commute. However, it can also increase resource consumption; for example, by making it easier to purchase a variety of products through online shopping. Mobile devices in particular have encouraged both delocalization and multitasking (Røpke et al., 2010). As technology is increasingly integrated into everyday life, it is seen as a necessity—especially by younger people and the highly educated (Aro & Wilska, 2014). However, the impact of increasing technology consumption on the environment is not straightforward: ICTs have the potential to increase resource efficiency as well as increase resource consumption.

ICTs have been hailed alternately as a pathway to sustainability and environmental harm mitigation or an engine of economic growth and environmental degradation. Estimations from 2010 show that the ICT sector is responsible for 1.7% of greenhouse gas (GHG) emissions and 3.9% of global electricity use (Malmodin et al., 2010). These emissions may have stabilized: an analysis of the carbon and energy footprint of the ICT sector for 2015 found that levels have remained similar to those from 2010. However, the full impact of ICTs on the environment is difficult to estimate, because the sector is so broad. It ranges from the individual level, with personal device usage, to the macro level of cloud computing and energy infrastructure (Williams, 2011). Models of environmental outcomes, such STIRPAT, do take technology into account. However, technology is typically treated as a residual impact, unaccounted for in the model (York et al., 2003).

A common misconception about ICT, often leading to greenwashing of the sector, is that it is untethered to the material world (Maxwell & Miller, 2013). This view, reflected in terms such as "cloud computing," is far from an accurate picture. The production and operation of ICTs involve massive amounts of material resources and energy (Van den Bergh et al., 2009), and their disposal poses special problems. Electronic waste yields health problems because the waste is often "recycled" by workers in developing nations who lack adequate physical protection. This toxic waste can also contaminate the surrounding environment (Maxwell & Miller,

2013; Patrignani & Whitehouse, 2015; Williams, 2011). The paradoxical view of ICTs as immaterial, even though they require significant energy and material resources, echoes Schor's materiality paradox: that consumption for non-material meanings creates more material waste (2010).

Those skeptical of ICT's ability to solve more environmental problems than they create emphasize rebound effects, a lack of decoupling and dematerialization, and increased resource usage as possible outcomes of ICT usage. Longo and York (2015) tested the theory that ICTs can help reduce the production and consumption of energy and found that ICTs show no signs of helping conserve resources, and could possibly increase resource usage. The potential of ICTs to decouple consumption from materials is often seen as a way to foster economic growth while also reducing environmental degradation. Decoupling from both material resources and environmental impacts is the basis for the ideal of sustainable development (Hilty et al., 2011). However, while ICTs have the potential to encourage efficiency and decoupling, prioritizing economic growth will likely negate these beneficial capacities (Hilty et al., 2011; Longo & York, 2015). Rebound effects are one possible reason decoupling could fail: as ICTs become more efficient themselves and also contribute to the reduction of energy-intensive production and renewable energy the resulting cheaper energy prices could lead to greater consumption of energy (Moyer & Hughes, 2012). Dematerialization also depends on the decoupling of consumption and material goods. Van den Bergh et al's study (2009) testing the ability of ICTs to contribute to dematerialization found that results varied: ITC's effect on economic growth and international trade had negative effects, but increased access to information and substitution through ICTs had a positive effect.

While ICTs might not inherently be "good" for the environment, there are ways in which their problematic impacts can be mitigated, or they can be employed in ways that benefit the environment. One such possibility is provided by Slow Tech, a framework for mitigating the environmental impacts of ICTs by applying the principles based on those developed by the slow food movement—good, clean, and fair technology—as well as actually "slowing down" both the production and consumption of technology (Patrignani & Whitehouse, 2014, 2015). Another avenue is through the emergence of a knowledge economy enabled by ICTs, which could lead to less intensive energy use and pollution as compared to other economies (Houghton, 2009). However, this approach would require additional effort beyond the implementation of ICTs: taking advantage of the information made available by ICTs, and the ability to communicate this information, is necessary for such technologies to be truly "green."

Many people also use ICTs to manage their own environmental impact: daily practices integrating ICTs, such as innovative monitoring systems, allow users to systematically analyze and reduce their own consumption (Lorenzen, 2012b). Other tactics include those of voluntary simplifiers, who extend their use of technologies in order to avoid consuming too many new goods and creating waste. Internet usage has also been shown to encourage those with pro-environmental attitudes to transform those beliefs into actions and engage in sustainable consumption (Wang & Hao, 2018). Access to information on sustainability that is widely available on the internet makes it easier for consumers to make "greener" choices. Many ICT users are not passively consuming technology; rather they are finding innovative and sustainable ways to use technology.

## Sustainability and New Consumer Practices

In a number of environmentally-significant sectors, sustainable alternatives are emerging, which raise the possibility of less damaging consumption. The transformation has been most far-reaching in food, but steps toward a "sustainable consumer culture" are also being taken in household energy, transportation, clothing, travel and other areas. There is a growing sociological literature on what is motivating consumers to live

lower-impact lifestyles. In addition to environmental concerns, researchers have found that personal health and saving money are important motives (Black & Cherrier, 2010; Lockie et al., 2002). While many studies assume that consumers experience motives as independent factors, the Bourdieusian approach argues that the habitus is a holistic construct, and that an ecological orientation is interwoven with multiple rationales (Carfagna et al., 2014; Kennedy et al., 2018). There is also divergence of opinion among sociologists about the significance of sustainable consumption. While none think that consumer behaviour is a sufficient condition for achieving sustainability, some are more optimistic than others that consumers can have any impact on structures of unsustainability. The pessimists often adopt a co-optation or conventionalization narrative (Guthman, 2014) which predicts minimal positive ecological change. Others believe that consumer actions, particularly those that are collective, can induce some transformation (Willis & Schor, 2012). We return to this issue below.

The sector that has seen the most activity to achieve sustainability is food. The alternative food movement encompasses production, distribution and consumption, and actors in each sphere oppose the corporate food regime for its impacts on the planet, human health and the well-being of farmers and (less routinely) farmworkers (Alkon & Agyeman, 2011; McMichael, 2000). Consumers are embracing local food, shortened supply chains, organic farming techniques, and new distribution models such as Community Supported Agriculture, as well as ideals of community associated with earlier agricultural eras (Bell, 2004; Lyson, 2004). Early discourses focused on teaching the consumer where their food comes from, on the assumption that education would be sufficient to transform behaviors. However, sociologists and others have critiqued simplistic models of localism on a number of grounds—romanticism, inattention to issues of farm labor, failure to consider issues of race and class, and faulty carbon accounting (Alkon & Agyeman, 2011; Goodman et al., 2011; Hinrichs, 2003). To date, the adoption of "alternative" methods into the corporate food regime suggests that while alternatives are having some beneficial local impacts, there is increased dominance and globalization of industrialized farming, with its highly destructive impacts on ecosystems and human health.

In energy and transportation, there has been rapid growth in ecologically less intensive household products. Both sectors have likely reached the point where high-cost early adopter growth is being exhausted, and further expansion mainly depends on policy and infrastructure. In energy, price declines have resulted in rapid increases in household installations of solar. The market collapsed with the policy uncertainty of 2016–2017, however that disruption may have subsided. Furthermore, a 2018 California mandate that all new home construction include solar capacity is institutionalizing this energy source. Recent research suggests this once niche technology has already begun to spread into the broad middle class (Barbose et al., 2018). The process of transformation is farther behind in transportation where the electrification of private vehicles has begun, but still represents less than 2% of the US market. A countervailing trend is the decline of public transportation ridership and the rapid expansion in ridehailing (Clewlow & Mishra, 2017). However the ridehailing platform Lyft now purchases carbon offsets for all rides.

Sustainable consumption is also leading to the emergence of alternative practices in housing, such as eco-villages (Litfin, 2013) and co-housing, in which common areas allow individual households to reduce their personal housing space. Eco-village residents also commit to low-impact living. A few developments have even instituted "One Planet Living," which means an ecological footprint of roughly 2 ha per person (Schor, 2010). Consumers are also attempting to reduce their footprints by participating in a variety of second-hand markets. These include clothing, toy, book and other goods swapping or resale schemes; gifting platforms such as freecycle; and commercial platforms like eBay and Craig's list (Nelson et al., 2007; Schor & Fitzmaurice, 2015). A related trend is the emergence of repair sites for electronics and

appliances that offer free or low-cost repair to induce people not to purchase new items. Commercial "sharing economy" platforms such as Airbnb and Uber/Lyft which were founded in the late 2000s attempted to motivate consumers by arguing they are reducing eco-footprints. In the case of ride-hailing (originally called "car sharing") the claim was reduced car ownership. Airbnb claimed it led to fewer hotels being constructed. Our survey research suggests that large majorities took these claims at face value. However, these claims are not supported by evidence. Ride-hailing is reducing public transit use and increasing trips in private vehicles. Impacts on car ownership are relatively small (Clewlow & Mishra, 2017). Airbnb is likely increasing travel by reducing lodging costs (Schor, 2020).

A final trend is a shift out of lifestyles that entail long hours of work and high expenditures (Schor, 1992) toward "downshifting" and voluntary simplicity. In 2004, 48% of respondents in a U.S. poll reported having downshifted in the previous 5 years, defined as having voluntarily given up income (Schor, 2010). The downshifting trend has also been identified in the U.K. and Australia, as well as other countries (Craig-Lees & Hill, 2002; Hamilton & Denniss, 2005). The voluntary simplicity movement is a small subset of downshifters, who are explicitly critical of consumer culture and attempting to reduce their environmental footprints by reducing consumption overall (Alexander, 2009; Schor, 1997; Willis & Schor, 2012). Voluntary simplifiers have been shown to have significantly lower eco-footprints than typical Americans (Kasser & Brown, 2003).

While there is a growing trend of people who are attempting to consume "consciously" (Brown, 2009; Kennedy et al., 2018; Schor, 2010; Willis & Schor, 2012) these practices and lifestyles raise complex issues and can be difficult to enact. Connolly and Prothero (2008) studied a small group of environmentally-committed consumers, but found that they were often skeptical and uncertain about the shopping choices they were confronted with. One respondent in this qualitative study lamented the difficulties of balancing cost and eco-impact, and detailed her indecision about whether she should buy organic chicken for her pet. A proliferation of "ethical" certifications has meant that consumers are forced to research products in ways that they often find stressful (Conroy, 2007; Schwartz, 2004). Some scholars have argued that couching environmental consumption within a neo-liberal framing undermines actual footprint reductions (Hobson, 2002). Kennedy et al. (2018) find that status and ethical concerns combine in complex ways, with consumers clustering into distinct groups. There are also debates in the literature about whether an initial environmentally beneficial purchase leads to more or less future green purchasing. Using experimental data, psychologists Mazar and Zhong (2010) argue that one "green" purchase leads to moral license for future high-impact choices. However, sociologists have found that initial purchases of green products can lead to further similar purchases and the adoption of a more generalized green lifestyle (Evans & Abrahamse, 2009; Lorenzen, 2012a). Another debate in the literature is about the relation of environmental purchases to collective action. Szasz (2007) has argued that purchasing environmental products such as bottled water leads consumers to enact a kind of "inverted quarantine," which then reduces their propensity to engage in the only kinds of activities—political voice and social movement activism—that will be effective. However, all the studies that address this claim find that activism and environmental purchasing are strongly correlated (Barnett et al., 2005; Forno & Ceccarini, 2006; Willis & Schor, 2012). Nevertheless, the structural nature of environmental degradation means that consumer actions will never be sufficient to create a sustainable economy and society. Sociological analysis leads scholars to the understanding that consumers *qua* consumers will have only a limited role to play in the transition to sustainability. Indeed, it is likely that only a fortuitous combination of social movement pressure with favorable economic, political and technological trends will yield ecological sustainability.

## Conclusion

There are growing classes of new consumers: those of the global middle class, some of whom are copying the resource-intensive lifestyles of the West, as well as those all over the world who are pursuing alternative, sustainable lifestyles. These groups raise an important question: what will the consumption trends of the future be? And how will these consumption trends impact climate change, for better or for worse? At the time of this writing, the Intergovernmental Panel on Climate Change (IPCC) has just released a report on the social and environmental impacts global warming of 1.5 °C, as well as the benefits of avoiding further warming even at levels previously considered "safe" (IPCC, 2018). However, this report still neglects the disproportionality of responsibility for global warming: the lifestyles of 10% of the global population are accountable for 50% of global carbon emissions (Anderson, 2018). Environmental problems caused by global warming will continue to accelerate unless the emissions generated by these high emitters—residents of developed nations and the ultra-wealthy of the world among them—are limited.

The essential task in coming decades is the need to dramatically transform expenditure patterns, interrupt the "treadmill of consumption," and re-orient economies all over the world to meet human needs in an equitable way. For sociologists of consumption and the environment, this requires a critical analysis of consumption—especially the ways in which inequality drives expenditures and the impacts of spending on human well-being. How can we downscale consumption in a way that meets criteria of climate justice, both within and across regions of the world? The expanding literatures on food justice, energy transformations and sustainable consumption have begun to point to answers to this daunting task. While we don't yet know the shape of the consumption regimes of the future, we do know they will need to be very different from current patterns and levels if the world is to avoid truly catastrophic climate and other ecological impacts.

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# Corporations and the Environment

6

Simone Pulver and Ben Manski

## Introduction

The classical foundations of sociology recognized the influence of economic life over the natural world and the material and ecological basis of market economies—see the ecological insights offered by Karl Marx and Friedrich Engels regarding capitalism and the environment (Foster, 1999a), Max Weber regarding organizations and the environment (Foster & Holleman, 2012), and Karl Polanyi regarding land as a fictitious commodity (Peluso, 2012; Prudham, 2013). Such research continued throughout the early twentieth century (Foster, 1999b). Yet, with the economic boom in the post-Second World War period and the accompanying belief in technology as a means to supersede resource limits, the recognition of interdependence between economy and environment waned in sociology and other disciplines. It was not until the 1970s that an emergent sub-discipline of environmental sociology began to challenge the human exceptionalism paradigm dominating sociological research and sought to ground sociological scholarship in a new environmental paradigm (Catton & Dunlap, 1978), recognizing at minimum the interdependence and perhaps even the unity of society and nature (Freudenburg et al., 1995). Environmental sociologists focused first on the values of individuals (Liere & Dunlap, 1980) and then on the collective action of movements to protect nature (Buttel & Flinn, 1974). In the 1980s, attention turned to how corporations, and the market systems of capitalism, consume resources, produce pollution, and shape discourses surrounding both processes.

In environmental sociology, debates about corporations and the environment have centered on two theories: the treadmill of production and ecological modernization. The treadmill of production (Gould et al., 2008; Schnaiberg, 1980; Schnaiberg & Gould, 1994; Schnaiberg et al., 2002) is one of several theories of environmental impact grounded in political economy that view continuous expansion/growth as the defining feature of capitalism (O'Connor, 1989; O'Connor, 1993; Roberts & Grimes, 2002). Ecological modernization theory (Buttel, 2000; Mol, 1995, 1997; Mol & Sonnenfeld, 2000; Mol & Spaargaren, 2000; Spaargaren & Mol, 1992) is a variant of general theories of modernization that emphasize the unique features of the modern period, including pervasive risk and reflexivity (Beck, 1999; Habermas, 1975). Debates within and across the treadmill of production and ecological modernization have structured much of the conversation in environmental sociology about the economy-

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environment intersection (Buttel, 2004; Fisher & Freudenberg, 2001). A particular focus of research has been on empirical assessments of both theories. And while organizational and industry case studies have provided some support for patterns of ecological modernization (Jänicke et al., 1989; Jorgenson & Clark, 2012), aggregate patterns in environmental pollution and resource consumption consistently point to increasing environmental impacts driven by growth in population and per capita gross domestic product, in line with a treadmill of production analysis (Dietz et al., 2007; Dinda, 2004; Jorgenson & Burns, 2007; Jorgenson & Clark, 2011; York et al., 2003).

The goal of this review is both to assess the contributions of these two theories to analyzing corporations and the environment and to extend the boundaries of the conversation between them. We bring into dialogue environmental sociology's two leading theories of economy and environment with the wealth of research on corporations generated by other environmental sociologists, in other sociological sub-disciplines, e.g. organizational, economic, and political sociology, the sociology of law and social movements, and in other disciplines, including political science, law, history, economics, and management. This cross-fertilization advances both consideration of corporations in environmental sociology as well as introducing nature/environment as a key explanatory variable in other areas of social science research. Scholarship on climate change offers an instructive example of the benefits of cross-fertilization. While the complex interrelations of corporations, states, markets, society, and climate change are a key focus of research in environmental sociology (Dunlap & Brulle, 2015), they have also been interrogated through the lenses of the political economy of the world system (Jorgenson, 2007; Roberts & Parks, 2009), environmental justice (Mohai et al., 2009), as well as by political scientists (Meckling et al., 2015), historians (Malm, 2016), lawyers (Reid & Toffel, 2009), economists (Blyth et al., 2007), and management scholars (Jones & Levy, 2007), just to name a few. In aggregate, this body of scholarship across disciplines provides the most compelling view of the power of corporations in the politics of climate change.

We begin our review by counterposing environmental sociology's two leading perspectives of how corporations under capitalism relate to the natural world. Our comparison highlights the contributions of each theory to understanding corporations and the environment but also reveals key gaps across the two theories. Moving beyond the systems' focus of both treadmill of production and ecological modernization theories, this review emphasizes variation in corporate environmental action and contingency in the politics of corporations and the environment. Functionally, the modern capitalist corporate form can be defined as a hierarchical organization that brings together land, labor, capital, and/or knowledge to transform inputs into outputs to create profit. How this transformative process unfolds, in what institutional context, and with what consequences for nature and society is a topic of extensive debate. Drawing on theories from organizational, economic, and political sociology, we offer a view of the corporation as a complex organization both responding to and shaping its operational environments. Corporations vary widely in their contributions to environmental harm and innovation, driven both by variation in internal organizational structures and cultures and by the dynamic interactions between corporations, states, markets, and various stakeholder groups. Finally, a note on terminology before proceeding; researchers use different words to describe the corporations that are the focus of this review chapter, including firm, organization, business organization, private sector, capitalists, producers, etc. Choices in vocabulary reflect disciplinary traditions. For example, the economics and management literatures generally use the word firm, while sociologists use organization as the catchall term. We use the word corporation, rather than the more neutral firm or organization, to emphasize the privileges of the corporate organizational form in relation to other forms of collective organization. To be incorporated is to exercise important state-granted privileges that

advantage corporations against unincorporated associations and individuals (Barley, 2007).

## The Corporation in Treadmill of Production and Ecological Modernization Theories

Debates about corporations and the environment in environmental sociology have centered on two system-level theories of the interactions among corporations, markets, and nature under capitalism, namely the treadmill of production and ecological modernization. We compare how the two perspectives theorize corporations and the environment across five categories: (1) The relationship between economic production and environmental harm; (2) the potential of technology-driven improvements in corporate environmental performance; (3) the relationship between corporations and the state; (4) the relationship between corporations and social movements; and (5) capitalism and proposed pathways to sustainability. The comparison highlights some of the signal contributions of both theories as well as some of their limitations.

Treadmill of production and ecological modernization theories both focus on economic production as the primary driver of society's impact on the environment and place corporations at the center of the field of action. However, they differ on the possibility of reconfiguring the environmental impacts of production. In their 1994 book *Environment and Society: The enduring conflict*, Schnaiberg and Gould describe the treadmill of production logic. They posit that the dynamics of competition and growth under capitalism require the continual expansion of production, which drives the exploitation of the environment. This expansion and the associated environmental harm is foundational to capitalism and present in all sectors of the economy. Schnaiberg and Gould describe three fictitious companies—Active Petroleum, Basic Chemical, and Consulting Associates—highlighting that each contributes to pollution through withdrawals from and additions to the environment. Despite differences across the three companies, the treadmill of production perspective places all three companies into one polluting category by pointing out that even the greenest corporations still contribute to environmental pollution. In contrast, ecological modernization theory envisions the decoupling of environmental harm from economic production and highlights opportunities for corporations to reduce their environmental impacts. Ecological modernization theorists posit that capitalism can be reformed, as the design, performance, and evaluation of processes of production and consumption are increasingly based on ecological criteria; what they characterize as the emergence of an "ecological rationality" (Mol, 1997). Moreover, corporations play a central role in pioneering the innovations that "delink economic growth from natural resource inputs and outputs of emissions and waste" (Mol, 1997:141). The focus of the theory is on leading green companies and industries and on the institutional fields of action that motivate and support them.

Treadmill of production and ecological modernization scholars have different views on the potential of greening production in part due to their diverging assessments of technology. Both recognize that technological innovation and efficiency can decrease the per unit environmental impacts of production. However, treadmill theorists argue that these per unit efficiencies will be outweighed by concurrent expansion in production. Looking historically, Schnaiberg and Gould (1994) argue that "for while there may be some reductions of impacts per unit produced, the total volume of production has risen fast enough to offset these effects" (53). In contrast, ecological modernization theory envisions that technology innovation will enable increases in resource productivity that will result in the absolute decoupling of economic growth and environmental impact (Fischer-Kowalski et al., 2011). In other words, they posit that resource productivity can outpace the expansion of production (Heck et al., 2014).

The theories also differ in the role played by the regulatory state. Schnaiberg and Gould's 1994 book details how the treadmill operates under both low and high regulation scenarios. Under the low regulation scenario, economic

production is mostly unfettered by environmental regulation. This scenario predominated in the United States for most of the twentieth century until political mobilization by those concerned about environmental damage led to the passage of numerous environmental laws in the 1970s, leading to the high regulation scenario. However, even in the latter, the state is a reluctant regulatory actor because its interests, including resources available for government action, international rivalries, etc., are tied to economic expansion. Moreover, treadmill theorists argue that corporations will resist environmental regulation because it imposes additional costs. Resistance may be direct via obstruction, obfuscation, or just minimal compliance, or indirect via the political arena, where corporations hold a privileged position. In direct contrast, ecological modernization scholars depict regulatory agencies as necessary partners in the environmental restructuring of the economy. In a dynamic rather than static model of the economy, environmental regulation does not impose costs but drives profitability, through innovation and increased competitiveness (Porter & van der Linde, 1995). The key is to design regulation in a way that advances these objectives (Mol, 1997). Moreover, ecological modernization theorists envision a slow shift in responsibility for the environmental restructuring of production from the state to the market, as corporations come to take the lead in greening.

Given the limits of state regulation, treadmill of production scholars look to social movements as the agents of system transformation (Gould et al., 2008). Both the state and corporations are caught on the ever-expanding treadmill, so change must come from outside the system. Gould et al. focus in particular on the consequences for the treadmill of creating and perpetuating social and environmental inequality and on "the role of non-elite individuals as citizens (polity) and workers (labor). . .[and] collective actions (such as those of NGOs or social movements) over individual choices/actions" (Gould et al., 2004:302). However, the potential of these actors to fundamentally change the treadmill is so far unactualized. In their assessment, "the empirical history of the period from 1976 to 2004 is one in which the treadmill has only occasionally been slowed" (Gould et al., 2004:302). Environmental social movements also play a prominent role in motivating the environmental restructuring of the economy envisioned by ecological modernization theory. Sonnenfeld (2002) enumerates seven postulates regarding the role of social movements in ecological modernization, related both to the importance of social movements and to social movement strategies. Social movement activity centers on insider, multi-issue advocacy strategies in collaboration with both state and increasingly market actors. Concerns about economic and environmental inequality are mostly absent from ecological modernization theory, as are analyses of the movements mobilizing for environmental and social justice.

Our final category of comparison focuses on the suggested pathways to sustainability articulated by the two perspectives. Critiques grounded in political economy approaches like the treadmill of production argue that capitalism is inherently anti-ecological and cannot be reformed. Transitions towards sustainability will require the dismantling of capitalism and a fundamental reconfiguration of economic and political systems (Gould & Schnaiberg, 1996; Jones, 2011). This call to action has seen success only in small pockets in society (Sevier et al., 2008). In contrast, ecological modernization theories view capitalism as salvageable. They posit the possibility of sustainability through efficient and green growth, supported by regulatory innovation and public-private partnerships. And while variants of this perspective (e.g. sustainable development, natural capitalism, industrial ecology, etc.) have been widely embraced by policy makers and corporate leaders (Esty & Winston, 2006; Hawken et al., 1999; Porter & van der Linde, 1995), there is no widespread empirical evidence to date that efforts at business greening have counterbalanced growth in production and consumption to result in more sustainable outcomes (York et al., 2003).

The comparison of treadmill of production and ecological modernization theories illuminates key debates that have engaged environmental sociologists, such as the role of technology in

environment-society relationships, the role of the state and social movements in the economy, and the dynamics of capitalism (Buttel, 2004; Fisher & Freudenberg, 2001). Moreover, several of the key issues of contention between the two theories mirror debates in other branches of sociology and other disciplines. For example, differences between the treadmill of production and ecological modernization theories align with a distinction in economic sociology between power-based versus institutional theories of economy and society (Dobbin, 2004). Like the treadmill of production, power-based theories emphasize the political processes that distribute the costs and benefits of economic activity unequally among actors. Power operates through coercion but also through discourse, by aligning how others view the world and their own interests with the interests of those exerting power. In contrast, ecological modernization offers an institutional theory of economy and society. Institutions, defined as formal and informal rules and conventions, are expressions of the underlying social order, and organizational behavior evolves with shifting social orders. A second example is provided by the debate between treadmill of production and ecological modernization scholars about the potential of technological advances to green production systems. This debate mirrors parallel discussions in the economics and policy literatures focused on the environmental Kuznets curve and the Jevons paradox. The former hypothesizes the relationship between pollution and economic development as tracing the shape of an inverted letter U. Technological and efficiency advances motivated by government regulation and consumer pressure are argued to lead to turning point in environmental pollution at a certain level of income, at least for select pollutants under certain conditions (Dinda, 2004). The Jevons paradox states that the more efficient use of resources leads to price declines which in turn drive increased consumption, undermining the environmental benefits of efficiency gains. Research focuses on the size and mechanisms driving such rebound effects (Alcott, 2005). Finally, a key cleavage in theories of corporations and the environment across the social sciences is between those who see corporations as expressions of the state and capitalist power, locked into a logic of extraction and dispossession of nature, indigenous peoples, and workers (Karliner, 1997; Korten, 1995) versus those who argue that corporations have transformatively reconfigured economic and social life, generating many benefits of the modern age, and are evolving to embody practices of social and environmental responsibility (Gladwin, 1993; Jones, 2018). Like the treadmill of production, the former emphasize the destructive influence of corporate power on resources, landscapes, workers, and communities; like ecological modernization, the latter identify the emergent potential of corporations to play a central role in driving the technological and behavioral change necessary for reaching sustainability. This cleavage is reproduced both within and across disciplines; research on corporations in anthropology and political ecology tends to be more critical, while research published in the political science and management literatures tends to more concerned with corporate efforts at greening (Baars & Spicer, 2017).

While the above contributions are valuable, there are several lacunae in both the treadmill of production and ecological modernization approaches to corporations and the environment. First, both perspectives can be critiqued for offering a theory of capitalism but not of capitalists and capitalist corporations (Freudenburg, 2005). The systems focus of both theories draws attention away from organization-level theoretical and empirical analyses of corporate environmental action. Second, both approaches can be read as teleological trajectories. Both describe two distinct logics of capitalism and the environment whose endpoints are pre-determined. As a result, less attention is given to the wide range of corporate environmental action and the implications of this range for the limits, possibilities, and dynamics of system change. Our review expands analytical focus from system tendencies to include the ways in which corporations vary in their interactions with society and nature and the patterns, drivers, and consequences of that variation. It reasserts the agency of corporations, not as

free from system constraints but as actors that are both the products of and shape the systems in which they operate (Fligstein, 1990; Hoffman, 2001; Perrow & Pulver, 2015; Pulver, 2007).

## Contributions from Organizational, Economic and Political Sociology

Organizational, economic and political sociology provide a basis for analyzing the emergence, mechanisms and consequences of variation in corporate forms and action (Dobbin, 2004; Scott, 2004). They add an organizational focus to the systems analyses offered by the treadmill of production and ecological modernization theories. An organizational perspective emphasizes variation across corporations, analyzes the internal organizational structures and cultures of corporations, and theorizes the relationship between corporations and their operational environments, in which the state plays a constitutive role. A core research focus in organizational sociology is the emergence and functioning of organizations. Organizational sociology identifies a key cleavage between economic/rationalist and cultural models of organizations. This cleavage applies both to theories of the internal structures and cultures of corporations and the relationships between corporations and their operating environments. Economic theories of the corporation argue that hierarchical organization, such as the corporate form, emerges when transaction costs render action through markets inefficient (Coase, 1937; Williamson, 1981). From this perspective, corporations function as "a complex nexus of contracts among individual rational actors" (Hart, 2012:174). Research in this vein focuses on the incentives facing different actors in an organization and what rational consideration of incentives would lead them to do. A classic example of the rationalist mode of analysis in organizational sociology is provided by Fama and Jensen's (1983) identification of the misalignment in incentives between shareholders and managers of a corporation, termed the separation of ownership and control. The latter are tasked with decision-making while the former bear the risk of management decisions. Corporations develop contract structures to mitigate the misalignment of incentives. In contrast, cultural modes of theorizing the corporation envision it as "set[s] of organizational routines enacted by individuals playing roles" (Hart, 2012:174). The cultural mode of analysis argues that corporations cohere not because of an ongoing self-interest-based negotiation among shareholders, management, and employees, but because individuals follow the organizational scripts that adhere to their roles in the organization. They identify role structures and routines as the key features of intra-organizational decision-making (Meyer & Rowan, 1977).

Corporate choices are driven not only by internal characteristics but also by the political, economic, social, technological, legal, and biophysical environments in which corporations operate and seek advantage. Theories range from depicting organizations as responding to external environments, as enacting their environments, and as engaging in a process of mutual constitution of organization and environments (Pfeffer & Salancik, 1982). Theories of markets provide insight on how corporations create their operational environments (Dobbin, 2004; Fourcade, 2007). Corporate influence can be material and performative. Corporations wield material influence via structural power based on contributions to the tax base and employment, instrumental power through lobbying and campaign contributions, and technological power, which reflects the significant contributions of the private sector to technology research and development. Corporations also manifest or perform their operational environments via rule setting, particularly through the development of private standards, and discursive power, reflecting corporate influence on agenda setting and issue definition (Clapp & Meckling, 2013; Fuchs, 2007; MacKenzie & Millo, 2003). The rational-cultural distinction extends to theorizing how corporations interact with external environments. Economic/rationalist theories of the corporation view corporate operational environments as a set of resources (Aguilar, 1967), and corporations are more or less efficient in characterizing and harnessing their resource

environments (Grundy, 2006; Porter, 1979). The more efficient corporations are those that survive and thrive. Cultural conceptions of corporations emphasize legitimacy over efficiency as the key to organizational survival. They theorize a corporation's environment as an organizational field, defined as "those organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products" (DiMaggio & Powell, 1983:148). DiMaggio and Powell argue that in established organizational fields, corporate strategies that are widely adopted become normatively sanctioned. Subsequent adoption of such strategies by other corporations provides a legitimacy gain regardless of the effects on performance.

A second key contribution of organizational and economic sociology is to identify the state as central to the existence of the corporation and to view the history of states and corporations as a mutually constitutive co-evolution. As Fligstein (1996) argues, "while most modern discussions of state-building have focused on warfare and welfare, modern capitalist states have been constructed in interaction with the development of their economies, and the governance of economies is part of the core of state-building" (660). Corporations are articulations of changing relationships between collective organization and state power. The history of the corporate form suggests that the organizational structures, privileges, and roles of corporations in society have varied over time, with meaningful consequences for local and global communities. The corporate form dates back to ancient civilizations. Roman law recognized corporate entities, such as craft guilds, political associations, and religious groups, as *corpus*, *collegium*, or *universitas* (Berman, 1983). In the Middle Ages, monasteries and convents, equestrian military orders, guilds, boroughs, faculty *collegium* and student *universitas* all functioned as corporations (Runciman & Magnus, 2003). Mercantilism delivered new corporations in the form of chartered trading companies. These operated in tandem with and sometimes functionally merged with the colonial, religious, and military companies produced by the earlier period (Morck, 2007). Most of the English colonies were themselves corporations, chartered by the British crown, and governed by appointed executives. The revolt against "taxation without representation" was in part a rebellion against the colonial governors themselves (Grossman et al., 1993; Ritz, 2001). The Boston Tea Party was an act of economic sabotage that cost the largest multinational corporation in the world, the British East Indies Trading Company, cargo valued today at US$20 million (Barley, 2007; Hartmann, 2002). Anti-corporate sentiment was so strong following the Revolution of 1776 that, for the century following American independence, state legislatures kept corporations on short tethers; corporations could not own other corporations, corporations were established for specific purposes and were not permitted to enter other industries, corporate officers could not serve on multiple boards of directors, directors were required to live in the same region the corporation was chartered, corporations could not spend money on elections or to influence public officials, and generally speaking corporations were required to operate in the public interest (Perrow, 2009; Prechel, 2000). Over time, much of the state's control over corporations has eroded. In its modern form, the corporation is characterized by multinationalism, interlocking directorates, hierarchical integration and financialization (Domhoff, 2002; Fligstein, 1990; Zeitlin, 1974), while also enjoying increasingly unrestricted access to political processes (Hadani, 2016) and growing constitutional protections against state regulation (Perrow, 2009). The balance of corporate and state power also varies across institutional context. For example, the varieties of capitalism literature differentiates ways of organizing the economy based on how corporations structure their relationships with other entities, including the state. The liberal, coordinated, and developing market economy varieties of capitalism are associated with different articulations of state and corporate power (Hall & Soskice, 2001). Differing relationships between state and capital also characterize

economies in East Asia (Hamilton & Biggart, 1988) and the evolution of industrial policy in the US, UK and France (Dobbin, 1994).

An organizational view of the state and corporations operates alongside classical political economy perspectives, which view the state as a class instrument, and pluralist theories of politics, which view the state as setting the terrain on which various constituencies vie for influence (Jenkins, 1994). Political economy theories assign corporations a privileged position of structural influence in relation to the state because of their role in generating tax revenue and political stability through prosperity (Block, 2010). The state protects ruling class interests and mediates between competing factions of the ruling class, all whilst portraying itself as serving the interests of all (Jenkins, 1994). The owners of capital and the corporations through which they extract surplus value constitute the ruling class (Sklair, 1994). Under the pluralist model, corporations are seen as separate from the state; they simply constitute one of a range of interest groups in politics, albeit a privileged one (Lindblom, 1977). Pluralism can be characterized as a theory of politics in which "autonomous groups in civil society were the primary source of social demands and the state was seen as an 'umpire,' that is, an external institution for adjudicating social interests" (Jenkins, 1994:19–20).

Applying the above insights to the domain of corporations and the environment expands debate beyond the competing system logics of treadmill of production and ecological modernization theories and introduces a new range of questions about the limits and possibilities of corporate action for nature and society. How, why and with what consequences do corporations vary in their interactions with society and nature? Answering these questions creates opportunities to engage the treadmill of production and ecological modernization research literatures to other scholarship on corporations and the environment in environmental sociology (e.g., Freudenburg, 2005; Gladwin, 1993; Hoffman & Ventresca, 2002; Perrow & Pulver, 2015) and sociology more broadly. Moreover, shifting the focus of research on corporations and the environment from a systems to an organizational perspective also gives environmental sociologists access to the rich research traditions on corporations and the environment in anthropology, economics, management studies, and political science, which all tend to ground their analyses in individual organizations, either as single qualitative case studies or as the unit of analysis in large-N quantitative research.

## Patterns of Corporate Environmental Harm and Innovation

Organizational analyses of corporate environmental action encompass corporate environmental *performance*, i.e. material measures of corporate pollutant release and resource consumption such as air pollution, toxic emissions, biodiversity impacts, spills, etc. (Dragomir, 2018), corporate environmental *practices*, i.e. management plans, governance strategies, and compliance, communication and lobbying actions, and the shifting *discourses* that corporations advance to define environmental problems and corporate rights and responsibilities. Together, these capture the material and ideational components of corporate action. The starting point for most scholarship is corporate environmental performance. However, it is worth noting that research on corporate environmental performance is limited by the lack of accurate, trustworthy, comprehensive, and longitudinal facility and/or organizational-level data. Most long-term, quantitative, longitudinal studies of corporate environmental performance in American environmental sociology rely on the publicly available US Environmental Protection Agency's Toxics Release Inventory database, which provides self-reported facility-level toxic release data dating back to 1988 (Collins et al., 2020; Kraft et al., 2011). A few other nations have similar pollutant release and transfer registries (PRTR) although with much shorter histories (Sullivan & Gouldson, 2007). More recently, mandated, publicly available greenhouse gas emissions reporting for facilities in the energy industry has enabled systematic

quantitative research (Galli Robertson & Collins, 2019; Grant et al., 2013), improving on analyses based on voluntarily reported data (Kolk et al., 2008). Researchers may acquire primary organizational environmental performance data, but these can be onerous to acquire (e.g., Heede, 2014) and limited in both the number of facilities in a sample and the timespan of the data (e.g., Kagan et al., 2003).

Corporate environmental practices provide a second empirical measure of corporate action, in combination with or as a proxy for corporate environmental performance data. Corporate environmental practices that have garnered quantitative and qualitative research attention include the implementation of environmental policies and management systems (Delmas, 2002), corporate governance systems (Kolk & Pinkse, 2010), sustainability reporting (Levy et al., 2010), compliance and enforcement actions (Gray & Shimshack, 2011) and lobbying expenditures (Brulle, 2018). Research focuses both on establishing a link between corporate environmental practices and performance and on explaining variation in environmental practices. Both single item and aggregate metrics of corporate performance and practices are available for large publicly traded corporations through public and/or proprietary sources (e.g., Newsweek Green Rankings, Dow Sustainability Rankings, Global Reporting Initiative, Trucost, CDP, and KLD), but these are relatively recent in origin (Mattingly & Berman, 2006).

A third measure of corporate environmental action are the discursive practices of corporations, both those that justify pollution and those that position corporations as environmental stewards. Freudenburg (2005) provides an overview of discourses used to justify corporate environmental harm. His theory of the double diversion combines an analysis of the material impacts of corporate action with a focus on discursive strategies corporations use to legitimate their pollution and resource consumption. He identifies six "privileged accounts," defined as "generally unquestioned assumptions or arguments that help to naturalize and legitimate the privileged access" (90). The first three turn on arguments that pollution is justified because it contributes to economic output and growth, provides employment, and furnishes critical materials otherwise not available. The second three privileged accounts concern the adverse consequences of regulating pollution, namely that it would force regulated corporations out of business, that it would cause regulated corporations to relocate operations outside the US, and that regulation is costly to the economy as a whole. Such discourses are used to bolster community support for polluting and declining industries and to prevent efforts at regulation and citizen action (Bell & York, 2010; Hager & Burton, 1999). The other key discursive practice pursued by corporations is embodied in the concept of corporate social responsibility (CSR), which positions corporations as partners or even leaders in environmental stewardship (Schmidheiny, 1992). Although debates about the social responsibility of corporations are long-standing (Carroll, 1999), the environment as a domain of CSR has arisen alongside national and global efforts to regulate the environmental actions of corporations (Hoffman, 2001). Some envision a tightly-coupled version of CSR, where claims regarding social responsibility are tied to significant improvements in core aspects of corporate environmental performance and practices (Esty & Winston, 2006; Gladwin, 1993; Jones, 2017). More critical perspectives argue that CSR is mostly rhetoric, only loosely tied to environmental practices and performance; CSR claims are a strategy to pre-empt critique and regulation (Banerjee, 2008; Hilson, 2012). CSR claims focus specifically on the corporation as environmental steward, but they build on a parallel range of privileged accounts that justify corporate management of the environment more broadly (Jermier et al., 2006). Justifications for environmental management via markets date back to Garrett Hardin, a nativist proponent of population control (Bhatia, 2004), who argued that converting common goods into private property could result in efficient management (Hardin, 1968). Such arguments have been the basis for marketizing fisheries, ground water, and the global atmosphere (Keohane & Olmstead, 2007). A closely related privileged account

argues for privatized control over formerly publicly owned resources (Davis, 2005). Government regulation is said to distort the optimal distribution that could otherwise be reached through private bargaining (Coase, 1960). Both justifications are critiqued for the privileges market systems confer on corporate actors (Bachram, 2004; Bumpus & Liverman, 2008; Morris, 2008).

The key finding of organizational analyses of corporate environmental action is variation. Single item and composite metrics of corporate environmental performance, practices, and discourses consistently point to environmental leaders and laggards within and across industries (Reilly & Hynan, 2014). On performance metrics, laggards outnumber leaders (Pulver, 2011; Pulver & Benney, 2013), although the latter are more likely to be the focus of research (Dauvergne & Lister, 2012), and there is often a disconnect between claims regarding green corporate practices and discourses and tangible improvement in environmental performance (Doda et al., 2016). Treadmill of production and ecological modernization theories offer limited insight on the drivers and consequences of variation in corporate environmental action. From a treadmill of production perspective, variation at the organization level is secondary to the overarching system tendency of increasing pollution. Others working in the political economy tradition go further and argue that variation is not just materially meaningless but functional to the reproduction of capital by deflecting critique (Beder, 1997; Dauvergne & Lister, 2012). Ecological modernization scholars also acknowledge variation but are interested only in the emergence of leading green corporations. However, other environmental sociologists have made variation in corporate environmental action the central feature of their analysis. Freudenburg's (2005) theory of the double diversion provides a theoretical basis for the centrality of variation. His approach aligns with the treadmill of production and ecological modernization in making production central to environmental harm. However, Freudenburg identifies disproportionality, defined as "the strikingly unequal patterns of privileged access to environmental rights and resources" (2005:89) by corporations, as the key feature of modern societies and economies, challenging both treadmill of production and ecological modernization theories. Moreover, he shifts focus to corporations at the polluting end of the spectrum. The starting presumption of a disproportionality approach is that the vast majority of environmental harm generated by corporations is due to the actions of a handful of egregious polluters. In Freudenburg's words, industrial environmental pollution is a case of "the tail wagging the distribution" (2005:91). Freudenburg's (2005) initial analysis provided only anecdotal evidence for disproportionality. Subsequent research establishes extreme disproportionality in toxic releases as characteristic of over three hundred industries in the US manufacturing sector; a pattern that holds even when controlling for facility size (Collins et al., 2020). Moreover, accumulating empirical evidence suggests that disproportionality in organizational contributions to pollution extends beyond toxic releases and is a common rather than isolated feature of the economy-environment interface. Research on corporate greenhouse gas (GHG) emissions establishes disproportionality in GHG pollution as a key feature of energy production (Alvarez et al., 2018; Grant et al., 2013; Heede, 2014). Disproportionality also characterizes phosphorus loading to stream and lake systems by agricultural operators (Nowak et al., 2006) and economy-wide emissions of fine particulate matter (Tessum et al., 2019).

An underlying disproportional distribution of environmental harm caused by corporations has important empirical implications. Research based on average levels of emissions or focused on the cleaner end of the spectrum fundamentally mischaracterizes the actors and processes causing environmental harm. In particular, average impact estimates are likely to overestimate the pollution contributions of the vast majority of polluters and underestimate the impacts of the worst offenders. Attention to disproportionality also provides a new perspective on attempts to empirically adjudicate between the treadmill of production and ecological modernization. If a handful of egregious polluters are responsible

for the vast majority of environmental impact, then the overall impact of a system will be relatively unaffected by innovation among leading green organizations. Significant reductions in overall environmental impact will result only from changing practices at the other end of the distribution (Collins, 2012).

## Explaining Variation in Corporate Environmental Harm and Innovation

Acknowledging the importance of variation across organizations opens a dialogue between macro-theories of economy and environment and organizational-level analyses. In sociology, anthropology, political science, and management studies, variation is the starting point of most unit-level research on corporate environmental harm and innovation. Researchers from these disciplines have coalesced on a shared model of corporate environmental action, which predicts unequal contributions to environmental harm and innovation due to both variation in internal organizational structures and cultures and variation in external operational environments (Bansal & Roth, 2000; Delmas & Toffel, 2004; Kagan et al., 2003).

### Internal Organizational Structures and Cultures

Both rationalist and cultural modes of analysis provide insight on the internal organizational characteristics that correlate with better or worse corporate environmental performance. A core rationalist research question is the relationship between corporate financial performance and corporate environmental performance. Most seek to investigate the effect of the latter on the former; in other words, does it pay to go green? (Ambec & Lanoie, 2008; Dixon-Fowler et al., 2013; Orsato, 2006; Russo & Fouts, 1997). However, stronger financial performance has also been linked to improved environmental performance (Stanwick & Stanwick, 1998). One of the key contributions of environmental sociologists has been to investigate the relationship between complex organizational structures and environmental performance. Size alone is not predictive of environmental performance—larger organizations may have more resources to dedicate to environmental controls, but they also have the capacity to be larger polluters (Grant et al., 2002)—but the organizational structures associated with larger organizations, in particular subsidiary and branch facilities, have been found to pollute more. Moreover, these internal organizational structures intersect with community characteristics (Grant et al., 2002; Grant & Jones, 2003). The presence of local civil institutions may mediate higher pollution by subsidiary and branch facilities (Grant et al., 2004), while community characteristics can intersect with facility characteristics to create "new recipes of risk" (Grant et al., 2010). Likewise, focusing at the level of the parent company, greater organizational complexity also predicts higher levels of emissions (Prechel, 2015; Prechel & Touche, 2014; Prechel & Zheng, 2012). The patterns derive from the incentives created by complex organizational structures. The subsidiary structure can allow organizations to avoid liability for their hazardous activities (Prechel et al., 1999).

Organizational governance practices are also key drivers of variation in corporate environmental action. Oversight structures and disclosure policies can realign organizational incentives in the direction of improved environmental outcomes (Walls et al., 2012). Boards of directors vary in their composition, in the resources they can access, and in their overview capabilities. Both board size and the number of independent and female board members correlate with improved environmental performance (de Villiers et al., 2011; Glass et al., 2016; Post et al., 2015). Corporate transparency and disclosure practices also link to environmental performance. Corporations face mandatory reporting requirements to government agencies like the Securities and Exchange Commission (Peters & Romi, 2013) and the Environmental Protection Agency (Kraft et al., 2011). Voluntary disclosure may take the form of corporate sustainability reports (Brammer & Pavelin, 2008) or the

submission of data to initiatives such as the Global Reporting Initiative (Brown et al., 2009; Milne & Gray, 2013) or the Carbon Disclosure Project (Kolk et al., 2008). Mandatory environmental reporting is linked to improvements in corporate environmental performance (Kraft et al., 2011; Ochsner et al., 1995), but the consequences of voluntary reporting are less clear. In a comprehensive review of corporate environmental disclosure, Aragón-Correa et al. (2016) find that disclosure can be a means to seek legitimation for poor environmental performance.

Theories of the corporation that focus on identity, roles, and organizational routines examine the effects of corporate culture on environmental performance. One of the earliest studies of industrial pollution in the US economy categorizes companies as crisis-oriented, cost-oriented, or enlightened management, based on how a corporation's culture filters its approach to complying with regulation. Organizations guided by enlightened management complied with regulation on principle, while crisis-oriented organizations were often out compliance until challenged by regulators and even then sought to resist fines or investments in pollution control technologies through legal strategies (Petulla, 1987). Corporate culture also serves as a guide for corporations in situations characterized by pervasive uncertainty. For example, in the case of corporate responses to climate change, corporate cultures shaped organizations' openness to outside information and choice of carbon mitigation strategies (Engels, 2009; Pulver, 2007; Sugita & Takahashi, 2015). Leadership at all organizational levels is an important contributor to corporate culture. It features prominently in analyses of the influence of chief executives on organizational environmental performance (Francoeur et al., 2017; Thornton et al., 2009). For example, Weinberg's (1998) research on a small group of sustainability pioneers showcases how the founders of Ben & Jerry's, The Body Shop, and Patagonia managed the conflict between business growth and their organization's environmental and sustainability values. He distinguishes between three types of green business culture—green marketing, caring capitalism, and sustainable growth—each of which is associated with a distinct response to environmental challenges. Finally, managers and employee green teams also contribute to corporate cultures. Prakash (2001) categorizes managers as policy-supporters, policy-neutrals, and policy-skeptics and argues that beyond compliance environmental policies result from both persuasive and coercive processes mobilized by policy-supporters. Likewise, organizations with employee green teams show improved environmental performance (Alt et al., 2015; Chen et al., 2015; Dangelico, 2015).

## External Operational Environments

Corporate operational environments function on multiple scales, ranging from local communities, to industries, to national economies, to the international community. Corporations both respond to and shape their operational environments across multiple intersecting institutional domains, including government, market, and stakeholders. As described in the first section of this review, both the treadmill of production and ecological modernization offer theories of how corporations engage with their operational environments. According to the treadmill of production, competition with peer corporations drives the need to minimize environmental costs, leading corporations to resist regulation directly and indirectly, through the political arena. The state as regulator is compromised by its reliance on the expansion of production, and social movement organizations are weak and exert minimal influence. Ecological modernization theorists argue that green corporations take strategic advantage of state regulation and social movement pressures, in ways that enhance their financial performance relative to their peers. Over the past three decades, much has been added to the two theories' initial characterizations of environmental politics, both by their proponents and others. We complicate and nuance the competing depictions of environmental politics offered by the treadmill of production and ecological

modernization through a discussion of three key actors in corporations' operational environments. First, drawing on three theories of the state, we expand the possibilities for theorizing the relationship between corporations, the state, and the environment. Second, we recognize the discipline of markets on corporate behavior. Third, we review the research on social movements and movement organizations both targeting and partnering with corporations to change environmental performance. By exploring each of these arenas we offer a more nuanced view of corporations as actors in environmental politics. Our starting point in all three arenas is that corporations prefer minimal constraint on organizational choices and thus seek to supersede the any limitations imposed by their operational environments. Princen (1997) argues that "for a business firm, the ideal economy is a frontier economy" (236), which provides free resources and waste sinks and lacks jurisdictional authority. The caveat, of course, is that even economic activity on the frontier is heavily dependent on public goods provided by the state, including the rule of law, enforcement of contracts, infrastructure, etc. (Fligstein, 1996). Nevertheless, the history of corporate activity related to the environment has long been one of frontier economics (Cronon, 2009). To the present day, efforts to regulate frontiers are directly opposed or avoided via shading, i.e. obscuring the environmental costs of production, and distancing, i.e. separating production and consumption, thus impeding ecological and social feedbacks (Princen, 1997). Although corporations continue to operate at frontiers—for example corporate carbon emissions to the atmosphere remain unregulated in many jurisdictions (World Bank, 2020)–the rise of environmental regulation and environmental movements has constrained corporate behavior. If no constraint is the first-best option, second best is an operational environment that serves corporate interests. Corporations may even promote environmental regulation, since it can confer competitive advantage as it did for Dupont in the international ozone treaty negotiations (Levy, 1997), or they may partner with social movement groups to enhance the legitimacy of their brands with consumers (van Huijstee et al., 2011).

## The State, Corporations, and the Environment

States are fundamental to the form and function of corporations and to their environmental performance and practices. Scholars researching corporations and the environment can be grouped into three underlying conceptualizations of the corporation-state relationship. Political economy perspectives, like the treadmill of production, draw on Marxist theories of the state, arguing that the regulatory state is compromised by its reliance on expanding production and thus will support expanded production at the cost of environmental wellbeing. The state's compromise with industrial capital to ensure stable economies leads to the metabolic rift theorized by Marx and empirically investigated in the forestry industry (Prudham, 2003), fertilizer industry (Clark & Foster, 2009), and marine fisheries and aquaculture (Clausen & Clark, 2005). World systems perspectives characterize the state as equally compromised in regulating transnational corporate power (Clapp, 2001; Dauvergne, 1997; Frey, 2003; Jorgenson & Clark, 2009). Political ecology and critical environmental justice also theorize the state as complicit with capital. Extractive industries offer numerous examples of how the legal infrastructures governing extraction enable corporate power and legitimate the use of force (Leonard & Grovogui, 2017; Peluso & Watts, 2001), as do toxic sacrifice zones (Lerner, 2010). Moreover, the histories of settler colonialism and racial capitalism link multiple intersecting systems of injustice across the state, capital, race and the environment (LeQuesne, 2019b; Pulido, 2017).

Others view the relationship between corporations and states through the pluralist lens, comparing the relative influence of business versus environmental constituencies on a terrain set by the state. Research in this vein examines the result of lobbying efforts (Brulle, 2018), coalition politics (Mildenberger, 2020) and interest group advocacy strategies (Gullberg, 2008; Pulver, 2002) on regulatory outcomes. These

scholars acknowledge the privileged power of business relative to other constituencies but also theorize the limits to business influence. Such limits include competing constituencies (Ronit, 2007; Sell & Prakash, 2004) and intra-business conflict, which may lead some corporations to oppose regulation while other support it (Falkner, 2008; Vogel, 1993). Pluralists also theorize that corporate influence varies across political institutions, with some political systems enabling veto coalitions by well-organized sectional interests (Christoff & Eckersley, 2011), while other governance contexts are less amenable to business influence (Pulver, 2017). A key finding of research in the pluralist tradition on corporate influence on US environmental regulation is the importance of the agenda setting phase. Corporations wield more influence as agenda setters than during later phases of the legislative process on issues ranging from city-level air pollution politics (Crenson, 1971) to environmental and natural resource legislation more broadly (Kamieniecki, 2006). Sociological research on corporate funding of the climate skeptic movement also emphasizes the importance of agendea setting (Dunlap & Jacques, 2013; Dunlap & McCright, 2015; Jacques et al., 2008; McCright & Dunlap, 2003), as does scholarship on the corporate efforts to undermine scientific uncertainty across a range of environmental issues (Freudenburg et al., 2008; Oreskes & Conway, 2011).

The third conceptualization depicts states and corporations as mutually constitutive. Research on corporations and the environment is this vein recognizes the many variants of corporate-state relations. For example, economies can be distinguished by national strategies of accumulation, ranging from "carboniferous capitalism" to ecological modernization (Christoff & Eckersley, 2011). The former identifies the fossil fuel base of most economies and the resulting interdependence of states and fossil fuel corporations (Newell & Paterson, 2010). Accumulation based on ecological modernization envisions a new articulation of state and corporation, with the emergence of state-corporate alliances aimed at resource efficiency, clean technology and environmental protection (Hawken et al., 1999; Mol, 1997). A corporate form reflective of ecological modernization is the benefit or B corporation, a status achieved by taking on legal obligations to workers, customers, suppliers and the environment in corporate decision making (Haymore, 2011). Research has also established that the liberal, coordinated, and development varieties of capitalism are characterized by distinct corporate environmental strategies related to carbon markets (Benney, 2015; Engels et al., 2008) and to CSR and environmental performance more broadly (Favotto et al., 2016; Hartmann & Uhlenbruck, 2015), although the effects on environmental outcomes are nuanced. For example, comparing histories of environmental regulation in the US and UK, two liberal market economies, Vogel (1986) characterizes the former as having antagonistic business-government relations and the latter as cooperative. Nevertheless, both systems generated environmental protections, and more recently, the two jurisdictions have shifted in their respective roles (Kelemen & Vogel, 2010).

## Corporations, Other Markets Organizations, and the Environment

While the state is a defining organization in the life of the corporation, corporate environmental action is also shaped by relationships to other market organizations, including peer corporations, supply chains, financial institutions, industry associations, and consumers. Competition with peer corporations is central to both treadmill production and ecological modernization theories. Competition between corporations drives the ever-expanding treadmill of production and consumption, as corporations seek continuous growth and externalization of environmental costs in order to increase profit and survive. This form of competition between corporations has been hypothesized to create an environmental race to bottom, as jurisdictions lower environmental standards in order to attract corporations minimizing their environmental costs (Frey, 2003; Korten, 1995). Empirically, evidence for an environmental race to the bottom is limited, as a number of factors intervene in the pattern

(Madsen, 2009; Wheeler, 2001). Ecological modernization theory posits a competitive race to the top. Win-win strategies that simultaneously benefit corporate environmental and financial performance are likely to be copied because they enhance the efficient functioning of the corporation (Ambec & Lanoie, 2008; Esty & Winston, 2006). A race to the top can also operate through cultural mechanisms. Research shows that the behavior of industry peers, when reported by third-party rating organizations, can be associated with emissions reductions as corporations copy the behavior of industry leaders (Sharkey & Bromley, 2015). Likewise, voluntary industry environmental programs can create group reputational benefits, resulting in peer pressure for members to improve compliance (Potoski & Prakash, 2005). A third perspective, grounded in economic sociology, argues that corporations seek to avoid direct competition with peer corporations, instead sorting themselves into differentiated niches. Producers create stable markets by locating themselves within an observable menu of market niches, based on the decisions of other producers (White, 1981). In the environmental arena, not all corporations can simultaneously reap the regulatory and reputational benefits of being environmental leaders. Therefore, if that niche is already occupied by another producer, an organization may actively choose not to invest in environmental improvements (Vogel, 1993).

Beyond peer corporations, other markets actors also play central roles in shaping patterns of corporate environmental action. Corporations are embedded in business-to-business relationships along supply chains. These relationships both enable the shading and distancing of environmental harm (Princen, 1997) and function as conduits of environmental technologies and standards. Trust relationships along supply chains have been found to enable integration of new technologies into industry practice in the construction sector (Biggart & Lutzenhiser, 2007). In retail-driven supply chains (Gereffi et al., 2005), big brand corporations can mandate environmental policy and performance actions by suppliers, both promulgating environmental values and exerting control over suppliers (Darnall et al., 2008; Dauvergne & Lister, 2012; Lambin et al., 2018). More generally, environmental standards can spread through a variety of market relationships. Prakash and Potoski (2006) demonstrate that trade linkages encourage the adoption of voluntary corporate environmental managements systems by corporations in exporting countries when corporations in importing countries are also adopters. Financial institutions are another key actor in a corporation's organizational field. In theory, financial institutions could force environmental improvement through green conditionality on loans, although this is rarely seen in practice (Scholtens & Dam, 2007). To the contrary, Prechel and Zheng (2012) find that greater capital dependence is associated with higher pollution rates. Shareholder activism, by institutional investors such as pension funds, combines leverage through stock ownership with social movement values to motivate corporate environmental and social action (Vasi & King, 2012). Industry or trade associations can exert pressure for conformity across corporate environmental action, either masking internal disagreements (Pulver, 2002) or seeking to create industry-wide standards, e.g. the Sustainable Apparel Coalition and the chemical industry's Responsible Care Program (O'Rourke, 2014; Prakash, 2000). However, the voluntary nature of industry association membership and program participation can lead to opportunism, as corporations with lower environmental performance free ride on the reputational benefits and efforts at improvement by others (Gamper-Rabindran & Finger, 2013; King & Lenox, 2000). Retail consumers constitute a final category of market actor. Consumption is central to supporting ongoing production (Curran, 2017) and thus could be an avenue for shifting patterns of corporate environmental harm and innovation (Spaargaren, 2003). However, consumers as a group wield little influence over corporate action, because their purchasing options are limited to structurally pre-determined portfolio of choices (Sanne, 2002). Moreover, for most products, sustainable consumption is a small fraction of total retail

consumption (Young et al., 2010), which itself a small fraction of the exchange relationships along the supply chain (Clift & Wright, 2000; Isakson, 2014). Consumer mobilization via product and corporate boycotts has been successful, but they are difficult to sustain (Friedman, 1985; Pruitt & Friedman, 1986; Tomlin, 2019).

## Corporations, Social Movements, and the Environment

Social movements have also become key players in the operational environments of corporations (King & Pearce, 2010). Over the past decades, in response to political and economic changes, movements have "decentered the state" and made individual corporations and industry groups direct targets of their demands (Hendry, 2006; Schurman, 2004; Walker et al., 2008; Wapner, 1995). Demands aimed at corporations come from local communities and organizations concerned with environmental justice in the US and around the world (Schlosberg, 2004), from blue-green coalitions bridging the environmental and labor movements (e.g., Mayer, 2009), from issue specific movements and organizations, focusing on food (e.g., Schurman & Munro, 2009), water (e.g., Bakker, 2007), energy (e.g., LeQuesne, 2019a), toxics (e.g., Pellow, 2007) and climate change (e.g., Pulver, 2017), to name a few, and from the environmental movement broadly (e.g., Spar & La Mure, 2003). These campaigns have brought to public attention the environmental harm caused by corporations, although it is worth noting that the majority of corporations escape social movement targeting and are not pushed into public view (Bartley & Child, 2014).

Schurman's (2004) analysis of the anti-biotech movement's challenge of pharmaceutical and food corporations theorizes the aspects of an industry that make it vulnerable to social movement demands, what she calls "industry opportunity structures." These include the economic and competitive behavior of corporations in the industry, relationships among actors in the industry's organizational field, including power and economic dependency along the commodity chain, and cultures of industries and individual corporations. Subsequent research has empirically validated the industry opportunity structure framework for a range of industries. It has been applied to both locally-initiated campaigns (Berry, 2003) and transnationally organized movements (McAteer & Pulver, 2009). Findings from this research indicate that corporations that cultivate reputations for social responsibility are more vulnerable to attack (King & McDonnell, 2012), while corporations that have already been targeted are less vulnerable (King & Soule, 2007).

When targeted, corporations can be further distinguished as responding via confrontational or collaborative strategies (Alcock, 2008). The former directly challenge social movement groups or attempt to preempt social movement demands, while the latter engage in partnerships and offer some concessions to social movement demands. Treadmill of production theorists predict a confrontational relationship between corporations and environmental movements and movement organizations, although with minimal effects on corporate behavior. In contrast, ecological modernization theory predicts opportunities for collaboration. The repertoire of confrontational strategies that attempt to quell social movement challenges include violently repressing movement organizations in partnership with the state (Downey et al., 2010; Pellow, 2014), sponsoring mass-based and localized countermovements that shore up corporate power and influence (Fisher, 2006), and preempting debate by manufacturing scientific uncertainty (Freudenburg et al., 2008; Oreskes & Conway, 2011). Research on the energy industry documents the range of confrontational strategies; e.g., the corporate-state apparatus of violence mobilized by the Shell Corporation against the Ogoni people in Nigeria (Watts, 2007), the front groups created to preempt community resistance against the coal industry (Bell & York, 2010), and the processes and agents mobilized to create the climate change denial machine (Jacques et al., 2008). Collaborative corporate strategies may include information exchange and mutual learning, management concessions, and increased access to the policy process and financial

contributions for the collaborating movement organizations (Husted, 2003; Stafford et al., 2000). However, collaboration may also lead to cooptation and demobilization (Baur & Schmitz, 2012; King & McDonnell, 2012). Overall, patterns of conflict and collaboration and the opportunities for social movement influence on corporate action shift across institutional context (Doh & Guay, 2006).

## Conclusion

Environmental sociology's two leading theories of the intersection of economy and environment chart divergent trajectories. Treadmill scholars predict ever-increasing economic production under capitalism, tied to ever-increasing environmental impacts, unless communities and social movements act to dismantle capitalism and the corporate-state alliance at its core. Ecological modernization theory envisions a transformation from within, as corporations, states and social movements reconfigure production to align with ecological as well as economic values. However, the system-level focus of both theories obscures both variation in the environmental performance, practices, and discourses of individual corporations and the limits, possibilities, and dynamics of system change. As Freudenburg (2005) argued, "instead of simply focusing on overall/average levels of environmental problems, sociologists also need to examine disproportionalities, analyzing the socially structured nature of environmental and discursive privileges. Doing so can offer important opportunities for insights, not just about nature, but also about the nature of power and about the power of the naturalized" (89). In this review, we highlighted the lacunae created by focusing at the system level and chart an expanded research agenda on corporations and the environment that takes seriously variation across corporations, as well as its forms, drivers, and consequences.

Adding an organizational focus brings environmental sociology's theories of economy and environment into dialogue with the large body of research on corporations, both within and beyond sociology. Various sociological subdisciplines offer unique contributions to the study of corporations and the environment. Political and economic sociology identify the role of the economy in state-building and offer a view of the corporation as a shifting articulation of state power and collective organization. Organizational sociology's analysis of cultural modes of organizational coherence and institutional theories of corporations operating within organizational fields adds the concepts of norms, role structures, and legitimacy to the more traditional view of corporations as efficient, profit-maximizing, and rational actors. Social movement scholars re-theorize the opportunity structure framework for corporate targets and provide insight on the consequences of conflict and collaboration between corporations and social movement groups. In aggregate, the wider literature on corporations and the environment offers a view of corporations as complex organizations, constituted by their privileged relationship to the state and both responding to and enacting their operational environments. Corporations vary in organizational complexity, financial performance, governance structures, and corporate cultures. These intersect with the shifting rights and restrictions on corporations granted/imposed by states, markets, and society to explain divergent patterns of corporate environmental harm across time and institutional context. The result is neither a picture of corporations locked on a treadmill of production nor headed on a path towards ecological modernization. Rather, corporations, states, and societies are the agents determining patterns of corporate environmental harm and innovation.

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# Just Transitions and Labor

7

Erik Kojola and Julian Agyeman

## Introduction

At the national and international level climate change is creating injustices as those who have contributed the least greenhouse gas emissions often face the greatest risks from the effects of climate change (IPCC, 2014; Roberts & Parks, 2007; Vanderheiden, 2008). Yet the inequalities in the transition to a more ecologically sustainable and less carbon-intensive economy have received less attention, particularly as governments, businesses, and environmental advocates promote carbon-reduction policies as a win-win for the environment and the economy. However, the benefits and costs of mitigating climate change and creating a more environmentally sustainable society will not will not necessarily lead to a more socially just society or what Agyeman et al. (2003) call *'just sustainabilities'*: "The need to ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems," (p. 5). Indeed it could reproduce, deepen, and further reinforce existing social hierarchies and injustices (Littig, 2018; Snell, 2018; Snell & Fairbrother, 2013; Stevis, 2012). People and institutions in power will have privileged access to the benefits of creating a greener economy while those in marginalized positions will have less access to the benefits and face unequal risks. Expanding renewable energy could rely on the same exploitative and gendered labor practices and forms of Indigenous dispossession as fossil fuel energy.

Therefore, scholars and activists have called for a just transition that will ensure equitable processes and outcomes in creating a more just, sustainable, and less carbon-intensive society (Abraham, 2017; Sierra Club, 2015; Healy & Barry, 2017; Jasanoff, 2018; Pollin & Callaci, 2019). For them, addressing environmental problems of climate change, resource depletion, and water pollution needs to be done in a way that does not create unequal harms across intersections of class, race, gender, nationality, and other categories of difference. In the past, environmental protection policies have been implemented without consideration of the negative impacts to workers, communities of color, women, and Indigenous people (Dowie, 2009; Foster, 1993; Montrie, 2000; Schiller, 2008). Instead, just transition asserts principles of workers' rights, racial and gender justice, and Indigenous sovereignty into the forefront of creating a greener economy that is more socially and ecologically sustainable. A just transition could turn the environmental and climate crisis into an

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opportunity to address socio-economic problems by restructuring the economy and society to be more equitable and democratic. Environmental protections could create green jobs that put people to work protecting the environment (Hess, 2012; Renner et al., 2009; White & Walsh, 2008). This framework challenges the typical assumptions about jobs versus the environment to envision a future in which people have decent and meaningful work that cares for human and nonhuman natures.

In the first section of this chapter we explore why a "just" transition is needed in the first place. We focus on processes of capitalism, colonialism, racism, and patriarchy to provide a broader theoretical analysis of how and why a green economy could reproduce inequalities. Then we explore how the term just transition has been developed and used by unions and social movements. The subsequent sections examine different conceptions of a just transition and the political struggles over the scope and depth of what a just transition should look like. Finally, we reflect on the efforts to create a just transition and possibilities for making these visions a reality.

## Why Is a "Just" Transition Needed?

Green jobs in renewable energy, construction of energy-efficient buildings, public transportation, and other green industries are touted as a solution to both environmental and economic problems (Pollin & Wicks-Lim, 2008; Renner, 2001; White & Walsh, 2008). Yet, the green economy could reproduce the same inequalities of the "dirty" economy across intersecting hierarchies of race, class, gender, sexuality, and immigration status as well as between countries across global positions of power. Scholarship on environmental justice and just sustainabilities has shown how access to environmental privileges are unequal across race, class, gender, and nationality, and that sustainability initiatives can reproduce existing hierarchies and inequalities unless there is specific political, policy, and planning attention to justice (Agyeman et al., 2016, 2003). Just transition research and activism is related to this framework in its' assessment of how a lower-carbon economy can have unequal benefits and harms without intentional actions to promote social justice.

First, green jobs are not necessarily good jobs. Developing renewable energy can follow a low-road to development with job insecurity, low pay, and poor working conditions. For example, Mulvaney (2014) finds that solar panel manufacturing raises environmental justice issues because of the occupational and environmental health risks in extracting the materials used in PV panels, which is typically in the Global South, and handling chemicals during production and disposal often by low-income, women, and immigrant workers who lack safety protections. Companies producing solar panels also rely on contracting production to East Asia where factories have poor working conditions and exploit marginalized workers (Mulvaney, 2013). Unions and worker advocates have raised concerns about the quality of jobs created in green sectors and demanded these jobs provide decent work with job security, good pay and benefits, and rights to collective representation (Materra, 2009; Pollin et al., 2008; Renner et al., 2009). Policies in the U.S. to phase out inefficient incandescent lightbulbs increased the use of more efficient compact fluorescent lightbulbs (CFLs). But this had the unintended, or overlooked, consequence of spurring closure of unionized incandescent lightbulb factories in the U.S. Midwest and opening CFL factories in China. Researchers found that GE plants in China manufacturing CFLs had poor working conditions with long hours, low pay, and a lack of health and safety training on how to deal with toxics like mercury in CFLs (Schiller, 2008).

Second, access to green jobs and green infrastructure may also be unequal. Jobs in renewable energy production and green technology manufacturing may be dominated by white men while the more dangerous and low-paying jobs may go to people of color. Meanwhile, wealthy and powerful communities may have greater access to green infrastructure like public transportation and green spaces, and be able to afford green products, like renewable energy and local

organic foods, that could increase energy and food costs for low-income people (Finley-Brook & Holloman, 2016; Gould & Lewis, 2017; Guthman, 2014b; Zitcer, 2015).

The negative and unequal impacts of environmental protections on working class, people of color, and Indigenous communities is partially because of white, upper-class, racist, and colonial assumptions in environmental policies. Many environmental regulations have been enacted without considering broader social impacts (Bullard, 1994a, b). Yet, the injustices inherent in the dominant narratives of sustainability and climate change mitigation are not due simply to policy and planning decisions and their embedded environmental elitism, but are connected to broader structural factors, social processes, histories, and ideologies. Therefore, sociological theories can help explain how and why inequalities are created in a green economy and why a "just" transition is needed. In this subsection, we discuss different theoretical approaches for understanding why the transition to a lower-carbon economy can reproduce social inequalities. We focus on systems of capitalism, racism, patriarchy, and colonialism.

## Political Economy of Capitalism

Political-economy theories emphasize class-based injustices and the dynamics of capitalism in producing crises for workers and the environment. Faber (2008) describes a polluter-industrial complex in which dirty and extractive industries use their political-economic power to limit environmental regulations and boost profits. Meanwhile increasing pollution disproportionately impacts the working class and people of color. Ecological Marxist theory describes a fundamental contradiction in capitalism between workers and environmental protections. Workers' livelihoods depend on wage labor, often in polluting industries, but those same industries degrade the environment, deplete resources, harm public health, and exploit human labor (Burkett, 2014; Foster et al., 2010; O'Connor, 1998). This contradiction places workers in a bind. Reducing carbon emissions can cost some workers their jobs, but those same industries exploit workers and are destroying the resources and ecological systems necessary for life. The tensions between jobs and the environment are greatest in extractive industries, such as logging and mining, and in regions that have economies tied to extraction and polluting industries (Obach, 2004). Therefore, a just transition is needed to ensure that workers do not bear the costs of environmental regulations and have a Faustian choice between a job or a clean environment by creating alternative jobs.

However, the trade-off between jobs and the environment is often exaggerated. Environmental protections can actually have negligible impacts on employment and even create jobs by opening up new industries and requiring more labor to ensure pollution reduction (Goodstein, 1999). For example, Montrie (2000) argues that environmental restrictions on mining can actually create jobs while job losses in coal mining in the U.S. are largely driven by automation and shifts in the global political economy. However, environmental protections can have concentrated negative impacts on workers in particular industries, facilities or regions (Freudenburg, 1992; Freudenburg & Frickel, 1994; Montrie, 2008).

Corporations and conservative politicians actively promote the jobs versus environment ideology. Industry engages in what Kazis et al. (1982) call "job blackmail" as part of a divide and conquer strategy to pressure workers into supporting industry and opposing environmental regulations. Bell and York (2010) show how coal mining companies in Appalachia actively construct a community economic identity tied to mining that assumes continued reliance on coal for their livelihood, despite dwindling employment and economic benefits from the industry. Restrictions on mountain-top removal mining and greenhouse gas emissions become targets for community anxieties about economic and social dislocation. Popular news coverage of environmental issues also reinforces the jobs versus environment ideology such as media accounts of the Keystone XL pipeline that pitted workers

against environmentalists and overlooked some union opposition to the project (Kojola, 2017).

Treadmill of production is another important sociological theory for understanding the relationships between capitalism, society, and the environment, and how these relationships would shape the green economy. Treadmill of production theorists argue that the drive for profit in capitalism requires businesses to continually expand and grow which creates ecological damage and exploitation (Buttel, 2004; Gould et al., 2004; Schnaiberg & Gould, 1994). Increasing profits relies on creating new consumer goods, reducing costs, and increasing productivity which is done by cutting wages, reducing labor through mechanization and automation, and securing cheaper material inputs. Automation eliminates the need for corporations to pay and manage workers which reduces jobs and can mean the remaining work is less skilled and lower paid or require new skills that current workers don't have (Adler, 1992; Braverman, 1998; Levy & Murnane, 2004). Environmentalists are often scapegoated to distract from job losses caused by corporate strategies, automation, and deregulation (Austin & Clark, 2012; Bell & York, 2010; Gaventa, 1980; Kazis et al., 1982). For example, the loss of timber jobs in the Pacific Northwest in the 1990s was largely due to mechanization but was blamed on habitat conservation for an endangered owl species (Foster, 1993). New technologies and faster production processes also rely on more natural resources and energy which accelerates resource depletion and greenhouse gas emissions as well as occupational and environmental health risks (Schnaiberg, 1980).

The capitalist treadmill will also operate in the green economy without changes to the relations of production and the structures of global capitalism. Therefore, green jobs might not be good jobs and a greener economy may still create waste. Guthman (2014a) shows that the organic food sector is following the same capitalist logics of traditional agribusiness with increasing industrialization and globalization. The need to make renewable energy competitive with fossil fuels or keep green products cheap has created pressures to reduce labor costs, automate production, and avoid pollution controls (Schiller, 2008). For example, efforts to decrease solar energy costs has meant cutting wages and avoiding unionization, and offshoring production to countries with lower labor costs and weaker environmental projections—following the broader pattern of globalization (Fthenakis & Moskowitz, 2000; Mulvaney, 2013, 2014; Raj-Reichert, 2013). Automation in green industries, like solar panel manufacturing or public transit, would limit the number of jobs and lead to less skilled and meaningful work. Although some proponents of green jobs think they could be more labor intensive and require more high skills (International Labour Organization, 2012), but there is not yet strong evidence to support these claims (Herman, 2015). Therefore, active policies are needed to ensure that the green economy creates decent employment that empowers workers.

## Colonialism and the Global Economy

Understanding the social impacts of transitioning to a greener economy requires an analysis of scalar and temporal geographies to interrogate colonialism and global capitalism. Colonialism and the world capitalist system treat societies in the global South as sources of natural resources and cheap labor and a dump for pollution (Bridge, 2009; Bunker, 1985; Bunker & Ciccantell, 2005; Faber & McCarthy, 2003; Muradian et al., 2012). This ecologically unequal exchange has enabled corporate profits and consumer lifestyles in the West, while creating poverty and underdevelopment in the global South and generating enormous greenhouse gas emissions (Amin, 1976; Emmanuel, 1972). Corporations and countries from the global North have appropriated land and resources from Indigenous communities in the global South, and in settler colonial societies like the U.S., Canada, and Australia. Globalization and free trade have also accelerated processes by which corporations seek out the lowest labor costs and weakest environmental regulations to locate production facilities (Schiller, 2008). The

ability to move dirty factories and extraction to peripheral regions in the global North and the global South with limited regulations has created "pollution havens" (Matthews, 2010) which exacerbates global inequalities and displaces pollution onto less powerful communities.

A global green capitalist economy based on free trade and dominated by colonial powers would maintain these same patterns of unequal and uneven development. (Un)just transition policies could reproduce the global inequalities of current industrial economies without dismantling forms of global hierarchy and domination. Stevis (2012) argues for thinking about scale and place as a just transition for workers in the global North could still rely on dangerous and exploitative work in the global South and displace the pollution from green industries. Technological innovations in renewable energy could create occupational hazards and reproduce unequal global supply chains based on poor labor conditions in the Global South (Mulvaney, 2013). For example, solar panel installation in the U.S. might be done by unionized workers with decent pay and benefits, but the solar panels might be produced in China under poor working conditions and use copper from polluting mines in the Congo. Electric cars are promoted as a way to reduce carbon emissions but the batteries require large amounts of minerals, such as 15,000 grams of cobalt, which is contributing to increased global demand for these materials (Frankel, 2016). Some of that cobalt comes from informal and small-scale mines in the Congo where child labor is common and surrounding communities are exposed to high-levels of toxics and heavy metals in the air, water, and fish that are linked to birth defects and other health problems (Banza et al., 2009; Squadrone et al., 2016). Therefore, a just transition requires a global analysis and assessment of the entire life cycle of a product across its supply chain (Mulvaney, 2013, 2014).

Renewable energy could continue dispossession of Indigenous lands and resources. For example, wind farms could be built on Indigenous people's lands and in rural areas which disrupts local communities livelihoods and access to land (Avila, 2018). Land and resource use by Indigenous and rural communities may be deemed "inefficient" while those same lands are deemed appropriate for producing green energy. Dams, for example, have been constructed in the name of sustainability and clean energy that have destroyed Indigenous communities by flooding their land and disrupting fisheries (Goldman, 2005; Khagram, 2004).

## Racism

Communities of color are often on the frontline of pollution and the impacts of climate change from sea-level rise to storms (Bickerstaff, 2013; Blaikie et al., 1994; Roberts & Parks, 2007). Yet, people of color, both in the global North and South, have generated less greenhouse gas emissions than whites and have not experienced the same privileges of the carbon-intensive consumer lifestyle. For example, suburbanization in the U.S. enabled whites to move out of cities which also meant increased fossil fuel consumption through a car-based lifestyle, large houses, and consumerism (Huber, 2013). Thus, communities of color hold less responsibility for climate change and should bear the least burden of mitigating climate change (Bullard & Wright, 2009). However, people of color will benefit less from the transition to a less carbon intensive economy due to systems and ideologies of racism without changing social relations of power. A greener economy could reproduce racial hierarchies and strengthen white supremacy (Teelucksingh, 2018).

The distribution of environmental goods and privileges, like a clean and healthy workplace, is driven by institutionalized and systemic racism—not simply overt and direct actions of racial prejudice (Bullard, 1994a, b; Park & Pellow, 2004; Pulido, 2000). Thus, access to green jobs will follow broader patterns of racialized labor markets in which people of color are more likely to be in lower-paying, lower-skilled, and lower-authority jobs and have higher levels of unemployment compared to whites (Elliott & Smith, 2004; Moss & Tilly, 1996; Western & Pettit,

2005). This is due to racial inequalities in quality and access to education, racial discrimination in hiring, and long-term patterns of wealth inequality. Therefore, whites, particularly those who are middle-class, college educated, and male, stand to benefit the most from a green economy. New green jobs could primarily go to whites especially in construction and manufacturing sectors that have traditionally been white, and male dominated in North American and Europe due to forms of structural racism, institutionalized labor market segregation, and actions by whites to protect traditionally-white occupations (Royster, 2003). In addition, whites may have privileged access to the "good" green jobs while the "bad" jobs in the green economy with lower pay and more hazardous working conditions could disproportionately go to people of color.

The benefits and burdens of sustainability will also be uneven across racial lines. Environmental racism means people of color are exposed to more pollution and environmental hazards and have less access to environmental privileges, partially because communities of color present the path of least resistance for citing polluting industries and are framed as being "dirtier" (Bullard, 1994a, b; Carruthers, 2007; Pinderhughes, 1996; Taylor, 2014). Meanwhile, institutionalized practices and ideologies of white privilege contribute to whites having greater access to environmental amenities (Park & Pellow, 2011; Pulido, 2000). Thus, the benefits of greening the economy, like cleaner air and water, will disproportionately go to whites and the burdens, like higher energy costs, will disproportionately fall on people of color without anti-racist policies. Sustainability projects, like parks and public transit, could be concentrated in white communities as decision-making about development is dominated by whites and based on racialized zoning and lending practices (Bullard et al., 2004; Taylor, 2014). Meanwhile the hazards produced in a greener economy will likely create unequal risks for communities of color. Disposal of hazardous materials in solar panels and batteries might be disproportionately placed in communities of color while large-scale wind and solar farms that create noise pollution and land disruptions may be placed near Indigenous and communities of color (Farrell, 2012). For example, plans to expand ethanol and biofuel production in California were developed with little consideration of the impact to communities of color (The Center on Race, Poverty and the Environment, 2011).

A racially unjust transition is not only about the distribution of environmental goods and harms, but also the lack of participation and recognition for people of color in racist and white supremacist societies (Fraser, 1997; Pulido, 1996; Schlosberg, 2007). Racist ideologies that devalue people of color lead to forms of misrecognition and invisibility that legitimate and naturalize inequalities. Being culturally and politically devalued by dominant ideologies and institutions contributes to a lack of meaningful participation by communities of color in developing and implementing the transition to a more sustainable society.

## Patriarchy

Feminist political ecologists and economists argue that gender is a core social category that shapes society-nature relationships and is intertwined with socio-economic processes and power relations (Mellor, 2009; Plumwood, 1996; Rocheleau et al., 1996). Thus, addressing climate change and creating a more ecologically and socially sustainable society requires addressing the forms of power, ideologies, and structures of patriarchy that produce gender oppression. Gender inequalities in the economy are endemic to patriarchal society in which women do more unpaid labor, make less money than men, are concentrated into traditionally feminine occupations, and hold less power in the workplace and government. These forms of hierarchy and domination could be reproduced, and even exacerbated, in the shift to a greener economy without addressing patriarchal structures and ideologies that create gender inequality in the fossil fuel economy. A green economy based on liberal market logics would likely continue the practices and discourses that devalue care work

and reproductive labor as either outside of the market or lower paid wage labor (Wichterich, 2015).

Green jobs may follow the unequal gendered patterns of existing labor markets including the concentration of women in feminized occupations and jobs with lower pay and less authority, and the privileging of traditionally male jobs. These patterns are produced by masculine ideologies about heroic and strong work and normative dualisms of production versus reproduction, strength versus weakness, and reason versus emotion (Gaard, 1993; Nightingale, 2006). In the global North, women in large numbers entered wage labor in the mid twentieth century but were largely constrained to service and administrative occupations. Men still dominate manufacturing, construction, and other industrial jobs which are the sectors often targeted for green job creation (Pollin et al., 2008; Renner et al., 2009). Many proponents of the green economy think it could revive traditional blue-collar jobs in manufacturing and construction by transforming them into "green collar" jobs that promote sustainability. Yet, this will largely mean more jobs for men, particularly white men, in traditionally masculine industries (Herman, 2015). Therefore, access to green jobs will be shaped by gender divisions in the labor market and forms of patriarchy that privilege men through greater political and economic power (Healy & Barry, 2017).

Much of the discussion about just transitions and green jobs has neglected questions of gender justice (Herman, 2015). Wichterich (2015) argues that dominant approaches to the green economy would expand commodification and privatization of nature and continue processes of othering and exclusion that subjugate women. Littig (2018) challenges the dominant green jobs and shallow just transition debate for failing to analyze gender and not making gender equity central to the creation of good green jobs. Some initial reports and analysis of the quality of green jobs have found that women are more likely to be in green sectors with low pay and low skill (Bird et al., 2010; Littig, 2017; Materra, 2009; UNEP (United Nations Environment Programme), ILO (International Labour Organization), IOE (International Organisation of Employers), ITUC (International Trade Union Confederation), 2008). For example, solar energy expansion in the U.S. has mainly created jobs for men while in Spain more women have employment in the industry, but they are still paid less than men (Acha, 2016). Other research in Europe and the U.S. has found that employment in renewable energy is dominated by men (Herman, 2015). The impacts will also be felt differently for women across overlapping forms of social difference including class, race, nationality, sexuality, and region. Therefore, white women may have greater access to good green jobs than African-American and Latina women, and experience green work in different ways.

Women face greater risks and burdens in adapting to climate change due largely to socialized gender roles (Giacomini, 2018; Sorensen et al., 2018; UNFCCC, 2017). In parts of the global South in particular, women carry a greater role in maintaining households, caring for family and community members, and doing agricultural labor. Women's unpaid labor in social reproduction and care work, and work in the informal sector also create forms of vulnerability which puts them on the frontline of adapting to climate change and facing greater costs from mitigation (Alam et al., 2015; Giacomini, 2018; Tandon, 2012b; UNFCCC, 2017). Developing biofuels could have disproportionate negative impacts on small-scale female agriculture as fields are converted to production for agrofuels. The interests of global renewable energy companies could take preference over women's subsistence in rural and low-income communities (Tandon, 2012a, b). For example, the Asian Development Bank assisted the Philippine government in reserving a million hectares of land to grow jatropha—a plant with seeds high in oil—for biodiesel production. This led to subsistence agricultural land being transformed into industrial biofuel production which eliminated a source of employment and livelihoods for women who harvested rice and other crops (Tandon, 2012a). Possible increases in fuel prices from the switch to renewables would also disproportionately

impact low-income and rural people, particularly women, who need to travel to markets to buy and sell goods or take family to medical care (Acha, 2016; Tandon, 2012b).

Failure to address the gender impacts of sustainability initiatives is partially due to a lack of recognition and participation for women in government and corporate policy-making and their unequal political and economic power in patriarchal societies. Thus, creating a more ecologically sustainable economy must involve empowering of women to be in positions of authority and democratizing decision-making while reconfiguring the systems and ideologies of masculinity that normalize and institutionalize gender inequalities.

## Emergence of the Concept

The just transition concept was developed by labor unions in North America in the 1970s as a demand to assist workers during industry closures and has subsequently been taken up by policy-makers, social movements, international organizations, and academics. The concept was proposed as a way to address the negative impacts of environmental regulations and changes in the energy industry on workers in polluting and fossil fuel industries (Snell, 2018). A just transition means that workers and their communities should not suffer when industries close or decrease production in response to environmental regulations. Tony Mazzochi, a leader in the Oil Chemical and Atomic Workers (OCAW) union, was a key figure in bridging labor and the environment and advocated for assistance to workers displaced by environmental protections and eliminating toxic chemicals—a "superfund for workers" (Hampton, 2018; Stevis, 2012). Mazzochi argued that federal funds were provided to clean up contaminated land and should also be provided for workers who lost their jobs through guaranteed income and job training and placement assistance (Hampton, 2015; Snell, 2018). Mazzochi thought people should not have to decide between a paycheck and a clean and healthy environment. Unions modeled the proposal on experiences helping workers displaced by industrial closures and technological change and government programs to assist workers in the 1950s when the defense industry scaled back after World War II (Snell, 2018). By the 1990s the OCAW and other aligned unions were using just transition to assert the necessity of considering the social impacts of the shift towards a less carbon-intensive society (Stevis & Felli, 2014). Some unions saw climate change as an opportunity to reduce economic inequality, empower workers, and generate new "green" jobs that are socially and ecologically beneficial.

Just transition language has expanded internationally and been adopted by unions across the world, international union federations and international institutions, like the UN and International Labour Organization (ILO), who have connected the concept to green job creation (Stevis et al., 2018). In the early 1990s, international union federations were using the language of just transition in climate change debates to argue that a proactive policy to assist workers through job training, relocation funds, income support, and benefits was necessary in an international climate agreement (Hampton, 2015). For example, the International Trade Union Congress (ITUC) advocated for just transition policies at the 1997 United Nations Framework Convention on Climate Change in Kyoto, Japan—a framework that would expand over the next several decades of international climate change negotiations (Hampton, 2015). The ILO and international trade union federations became increasingly involved with climate change and sustainable development in the 2000s. They promoted analysis of the social impacts of climate and green job creation, and asserted the need to involve labor in decision-making (Olsen & Kemter, 2012). In 2008 the UN Environmental Program (UNEP) took a major step in promoting just transition (Littig, 2017) by commissioning a study by Worldwatch Institute called *Green Jobs: Towards Decent Work in a Sustainable, Low Carbon World* (UNEP (United Nations Environment Programme), ILO (International Labour Organization), IOE (International Organisation of Employers), ITUC (International Trade Union Confederation), 2008). UNEP asserted the need to create jobs while improving the environment

and incorporated ILO considerations about decent work such as pay, job security, and collective bargaining rights. Green jobs were presented as a way to address expanding inequality. This asserted a more political and social justice analysis into UNEP efforts. But Littig (2017) argues that the quality of green jobs has still received limited attention and critical analysis.

Green jobs became a major topic of policy debate in the U.S. after the 2008 Great Recession as progressive organizations and unions advocated for policies to develop green industries and job creation to address unemployment and economic stagnation. The idea caught on with Democratic politicians and the Administration of U.S. President Barack Obama who hired 'Green Czar' Van Jones for this very purpose. Democrats pushed the idea of a Green New Deal with the support of unions who saw an opportunity to put their members to work while asserting a stronger role of the government in industrial policy and reversing neo-liberal deregulation and privatization (Greenpeace, 2015; Inslee & Hendricks, 2008; Pollin & Callaci, 2019). Yet, the successes were limited, partially as Republicans mobilized in response and framed green jobs as government overreach into state planning. Opposition was able to limit funding and stall roll out of new programs (Hess, 2012). Despite developing the concept, the U.S. has actually lagged behind other countries and international institutions in adopting just transition policies. Some industrial and mining unions in the U.S. have rejected just transition as simply meaning the loss of their jobs and lacking tangible solutions for displaced workers (Labor Network for Sustainability, Strategic Practice: Grassroots Policy Project, 2016). The United Mine Workers of America (UMWA) has largely opposed just transition and advocated against most climate change policies (Abraham, 2017; Juravich, 2016).

## Social Movement Demands for Just Transitions

By the mid 2000s, the just transition discourse had expanded beyond the labor movement as other social movements, community groups, and political parties took up the language emphasizing dynamics of race, nationality, gender, and indigeneity. These groups have expanded the debate around a socially and ecologically just sustainability.

Racial justice and civil rights activists in the U.S., like Van Jones and Green for All, argue that transitioning to a renewable economy is an opportunity to address racial inequality and create good jobs for people of color (Jones, 2008). The dirty fossil fuel economy was based on racial hierarchies and provided fewer opportunities for workers of color. Now advocates are pushing for initiatives that include prioritizing people of color and women in hiring for green sectors, such as solar panel installation, which can 'float all boats" (Van Jones) and create "pathways out of poverty" (Green For All, 2009). Developing renewable energy projects and urban sustainability initiatives can be a way to create jobs in urban communities of color while engaging them in environmentalism (Carter, 2007). These approaches attempt to reconcile the history of jobs in construction and energy, even unionized sectors, being dominated by white men and rally communities of color around sustainability as a way to enhance community prosperity.

Organizations have promoted programs that help formerly imprisoned people get training in green jobs and create pathways to employment opportunities (Green For All, 2011; Kobell, 2016). For example, in Oakland, CA, the nonprofit Cypress Mandela created a program in which construction unions partnered with state agencies and community colleges to train formerly incarcerated people in green construction skills like solar panel installation. Cypress Mandela then works to secure employment for program participants with unionized contractors (Green for All, n.d.).

Feminist groups and leaders have also taken up just transition emphasizing the gender dynamics and the need to promote women's rights. For them, sustainability must mean organizing society around principles of care, sufficiency, and wellbeing (Donor Committee for Enterprise Development, 2012; Kuhl, 2012; Tandon,

2012a). For example, a discussion at the UN climate negotiations in Germany with labor and women rights organizations emphasized how just transitions should be bottom-up and participatory centered on women's decision-making (Acha, 2016). Some advocate for expanding the notion of green jobs to include work in social services, the public sector, and healthcare because these are inherently "green" jobs that can help create a just and healthy society and are also primarily held by women (Herman, 2015).

Indigenous communities are also demanding a just transition that recognizes how their lands have been ravaged by resource extraction. The Black Mesa Water Collective is working to shut-down coal mines and coal-fired power plants on the Navajo reservation in Arizona while restoring the ecosystem and creating new jobs in renewable energy for tribal members (Chorus Foundation, 2016). The group is developing a participatory and holistic approach to community development and energy production in which PV panel manufacturing and solar energy generation would operate on reclaimed mine sites under the control of the community (Labor Network for Sustainability, Strategic Practice: Grassroots Policy Project, 2016). The Navajo tribal council passed green jobs legislation and created a green economy fund to promote these efforts.

## Variations in Just Transition

Just transition is a contested political concept that is a site of conflict, struggle, and tension. There is no single definition of just transition, particularly as the term's use has expanded. This is similar to other concepts like sustainability that are contested and used for divergent political projects (Stevis, 2018a). Activists and scholars disagree over what a just transition requires and how it can be achieved. Approaches range from neo-liberal and market-based to state-centered green Keynesianism to eco-socialist and post-capitalist. (Un)-just transition policies could be led by the state and determined by bureaucrats and fail to address class, race, and gender disparities or just transitions could be developed through democratic processes that empower workers and communities to make decisions collectively and reduce inequality. Developing lower-carbon and less-polluting industries may or may not address racial and gender inequalities, and global political-economic systems based on racism and colonialism.

Within these different approaches, unions have taken different positions on just transition which reflects different political ideologies, organizational histories, industries, and political-economic structures. Rathzel and Uzzell (2011) find that union leaders across the globe are re-conceptualizing relationships to the environment through climate change which range from narrow technological approaches to broader social critiques based on the interconnections between class, race, gender, and environmental justice. Stevis (2018b) categorizes union environmental policies according to breadth, depth, and agency. The breadth depends on the degree to which the existing system would be transformed which ranges from neo-liberal to anti-capitalist. Depth relates to the scale and scope of the approach and to what extent it considers impacts across space. For example, a shallow just transition policy would displace environmental harms and poor working conditions on countries of the global South while benefiting unionized workers in the global North. Agency addresses the extent to which workers, unions, and communities will be involved in the process.

In the following sub-sections we build on Stevis' (2018b) analysis of breadth, depth, and agency and Hampton's (2015) research on union climate change politics to categorize just transition approaches into market-based, state-led and ecomodernist, and post-capitalist approaches. We also expand on how the breadth, depth, and agency of just transition approaches addresses dynamics of racism, colonialism, and patriarchy, and the degree to which women, people of color, and immigrants participate and are recognized in creating a more sustainable economy.

## Market-Based

On one end of the spectrum are just transition and green jobs policies that follow a market-based approach in which globalization, neo-liberalism, and economic growth are seen as compatible with sustainability. These approaches lack depth and agency, although there might be some limited agency for unions in decision-making about policies for market incentives. There is a varying degree of breadth depending on the geographic scale of the proposals. Promoters of market-based policies include the World Bank and OECD and some business groups (Green European Foundation, 2009) who view sustainability as a way to energize new forms of "green" growth. Better management of capitalism can supposedly resolve ecological problems without disrupting the economy and corporate profits (Beckerman & Pasek, 2001). Neo-liberal plans largely rely on incentives and tax policies to encourage investment in renewable energy and public-private partnerships to fund green production initiatives (Wichterich, 2015). The lack of green jobs is understood as an issue of supply and demand, such as analysis by the OECD that emphasizes labor shortages in green industries and the need for training new types of skilled workers (Martinez-Fernandez et al., 2010). Commodifying ecosystem services is also viewed as a way to protect the environment, promote efficiency and spur new investment.

Market-based approaches include limited mechanisms for a just transition often based on education, job training and business development assistance for workers and marginalized communities, such as programs to retrain displaced workers in green skills (Martinez-Fernandez et al., 2010; Robins et al., 2018). For example, national legislation in the U.S. and Australia in the late 2000s provided funding for green job training programs (Martinez-Fernandez et al., 2010). However, in these programs, workers are often on their own to find the new green jobs created by the private market. This model is based on market mechanisms of increasing labor market demand and supply, and assumptions that individual workers simply need more education and skills in order to improve their market chances (Bowen, 2012).

Market approaches to the green economy may include women, rural communities, people of color, and Indigenous people through mechanisms to help them enter the market. This is often through training and jobs programs and encouraging entrepreneurship (Donor Committee for Enterprise Development, 2012). People in rural communities and the global South are seen as potential green entrepreneurs. Market approaches may support targeted hiring for minorities and women, but not industrial policy to direct development to communities of color. Participatory planning procedures in which communities—not the market—make decisions about development are not considered.

Some unions have aligned with neoliberal approaches and joined business groups and international institutions in framing just transition as a win-win for business and labor (The World Bank, 2007). Hampton (2015) argues that the UK labor federation, the Trade Union Conference (TUC), has adopted a watered-down form of just transition and tried to create partnerships with government and business that overlooks the fundamental tensions in creating a more just economy and society. Green technologies are presented as new areas for growth, innovation, and job creation. For example, union federations in the UK have supported the EU's carbon trading program, which has been critiqued for turning climate into a new market for finance and speculation. Yet, unions did push for caps on profits from emissions trading and for revenues to go towards alleviating energy poverty and developing green infrastructure (Hampton, 2015).

Critics argue that corporations and neoliberal politicians have taken on the language of just transition as a way to maintain the status quo and foster economic growth while appearing to address environmental issues. This approach will not curtail the profits of industry by stopping fossil fuel production or give workers and communities a greater share of profits and control over production. Bratman (2015) argues that green economy discourses are taken up by states

and elites in order to maintain power and hegemony by creating a sense of legitimacy and co-opting claims of environmental activists.

Market-based approaches do not disrupt the neoliberal global economic system or address fundamental power relations of race, gender, and class that create unjust transitions. Commodifying and privatizing nature by placing monetary values on ecosystem services and carbon pricing ultimately turns public resources—the commons—into private property in a process David Harvey calls primitive accumulation (Harvey, 1996; Harvey, 2005). This means small-scale agricultural producers and Indigenous communities whose livelihoods rely on subsistence practices will lose access to the commons. A "green" economy based on capitalist growth logics will ultimately be unsustainable in a world with finite resources (Schnaiberg & Gould, 1994; Schnaiberg & Pellow, 2002) while continuing to privilege profits over socio-ecological wellbeing. A neoliberal approach to a green economy based on financializing nature, market mechanisms, and private entrepreneurship will not be socially just (Bakker, 2005), despite some minimal efforts to use the language of just transitions and environmental justice. Market-driven just transitions do not address the underlying racial logics of capitalism and unequal ecological exchange between the Global South and North. Wichterich (2015) contends that these approaches adopt a liberal inclusivity to address gender, race, and the global South, which is about bringing new groups into the market, not reconfiguring social relations of power.

## State-Led and Eco-Modernist

Other conceptions of just transition involve a greater role for the state in developing a greener economy, which would scale back the power of markets and corporations while giving workers more voice (Abraham, 2017; McBride & Shields, 2011; Newell & Mulvaney, 2013; Stevis & Felli, 2014). These approaches have more depth than market-based policies, but range in the extent to which they challenge the social relations of capitalism, racism, patriarchy, and colonialism. They often provide greater agency for unions in coordinating policy with the state and industry, but vary in how much democratic decision-making is extended to other communities, particularly racial and ethnic minorities. The breadth can also vary widely from global perspectives to narrower national or regional-level policies that can reproduce North-South disparities and neocolonial systems of unequal exchange.

The mainstream labor movement, especially at the international level, and some international institutions, like the International Labor Organization (ILO), broadly support a state-led green Keynesianism (Olsen & Kemter, 2012; UNEP (United Nations Environment Programme), ILO (International Labour Organization), IOE (International Organisation of Employers), ITUC (International Trade Union Confederation), 2008). Green Keynesianism developed in North American and Europe, but has also been taken up by Asian and African countries (Herman, 2015; United Nations Environmental Programme, 2009). Progressive policy advocates argue that a state-led transition, what some have called a "Green New Deal," could create decent employment and accelerate the transition towards a lower carbon economy (Inslee & Hendricks, 2008; Pollin et al., 2008). Renewed industrial planning would challenge neoliberalism by reinvigorating the role of the state and promoting workers' rights and environmental regulations. In a Green New Deal, governments would drive demand for renewable energy, green infrastructure, and other industries through research and development funding (Hess, 2012). Funds would be targeted to assist displaced workers and communities, such as coal mining regions, with new development and job training and placement programs (Abraham, 2017). Workers' collective bargaining rights would be protected in order to ensure decent work and decision-making would be done in collaboration with unions, the state, and employers (Bryce, 2017; Green European Foundation, 2009; Sheldon et al., 2018; United Nations Environmental Programme, 2009).

There are some examples of state-led just transitions. For example, the Healthy Connecticut

Alliance, which included community and environmental organizations, pushed for the closure of a coal power plant to include policies to help the unionized workers find new jobs, provide pensions for workers that retired, and create jobs restoring the site (Labor Network for Sustainability, Strategic Practice: Grassroots Policy Project, 2016). In Germany, a national commission that includes government, business, labor, and civil society representatives is working on plans to eliminate coal power while assisting coal mining regions such as the Ruhr Valley where 600,000 coal miners were once employed but the last mines are slated for closure (Amelang et al., 2018). In the Ruhr Valley, coal miners were proactively trained in new skills before mine closures and there are plans for redevelopment such as turning a mine shaft near the city of Bottrop into a hydroelectric storage facility (Bryce, 2017). Still, cities and towns in the region have high levels of employment and the impact of transition policies remain uncertain. Although replicating even these limited successes may be difficult in other socio-political contexts particularly liberal market economies like the U.K. or U.S. with a weaker role of the state and unions in economic and social policy (Stroud et al., 2014).

The basic foundations of capitalism would remain intact through state-led green growth, but with more state regulation and industrial policy, limits on pollution, and checks on corporate power and markets. State-led approaches have been critiqued for enabling continued economic growth, relying on top-down solutions, and emphasizing gradual change that will not adequately address the current social and ecological crisis. Rossman (2013) argues that many just transition frameworks lack an analysis of power and social change. Green Keynesianism operates within the existing capitalist mode of production with a belief that state power can facilitate a shift towards a sustainable future. Some approaches emphasize eco-modernist technological solutions that privilege large-scale industrial projects and technological solutions, yet others prioritize creating more labor intensive and less automated forms of work to reduce carbon emissions. Eco-modernist approaches based on scientific authority and technological solutions will continue masculine assumptions about dominance of nature through science and technology (Mies & Shiva, 1993).

Support for state-led growth and adoption of new technologies reflects unions' history of advocating for industrial growth as part of the treadmill of production (Schnaiberg & Gould, 1994; Soder et al., 2018). Stevis (2011) observes that many unions adopt an ecological modernization perspective that reproduces growth ideology and does not critique capitalism. Unions in the U.S., UK, and Australia have supported development of carbon-capture and sequestration (CCS) technologies for coal power plants, which are largely rejected by environmentalists and climate analysists as insufficient and perpetuating fossil fuel extraction (Brecher and Sustainability, 2013; Hampton, 2015). The faith in technological solutions to resolve environmental and social problems overlooks how technology is also shaped by power and ideology and can reproduce socio-environmental problems and inequalities unless the underlying systems are transformed (Feenberg, 2002; Jasanoff, 2004; Marcuse, 1964). Still, Keynesian policies can empower workers and communities to have an active voice in policy-making and increase public control over energy and other infrastructure.

Critics contend that international institutions and governments may adopt the language of empowerment and social inclusion in just transitions but in ways that lack depth and a critique of power (Wichterich, 2015). Critics argue that these concepts can be co-opted to legitimate market expansion and commodifying nature in order to resolve capitalist crisis by bringing new materials and social relations into processes of accumulation (Harvey, 2005; Wichterich, 2015). Yet, because these approaches are driven by the state, rather than the market, there are possibilities for democratic and popular intervention.

National green Keynesianism can reproduce internal racial and gender inequalities, and continue to benefit industrialized countries and create global disparities. In the U.S., the original New Deal program privileged white male workers, and

institutionalized racial and gender disparities such as exempting farm and domestic workers from unionization laws, and racist housing practices (Goldfield, 1997; Quadagno, 1994; Valocchi, 1994). Without explicit policies to include women, people of color, and immigrants, a new green deal may also reproduce inequalities and continue racist state practices. Industrial policy planning that includes unions provides workers with some voice, but union leadership in many countries is male dominated and workers in service and informal sectors may lack formal employment and collective representation to engage in these forms of state policy-making. Meanwhile policies that lack breadth can promote development of high-skilled green industries in the Global North, such as installation and operation of solar energy farms, while relying on hazardous and exploitative labor in the Global South, such as mining rare earth metals and dealing with toxic waste from solar panels (Mulvaney, 2014). State-led just transitions will not inherently address historical processes of ecologically unequal exchange without forms of technology and wealth transfer to less industrialized countries.

## Post-Capitalist

Eco-Marxist, political ecology, and other critical scholars and activists as well as some radical unions, social movements, and political parties have pushed for transformative post-capitalist just transitions. They want to challenge social-ecological hierarchies and capitalist relations of production by expanding worker and community control over production and integrating anti-racism and anti-colonialism into policies (Felli, 2014; Satgar, 2018; Schwartzman, 2011; Stevis & Felli, 2014). They envision creating various kinds of post-capitalist and eco-socialist futures. These just transitions are deep—they reconfigure social relations and markets—and emphasize agency by democratizing decision-making for all workers, not just unionized male industrial workers, and communities. Post-capitalist approaches are based on a critique that state-led, eco-modernist, and neoliberal solutions will not resolve fundamental ecological and social crisis because the root causes of capitalism and industrialism are left intact by "green" forms of growth (Foster et al., 2010; Moore, 2015; O'Connor, 1998). Market-based and state driven solutions are both critiqued for their lack of depth and potential for reproducing hierarchy and domination while giving power to technocratic forces over democratic governance.

For post-capitalist approaches, achieving meaningful justice requires socializing production and democratizing decision-making (Schwartzman, 2011; White et al., 2017). For example, Trade Unions for Energy Democracy promotes a fundamental restructuring of the global economy to give people democratic control and ownership over energy while addressing the climate crisis, land degradation and promoting workers' rights (Sweeney, 2012, 2018). Union workers in the UK occupied a wind turbine factory operated by Vestas when the company planned to close the plant and although the action was ultimately unsuccessful, it mobilized new forms of class-based climate actions and solidarity (Hampton, 2015).

Feminist movements and theorists in the global North and South are challenging the cultural values of growth and consumption to emphasize living well and having enough in the transition to a sustainable society (Mies & Bennholdt-Thomsen, 1999). They focus on the interdependencies of nature and society and the need to foster cooperation, public goods, and redistribution that will promote collective wellbeing (Martínez-Alier et al., 2010; Muraca, 2012). Feminist approaches assert that society should be organized around principles of care and communal wellbeing between human and nonhuman natures rather than profit and growth (Littig, 2017, 2018). Therefore, a just transition is not simply ensuring women have jobs in green industries, but rather, must involve reshaping the very idea of work and relationships between unpaid and paid labor, and transforming the workplace to be more equitable, democratic, holistic, and sustainable.

De-growth and post-growth frameworks argue that a green economy based on a growth logic will be unsustainable and unjust—reproducing logics of othering, exploitation, and exclusion. These transformative approaches envision principles of care and just livelihoods replacing market logics of privatization and growth which can create sustainable socio-ecological relations and breakdown multiple forms of social oppression (Mellor, 2009; Power, 2004). Sustainability requires organizing society around principles other than profit and competition and directing production towards socially useful goals that promote wellbeing and equitable socio-ecological relations (Martínez-Alier et al., 2010; Power, 2004). Reducing working time could reduce resource use while freeing people to engage in unpaid labor and recreation (Gorz, 1994; Rosnick & Weisbrot, 2006). Thus, the demand is not simply for more of the same kind of jobs but for people's needs to be met so they do not depend on an exploitative and polluting job.

For eco-socialist and feminist perspectives, a just transition cannot simply be about creating jobs and advancing distributional justice but must also advance procedural and representational justice, as well as *recognition* (Schlosberg, 2003). Thus, workers, people of color, women, Indigenous communities, and immigrants need to be recognized by having their cultures and identities valued while also having power in directing the transition. Recognition requires dismantling systems and ideologies of oppression and hierarchy which is necessary for meaningful participation in politics (Fraser, 1997). Real democracy is demanded in which communities have control over energy systems and workers have authority in the workplace (Wichterich, 2015). Therefore, the process of a just transition is just as important as the outcome. Active participation by workers and communities will help to avoid negative and unintended consequences of sustainability while challenging the ideologies that silence marginalized people.

Movements in the global South demand breadth in a just transition that advances transnational justice by addressing the legacies of colonialism and challenges the dominant capitalist development paradigm (Acosta & Abarca, 2018). Workers, unions, and social movements in the global South have called on industrialized countries to provide them with funds, technologies, and other resources to address the ongoing and historical inequities of extracting resources while leaving behind poverty and pollution—"ecologically unequal exchange" (Hirsch et al., 2017; Mathews et al., 2016). A just transition cannot continue to treat the global South as a pollution sink and resource base to fuel the profits and mass consumption lifestyles, even green ones, of the global North (Brand & Wissen, 2012). Some of these movements do not want to follow a greener version of the West's development path, but instead want to flourish according to their needs and desires and create economies based on social solidarity and ecological sustainability (Acosta & Abarca, 2018).

## Is a Just Transition Possible?

The ability to achieve any of the different forms of just transition we describe above is uncertain. What groups and movements will mobilize to demand a just transition? Will unions, civil society, and environmentalists embrace the concept? How can a just transition avoid corporate greenwashing and cooptation? Will the transition be large enough and fast enough to mitigate climate change?

Skeptics argue that a transition is insufficient to address the rapidly accelerating pace of climate change and social injustices. The language of transition presumes a gradual and smooth process of change but critics argue that a fundamental revolution in how society uses fossil fuels is necessary which requires a rapid *transformation*, not a *transition*. Others are skeptical of the feasibility because there are no examples of a holistic, large-scale and rapid industrial transition that demonstrates the possibility of enacting a massive transition away from a fossil fuel economy in a way that protects workers (Müller, 2018).

Snell and Fairbrother (2013) also raise a key analytical and political question—what power do

unions have to make a just transition happen? This is particularly pertinent given the declining size and power of organized labor in much of the world and the dominant business union model in much of North American and Europe focused on securing economic gains for their members.

Still, workers and their unions are an important factor in climate change politics because they have power to fight for or oppose climate change policies. Unions can disrupt production and change the economy—the driver of climate change—through collective bargaining and direct action in the workplace which does not depend upon passing legislation or international treaties (Hampton, 2015). Hampton (2015) argues that unions are a potentially powerful climate change actor who are beginning to understand climate as a class and workplace issue, which some British unions have incorporated by promoting energy practices and monitoring, creating climate committees, and negotiating with companies to sign pledges about taking action on climate (Hampton, 2018). In 2017, the National Union of Metalworkers of South Africa (NUMSA) threatened to go on national strike if workers at six coal-fired power plants were not ensured a just transition after closure (Sweeney & Treat, 2018). But, organized labor alone will not succeed without building solidarity with other social movements.

## Limited Gains

International union federations and large unions in the global North who support just transition have focused on pushing policies at international climate negotiations and convincing national level policy-makers. Yet, there has been limited progress (Hampton, 2015). Global and regional climate agreements thus far have not contained strong just transition provisions and unions, civil society groups, and social movements still have limited influence in climate negotiations. Sweeney (2014, 2016) contends that the mainstream approach of international unions relies too heavily on technical policy arguments and assumes that a green economic transition is inevitable and simply a technocratic issue. Sweeney (2014) argues that making the transition happen requires placing demands on dominant institutions and asserting the power of workers and communities through social mobilization and "pressure from below." Demands for public ownership of energy production from unions like NUMSA and calls from the Latin American delegation of the Trade Union Confederation of the Americas (TUCA) to resist privatization of the commons and show solidarity with indigenous communities include some of the emerging efforts in this direction (Sweeney & Treat, 2018).

## Building Coalitions

Beyond the potential material and social benefits of implementing just transition policies, the framing of just transition creates a compelling message with discursive and symbolic power. Supporters of just transition think the concept can mend long-standing tensions between the labor, environmental, Indigenous, and racial justice movements by advancing joint goals of job creation, economic equality, democratic decision-making, and reducing greenhouse gas emissions (Stevis & Felli, 2014). Just transition rhetoric could spark cross-movement alliances for social and environmental justice and unite powerful social movements to push for transforming economic and energy systems (Hess, 2012). This is particularly important because labor and working class opposition to climate change has weakened political support for climate action and reinforced anti-environmental ideologies and climate change denial (Antonio & Brulle, 2011; Dunlap & Jacques, 2013; Dunlap et al., 2016).

Labor-environment coalitions must confront a legacy of divisions between unions and environmentalists and assumptions about a trade-off between jobs and the environment (Burgmann, 2013; Kojola, 2017; Matthews, 2010). These divisions are constituted within broader power relations and ideologies in which economic growth is taken as essential to society's wellbeing. In the U.S., the labor and environmental movements have a mixed history with

moments of collaboration as well as intense conflict (Foster, 1993; Gottlieb, 2005). Clashes have arisen around the real and perceived loss of jobs from environmental regulations as well as cultural, class, and political differences (Adkin, 1998; Estabrook et al., 2000; Rose, 2000). The traditional industrial working class, which historically was the most heavily unionized, often works in environmentally destructive jobs, such as manufacturing and mining. On the other hand, the middle-class, which is the basis of the mainstream environmental movement, tends to work in professional occupations and service and information industries that are less directly environmentally degrading (Rose, 2000). Social movement scholars argue that the tensions between unions and environmentalists arise out of cultural class differences between the groups and different institutional structures and norms (Mayer, 2009; Obach, 2004; Rose, 2000).

Relationships between unions and environmentalists with indigenous people, immigrants and people of color also have a contentious history. Support for expanding heavy industry and extractive industries has put unions at odds with indigenous communities who oppose development as a threat to their sovereignty and livelihoods (Ali, 2003; Gedicks, 1993). Meanwhile, environmental conservation has displaced indigenous peoples and privileged white people's recreation over indigenous livelihoods (Dowie, 2009). Some unions, particularly in North America and Europe, have backed racist and xenophobic policies in order to protect the jobs of their members, although this is shifting as unions in the service sector focus on organizing immigrants and people of color (Fine, 2006; Milkman, 2006; Ness, 2005). The mainstream environmental movement has also taken xenophobic positions and opposed immigration in order to control population (Gottlieb, 2005; King, 2008; Salazar & Hewitt Jr., 2001).

Racial and class divisions between social movements can be bridged by framing joint solutions to environmental, social, and economic problems. Mayer (2009) argues that developing shared interests and identities is essential to cross-movement coalitions particularly for blue-green alliances. This requires a discursive shift that reframes environmental issues as interconnected with the economy and public health and centered around social justice. Just transition could be a bridging frame (Benford & Snow, 2000; Snow et al., 1986) that aligns the views, beliefs, and identities of the environmental, labor, civil rights, and feminist movements (Hess, 2012).

There are some signs that cross-movement alliances are forming and groups are expanding how they conceptualize the environment and sustainability. Stevis (2012) argues that the past two decades have witnessed an increase in union environmentalism. Parts of the labor movement are advocating for sustainability to include workers of color and demanding environmental and occupational health protections for low-income and service workers, such as immigrant farmworkers in California (Harrison, 2011; Kojola, 2014; Pulido & Pena, 1998). Recent union articulations of just transition acknowledge the need to create employment for women and people of color (Brecher, 2017; Hampton, 2015; Kuhl, 2012). Still, just transition disrupts the dominant productivsm of many labor unions and some have been hesitant or resistant (Hess, 2012). Meanwhile parts of the environmental movement have begun shifting towards a greater focus on social justice and questions of equity, and making efforts to build coalitions with racial justice, labor, and other social movements (McGurty, 2007; Pellow & Brulle, 2005; Taylor, 2000) and adopted just transition language (Sierra Club, 2015; Greenpeace, 2015). Yet, the extent to which the mainstream environmental movement has adopted principles of social justice remains uncertain and contested particularly given the long histories of racism and nativism in mainstream U.S. environmentalism (Gottlieb, 2001; Park & Pellow, 2011; Taylor, 2016). Coalitions will be superficial and limited if the justice transition framing is purely strategic and not integrated into a deeper embrace of environmentalism, and racial and class analysis (Stevis, 2011).

## Alternative Ideas and Real Utopias

Outside of the international and national climate change policies, social movements, Indigenous communities, and unions around the world are developing alternative ways of organizing relationships between society, the economy, and nonhuman nature. These activists and scholars are enacting what some have called real utopias to provide an alternative vision for society that is still grounded in realities of current political-economic conditions (Satgar, 2018; The Center on Race, Poverty and the Environment, 2011; Wright, 2010). Groups in Latin America are drawing on Indigenous ideas of *buen vivir* to create alternatives to the dominant development model (Acosta & Abarca, 2018) while activists in Africa are using the ethical framework of *ubuntu* to create a response to the climate crisis (Terreblanche, 2018). Social movements and some progressive governments are experimenting with universal basic income as a way to ensure just transitions for all and to create less exploitative and more meaningful forms of labor (Marais, 2018). These various local and regional movements are beginning to coordinate a transnational but locally autonomous movement for just transitions.

## Conclusion

Mitigating climate change and creating green jobs could address interrelated economic, social, and ecological crises. However, a just transition to a more environmentally sustainable society is not guaranteed. Policy reports and government programs about the green economy often lack a critical and holistic analysis of power and historical forces that shape why green jobs can be bad jobs, marginalized communities can be left out, and global inequalities exacerbated. In this chapter we provide theoretical context and empirical history to understand why and how labor unions and social movements have demanded a just transition that will benefit workers and oppressed communities. We locate the need for an active just transition in a broader analysis of just sustainabilities and how interrelated systems of capitalism, racism, colonialism, and patriarchy can (re)produce injustices in a less carbon and resource intensive economy.

The just transition framework emerged in the 1970s from unions in North America as a way to assist workers displaced from industrial closures and overcome the divide between jobs and a clean environment. The concept has expanded as anti-racist, feminist, and indigenous movements around the world are demanding that issues of justice, democracy, and oppression be front and center in debates about climate change. But the popularity also means there are wide variations in how different institutions, organizations, and movements understand a just transition that include market-based, state-led eco-modernist, eco-socialist, and de-growth approaches. These are important political struggles over broader ideologies and visions for the future.

Yet, the prospects of enacting any of these policies are uncertain. Despite just transition language being taken up by international institutions, unions, and civil society groups, there has been limited substantive action. Still, just transition provides a powerful frame that could bridge diverse movements and help build popular support and political pressure to create a more ecologically sustainable, socially just, and democratic society.

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# Part II

# Energy, Climate, and Health

# Sociology of Energy

8

Stephanie A. Malin, Adam Mayer, and Jill Lindsey Harrison

## Introduction

Sociologists have long investigated the roots, meanings, and consequences of modernity and socio-technical change, yet energy remains an underdeveloped area of inquiry. This is not for lack of trying—scholars have repeatedly called for the development of a formal sociology of energy (Lutzenhiser, 1994; Rosa et al., 1988; Ryan et al., 2014). Nor is this due to a lack of importance. Indeed, our current period is deeply shaped by climate crises; conflicts over the nature, type, and scale of energy production; questions regarding democratic access to affordable energy; and the considerable potential socio-ecological outcomes of dependence upon finite natural resources.

The lack of a coherent sociology of energy is paradoxical, given energy's central role in people's lives. While many energy-related threads weave through the environmental sociology literature, they do not yet tie together. In this chapter, we begin to bring together the various ways that social scientists have applied a sociological lens to studies of energy systems. Throughout, we pay particular attention to analyses focusing on issues of power and inequality. In so doing, we endeavor to present a more unified and theoretically consistent overview of the sociology of energy.

Our review includes studies of fossil fuel and nuclear energy production systems, as well as renewables. Fossil fuels such as coal, oil, and natural gas have played historically powerful roles in industrialization, its globalization, and continued dependence on these heavily polluting industries, even as the impacts of climate change intensify. Centralized, risky, and expensive technologies such as nuclear power have further consolidated and privatized ownership and control over energy production and development. Human societies' current reliance on fossil fuels and nuclear energy means that related industries and elite players within them have had extraordinary power and influence over the shape and substance of our societies, political systems, economic structures, norms, and the planet. These industries cause harms that manifest unequally, disproportionately burdening those who are already marginalized and suffering from other environmental harms. These industries now also deeply shape ongoing conflicts and discourses over appropriate responses to global climate change. Renewable energy systems, such as

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wind and solar, are intended to be more sustainable alternatives to fossil fuels and nuclear energy but, as we will show, present their own share of injustices and ecological impacts.

Due to space constraints, we cannot include every study related to energy and its socio-environmental dynamics. We look predominantly at studies based in the U.S., though we do link our observations to global processes. The U.S. has been the historical epicenter of the extractive industries we examine, shaping global energy development trajectories as other nations industrialized according to U.S. development ideals. We do not delve deeply into the literature of energy efficiency, given our more macro- and meso-level foci on systems and structures of power and inequity; nor do we review the literature on attitudes and behaviors related to energy consumption and technologies. *Instead, we address the relationships between power and structural inequality in energy production, with a concerted focus on the impacts of energy production systems on their host communities.* We conclude by discussing emergent perspectives about transitions to more sustainable, equitable, democratic, and otherwise just energy systems. As we show, scale matters. And political economic transformation may provide the most sustainable solutions for embedding globalized energy markets in their socio-environmental contexts.

## Progress toward a Sociology of Energy

> All social scientists—especially environmental sociologists—must take energy seriously, since it is fundamental to social organization and a central factor in society-environment interactions (Lutzenhiser et al., 2002: 223).

Rosa et al. (1988) and Lutzenhiser et al. (2002) recognized the discipline's need for a formal sub-field around the sociology of energy to nurture productive dialogues, debates, and theoretical developments. Early ethnographic fieldwork, though limited in scope, offered more detailed portraits of energy consumption (Wilhite Jr & Wilk, 1987), uncovering people's perceptions of their energy use versus actual consumption (Kempton and Montgomery, 1982), as well as a deep-rooted sense of social obligation in conserving energy resources (Kempton, 1993). While some of the more voluminous attitudinal literature on environmental issues examined people's perceptions of energy sources such as nuclear power (e.g., Rosa and Dunlap, 1994), much survey-based work tended to be disconnected from sociological theory, especially related to multi-scalar political economic perspectives.

To encourage formalization of this sub-field, Lutzenhiser and Hackett (1993) and Lutzenhiser et al. (2002) argued for a *political-economic model* that accounts for impacts of social structural variables on levels of support for various energy systems. Importantly, this nascent sub-field *has* started to emerge. In this chapter, we highlight valuable research that documents the people and communities affected by energy production; the ways in which firms, government agencies, and other powerful actors exert substantial, undemocratic influence on energy policy trajectories and discourses; and the multi-scalar ways in which these dynamics can produce and exacerbate environmental injustices. We highlight these three foci as important threads in energy research in each section below.

In the following chapter, we examine research on extraction's sociological dynamics, especially aspects of power and structural, environmental inequity. We interrogate these dynamics first through the sociological literatures on energy boomtowns and natural resource dependence, focusing on structural inequities—since this was some of the initial research systematically examining resource- and energy-related outcomes. We then take a deeper dive into scholarship on these three empirical domains described above, by focusing on specific energy systems and highlighting issues of inequality within each. To that end, below we examine socio-environmental and EJ dynamics at various sites of extraction for three of the most significant sources of energy in the modern industrial era: coal, (unconventional) oil and gas, and nuclear power. We also examine outcomes at sites of energy production, such as refineries and power plants. Subsequently, we

address EJ issues that have emerged in the context of renewable energy development. We conclude by outlining the ways sociology of energy can progress and more systematically examine the sociological dynamics of extraction, energy production, and access.

## Historical Perspectives on Energy from Fossil Fuels: Power, Poverty, and Reproduction of Structural Inequality

This section of the chapter maps out two strands of research that engage with questions of power, inequality, and social change occurring with changes in energy systems. These literatures provided some of the foundations for environmental sociology and sociology of energy, as these studies examined how extractive systems for energy production often related to structural changes in communities and structural drivers of poverty, including the marked impacts of extra-local firms. This work provided important foundations for environmental sociology's examination of power and inequities in the contexts of energy extraction and production.

### Energy Boomtowns and Social Disruption

The 1973 oil crisis set in motion a scramble for more sources of domestic oil production in the U. S., subsequently increasing exploration for fossil fuels, particularly in the western states. Rural sociologists and scholars conducted a series of studies to understand the 'boomtown' dynamics that occur when isolated, seemingly idyllic rural communities find themselves undergoing rapid change because of an energy boom.

In a widely cited conference paper, Kohrs (1974) argued that energy development upended the quiet rural life of Gillette, Wyoming, as workers from other parts of the nation flooded the town and social ills like prostitution, domestic violence, divorce, and a general perceived loss of control became widespread. Subsequent analyses largely confirmed Kohrs' initial claims about energy boomtowns (e.g., Bacigalupi & Freudenberg, 1983; Brown & Swanson, 2004; Cortese & Jones, 1977; England & Albrecht, 1984). Importantly, scholars began to identify phases in boomtown development, wherein crime and general social dislocation often spiked during early stages of a boom (Brown et al., 1989, 2005; Freudenburg, 1992), though some communities were resilient over time (Smith et al., 2001).

Although these early studies provided novel insights into the social dynamics of energy boomtowns, critics soon pointed out questionable methodological choices (e.g., Summers & Branch, 1984; Wilkinson & Thompson, 1982) and simplistic assumptions about the "roughneck" nature of energy workers. For instance, Smith (2008) conducted interviews in Gillette, Wyoming, and found that many miners were older, family men with little interest in wild parties and a stereotypical roughneck lifestyle. Indeed, many of her informants hoped to stay in Gillette for the remainder of their careers, contrary to early claims about the transient nature of energy workers. After a flurry of papers on energy boomtowns in the late 1970s and early 1980s, interest in energy boomtowns faded until the 2000s (e.g., Luthra et al., 2007).

The mid-2000s boom in domestic oil and gas production engendered renewed interest in the classic boomtown scholarship (e.g., Jacquet, 2014; Jacquet & Stedman, 2011; Stedman et al., 2012). Jacquet and Kay (2014) caution that the classic boomtown model rests on several assumptions that are not necessarily tenable for the current boom in unconventional oil and gas development. Chief among these is the idea that booms are sudden, dramatic upswings in extractive activity; instead, current technologies are more likely to create short booms and busts, often on a small spatial scale. Further, classic boomtown research focused almost exclusively on bucolic, isolated rural communities, yet technological changes have brought energy production in much closer proximity to peri-urban and even suburban areas (Fry, 2013; Fry et al., 2015).

## Socio-Economic Natural Resource Dependence and Poverty

Although we might expect that regions rich in natural resources would experience economic prosperity, a long tradition of research identifies a 'resource curse' or 'paradox of plenty'—in which nations or regions endowed with significant natural resources (e.g., fossil fuels) often have heightened poverty and unstable or authoritarian governments (Papyrakis & Gerlagh, 2004; Ross, 1999, 2015). A related tradition rooted in rural sociology identifies structural natural resource dependence, particularly dependence upon fossil fuel extraction, as a significant driver of persistent poverty and economic malaise in rural regions within countries like the U.S. and Canada (Humphrey et al., 1993; Peluso et al., 1994).

Natural resource dependence describes communities' socio-economic and cultural reliance on one (or perhaps a few) extractive sectors, with little to no economic diversity. Because extractive industries are susceptible to the volatility associated with commodities markets, natural resource dependent communities often experience severe boom and bust cycles and occasionally a final bust, such as the closing of a mine, which hollows out the local economy (Krannich & Luloff, 1991; Malin, 2015; Stedman et al., 2004). Freudenburg (1992) theorized that, while natural resource dependent communities often seem to have economic diversity, many industries are tightly coupled to the main extractive industry and thus suffer from boom and bust cycles. Freudenburg and Gramling (1998) further illustrated the tight economic linkages among industries that appear to be only indirectly linked to the main extractive or production activity by showing how, in the context of Louisiana oil production, even indirectly linked sectors such as retail trades, housing, restaurants, and hotels were deeply affected when the oil industry busted. Across contexts, natural resource dependent communities are structurally vulnerable to rapid economic and social change wrought by their over-reliance on extractive industries (e.g., Flint & Luloff, 2005; Freudenburg, 1992; Freudenburg & Gramling, 1994, 1998; Stedman et al., 2004).

This can engender other processes that exacerbate rural poverty and other social problems. Extractive industries can crowd out other types of economic development. For instance, researchers have documented how the decaying wreckage of extractive infrastructure can act as a spatial blight on a region, creating a place-based stigma that inhibits new business formation or investment because the area is viewed as permanently damaged (Colocousis, 2012; Ellerbusch, 2006; Thomas, 2016).

Natural resource dependent communities may engage in "developmental channelization" (Gramling & Freudenburg, 1996) or "cognitive lock-in" (Hudson, 2005: 532), whereby communities and their leadership are seemingly unable to imagine an economic future that does not center on a once dominant extractive industry. Industries that were a historical part of the community may now be perceived as part of the local social fabric (Malin, 2015). Thus, in some situations, communities do not diversify their economies or transition to new models of economic development because of strong familial, community, and contemporary cultural ties to a given extractive industry (Freudenburg, 1992; Malin, 2015). This has been repeatedly observed in U.S. coal mining communities (Bell, 2016; Bell & York, 2010; Blaacker et al., 2012; Dicks, 2008; Lewin, 2017) and in uranium communities (Malin, 2015). In the next section, we turn to literature that attends to ways industrial-scale, centralized, and fossil fuel-based energy development shapes inequities for host communities, utilizing an environmental justice lens.

## Inequality, Injustice, & Extractive Energy Development

While the political-economic lenses utilized above allow us to better understand structural drivers and outcomes of energy extraction and production, environmental justice (EJ) perspectives allow researchers to see other important consequences of energy production. An

EJ lens illuminates structural violence (Farmer, 2004) that can occur when marginalized communities act as internal colonies or sacrifice zones (Gaventa, 1982; Kuletz, 1998; Lerner, 2010) to supply often wealthier urban population centers with energy and other raw materials. As we detail below, fossil and nuclear fuels utilized for energy production have well-documented histories of creating and amplifying environmental inequities, such that low-income communities, communities of color and particularly Native American, Indigenous, and Tribal communities, and other marginalized groups bear a disproportionate burden of hazardous industrial activity (Ard, 2015, 2016; Campbell et al., 2010; Clark et al., 2014; Downey & Hawkins, 2008; Faber & Krieg, 2002; Grant et al., 2010; Liévanos, 2015; Mohai & Saha, 2015; Mohai et al., 2009a, b, 2011; Pastor et al., 2001; Taylor, 2014). Sociologists have been at the forefront of this scholarship.

Dynamics producing the inequitable outcomes we describe below are complex. U.S. environmental regulations are typically not designed to track or reduce environmental inequalities, but instead to improve environmental conditions measured at large spatial scales and for the population overall. Further, environmental regulatory agencies have long been subject to 'capture' by the industries they are charged with regulating (Harrison, 2014). Industry actors use their massive financial power to pressure local, state, and federal regulatory authorities to relax environmental regulations, limit regulatory enforcement, and allow facilities to continue to operate despite regulatory violations and expired permits (Davidson & Frickel, 2004; Faber, 2008; Freudenburg & Gramling, 1994; Gould et al., 2015). Additionally, in low-income communities where residents struggle to make ends meet, they lack the free time, scientific support, credibility, and other resources needed to fight powerful industries. Their elected officials feel compelled to welcome industrial development in exchange for jobs and tax revenues, despite the accompanying hazards, and workers feel reluctant to report or challenge environmental problems for fear of retaliation. These dynamics, and potentially lower property values, make such communities attractive to those industries seeking to locate or expand their hazardous facilities or willing to violate existing laws (Mohai & Saha, 2015). When these debates are framed as zero-sum 'jobs versus environment' scenarios and when operators promise local jobs, it becomes difficult to oppose these short-term potentially profitable activities over longer-term sustainability concerns (Freudenburg, 2005). These structural dynamics can turn communities into sites of acceptance for risky industrial activity (Malin, 2015).

The clustering of environmental problems in communities of color showcases an enduring legacy of centuries of industrial practices and government policies that have produced residential segregation, while systematically affording material resources—from wealth to clean air—disproportionately to whites (Lipsitz, 1995; Mascarenhas, 2016; Mohai & Saha, 2015; Morello-Frosch, 2002; Pulido, 1996, 2017; Taylor, 2014). In the U.S., these practices and policies have been structured through centuries of settler colonial practices (Whyte, 2018) and also include explicitly racist institutions of forced removal and relocation of thousands of Native people, slavery, Jim Crow laws, and 'redlining' practices through which banks and other actors refuse mortgages and other services to people in majority-minority neighborhoods. Racist hiring practices have also allowed employers to allocate the best paying and 'cleanest' professional-sector jobs to whites. Since the 1950s, U.S. federal highway development projects and government urban 'renewal' programs have destroyed entire communities (often of color), even as sovereignty of Indigenous and Tribal nations have been consistently violated through state-sanctioned violence and treaty violations. Finally, weak environmental law and uneven enforcement of existing laws further concentrate the environmental 'bads' from energy production into marginalized communities (Mohai et al., 2009a, b).

Below, we examine socio-environmental dynamics related to these historical and contemporary inequities at various sites of extraction.

We focus on three of the most significant sources of energy in the modern industrial era: coal, unconventional oil and gas, and nuclear power.

## Coal's Socio-Environmental Impacts

Sociological research on coal extraction and production has highlighted persistent structural inequities and environmental injustices related to this industry. As Bell and York observe, "coal may be responsible for more environmental harm than any other energy source" (2012: 359). Coal produces more than 40% of energy around the world annually (International Energy Agency, 2012), fueling over 500 coal-fired power plants in the United States alone (American Lung Association, 2011, cf. Bell and York, 2012; EIA, 2021). Global production is projected to increase over the next 40 years (Energy Information Administration (EIA) 2017), as export-oriented manufacturing drives increased coal consumption in the Global South, where much of the Global North's production activities have been outsourced.

This comes at a cost, as burning coal for energy generates about 45% of global carbon dioxide emissions (EIA, 2021)—and leads to significant methane emissions (US EPA, 2012), mercury contamination, and sulfur dioxide, nitrous oxides, and small particle pollution (Bell & York, 2012). In the U.S. alone, coal-fired power plant pollution is linked to tens of thousands of additional premature deaths, heart attacks, asthma attacks, hospitalizations, and emergency room visits each year (Physicians for Social Responsibility, 2009). Coal-fired power plants, as well as coal mining and processing, engender a host of additional environmental problems, including toxic coal waste ponds that can breach their earthen dams, dust-coated communities near coalmines, valleys filled with debris, and watersheds permanently damaged by mountaintop removal and other mining practices (Bell, 2016). Public health impacts include increased rates of mortality, birth defects, respiratory, and cardiovascular ailments in coal mining areas like Appalachia (Ahern et al., 2011; Hendryx, 2015).

The harms of the coal industry play out along lines of social inequality. Hendryx (2010) found that people living in areas of mountaintop-removal coal mining experience higher rates of both poverty and mortality. Similarly, Greenberg (2017) and Liévanos et al. (2018) found that new coal waste impoundments are disproportionately proximate to socioeconomically disadvantaged communities. Moreover, Liévanos et al. (2018) show that the hazardous impacts of coal mining persist long after the mines themselves close, as the authors found that coal waste impoundments were disproportionately located in communities with *past* (rather than current) coal mining activity.

Coal communities often suffer multiple intersecting environmental and economic injustices and experience persistent structural inequities that can disrupt people's daily lives. Coal communities have been depicted as internal colonies dependent upon coal extraction (Bell, 2009; Fox, 1999). Indeed, coal companies can cause serious socio-environmental devastation in these places, which can irreparably harm community social fabrics (Erikson, 1976). Moreover, these problems persist as communities come to identify with and defend the industry. Lewin (2017), Bell (2016), and Bell and York (2010) have shown that the economic and cultural domination of large coal companies in coal mining communities can create such strong economic identification with the industry that citizens harmed by coal extraction while gaining little from it still support the industry, political leaders align with it, and residents and leaders alike idealize its eventual resurgence. As Blaacker et al. (2012) compellingly show, residents of coal mining regions can significantly overestimate the positive impacts of the coal industry in their region. Because of these misperceptions, people may become more willing to overlook environmental and social costs of coal extraction and production. For instance, Scott et al. (2016) examined the aftermath of a massive coal slurry spill in Martin County, Kentucky, where more than 300 million gallons of waste leaked from

an impoundment. Though it devastated watersheds, ecosystems, and nearby communities, the authors found that many residents regained trust in the responsible company within ten years.

Studies indicate that coal heightens local poverty and provides few economic development opportunities. For instance, Perdue and Pavela (2012) have analyzed the economic impact of coal mining on West Virginia communities and found that counties with higher rates of coal production also has higher rates of poverty. However, the effect of coal mining may vary across time and region, with some positive effects in recent years and in certain regions (Betz et al., 2015; Lobao et al., 2016; Partridge et al., 2013).

Despite the economic, social, and cultural power of coal companies, activists have mobilized against local environmental, social, and economic injustices associated with coal production. Women have been at the forefront of this activism in Appalachia (Bell & Braun, 2010; Bell, 2008, 2016; Burns, 2007)—in part because they are less likely than men to be directly employed by, and thus dependent upon, the industry. It also stems from ways dominant gender norms make it socially acceptable for women to become political active when protecting their families' health (Bell, 2008; Bell & Braun, 2010). Gendered outcomes can have different patterns when more women are employed in the industry, however, as demonstrated in Smith's (2008) study of Wyoming's Powder River Basin.

Internationally, coal mining has created similar environmental injustices and upheavals, often experienced by the most marginalized or poorest members of these societies. While we regrettably do not have the space to review this all here, important patterns emerge around structural inequity and environmental injustice. In China, with its staggering increases in most forms of energy production as it quickly becomes a global superpower, coal has been found to generate massive environmental inequities. For instance, ethnic minorities, such as Inner Mongolians, have protested coal mining's detrimental outcomes and its comparatively small benefits for ethnically marginalized communities providing most of the labor (Liu et al., 2014). In South America, environmental inequities have resulted from coal mining, as marginalized members of the public (such as smallholder ranchers) are excluded from decision-making processes surrounding coal mining (Bustos et al., 2017).

## Unconventional Oil and Gas Production's Socio-Environmental Impacts

Unconventional oil and gas production has developed rapidly and widely in the U.S. – accompanied by various environmental injustices and economic outcomes that can affect populations unevenly (Mayer et al., 2018), often privatizing profit and nationalizing risks such as public health, social, and environmental costs (Faber, 2008). The United States has recently emerged as the top global producer of hydrocarbons. This is largely due to its increased use of unconventional technologies such as hydraulic fracturing to tap previously inaccessible oil and natural gas in shale layers scattered around the country (EIA, 2021). The federal deregulation of the industry since the 1970s—and especially through the 2005 Energy Policy Act—accelerated unconventional drilling as well (Malin et al., 2017; Warner & Shapiro, 2013).

Conflict and tension over the pace and scale of unconventional oil and gas (UOG) production have characterized the recent boom. Supporters of UOG production laud the potential for economic growth, job creation, and the energy independence it may offer (Ceresola & Crowe, 2015; Silva & Crowe, 2015). Others oppose the industry's rapid development, concerned over public health and environmental risks, economic instability of boom-bust prone industries, and communities' lack of political power over decisions about drilling (Malin, 2014; Mayer et al., 2017; Ryder, 2017, 2018). Communities' lack of power in such decisions stands in stark contrast to the meta-power—or ability to control the rules of the game—exercised by operators at

most phases of UOG production (Hall, 1997; Malin et al., 2019).

UOG production poses various environmental and public health risks. These include exposure to hazardous chemicals used in fracturing fluid, which is associated with adverse human health outcomes (Colborn et al., 2011), including higher rates of birth defects (McKenzie et al., 2014) and childhood cancer (McKenzie et al., 2017) in populations living in close proximity to UOG production in Colorado (see also Adgate et al., 2014; McKenzie et al., 2012). Studies have shown that the industry fails to report oil spills, and that UOG production contributes to water contamination (Rozell & Reaven, 2012), air pollution (Ahmadov et al., 2015), industrial accidents (Blair et al., 2017; Haley et al., 2016), induced seismic activity (Keranen et al., 2014), and other hazards to human health (Adgate et al., 2014; Rabinowitz et al., 2015).

Although increased UOG production has helped decrease energy costs (unless we start counting subsidies for fossil fuel industries), its consequences for host communities are murkier. Kinnaman (2011) reviewed several early industry-funded studies, finding that they tended to overstate the economic benefits of UOG production. Jobs often go to workers from outside host communities (Wrenn et al., 2015). Haggerty et al. (2014) studied the U.S. West and found that long-run specialization in oil and gas development is associated with lower incomes, heightened crime, and reduced educational attainment. Munasib and Rickman (2015) found marked employment growth in North Dakota but no effects in Arkansas. Other studies find that unconventional oil and/or natural gas extraction is associated with modest wage and employment growth (Lee, 2015; Tunstall, 2015; Weber, 2012), but these gains may be short-lived and mostly concentrated within the oil and gas sector, suggesting limited multiplier effects (Cosgrove et al., 2015; Komarek, 2016). The job growth and tax revenues provided by UOG can be offset by increased strain on local infrastructure from heavy equipment traffic, elevated water usage, noise and light pollution, and negative impacts on air and water quality (Anderson & Theodori, 2009; Brasier et al., 2011; Gullion, 2015; Jacquet, 2012; Jacquet & Stedman, 2011; Ladd, 2013, 2014; Schafft et al., 2013; Theodori, 2009; Willow, 2016). Perry's work in Pennsylvania has shown how rural communities can experience collective trauma amid rapid and widespread UOG production, as social and community fabrics and livelihoods are disrupted (2012). Malin and DeMaster (2016) showed that when small- and medium-sized farming operations in Pennsylvania lease their property for UOG production, they can implicate their rural livelihoods in dual systems of natural resource dependence. Further, Willow (2014) found that deregulated UOG production can create barriers to more sustainable energy development.

Evidence continues to accumulate that UOG production has complicated environmental justice outcomes (Clough, 2018), especially in the communities where extraction takes place. Concerning distributive justice, there are a disproportionate number of wells in poorer regions of Pennsylvania (Bienkowski, 2015; Ogneva-Himmelberger & Huang, 2015). Wylie and Willow (2014) compiled multiple instances of environmental injustice in their special issue examining the political ecology of UOG production, including inequitable access to technology and information possessed by the industry as compared to members of the public.

The massive power inequities between oil and gas companies and the communities hosting drilling sites also create significant procedural injustices. In these contexts, members of the public often have fewer resources, less access to information, and fewer opportunities for meaningful participation in making decisions about UOG production near homes, schools, or on public lands (Malin et al., 2019; Wylie, 2018; Wylie & Willow, 2014). Wylie and Albright (2014) demonstrated how UOG operators can hold comparatively massive power in the face of community or grassroots efforts to gain information or share and record their experiences with the industry by creating publicly accessible databases regarding leases and other industry actions. Malin (2014) has shown how Pennsylvania farmers often feel compelled to sign leases with

UOG producers, and that they need substantial financial resources to hire the legal counsel needed to ensure more equitable lease terms. Gullion (2015) has demonstrated the ways in which Texas homeowners mobilized to combat their lack of control over the zoning and regulation of UOG production in their neighborhoods.

In U.S. states like Colorado, the state has thwarted local efforts to regulate or ban UOG production (Davis, 2014; Ryder, 2017; Ryder & Hall, 2017). Concerned members of affected communities may also find the convoluted regulatory system blunts their ability to engage with siting decisions, hampering procedural equity. Further, in many U.S. states, mineral rights ownership is severed from surface rights ownership. In such scenarios, people who live on a property may have little to no input about UOG development, as state laws typically privilege mineral owners over surface owners (Mayer & Malin, 2018).

In the United Kingdom, similar environmental inequities have emerged around the use of UOG production methods, as members of the public lack the ability to meaningfully influence policy decisions related to UOG production (Cotton, 2017). In eastern Australia, coal-seam gas extraction and production have generated similar controversy, and the public has mobilized to demand the recognition of a social contract between host communities and oil and gas operators (Lacey & Lamont, 2014). Yet, the environmental injustices that result—from environmental health impacts such as asthma and cancer clusters to increased risk of toxic contamination among vulnerable and rural populations (White, 2013)—compete with the mining sector's economic power and dependence of Australia upon its, which now accounts for over 15% of the nation's economic activity (Cleary, 2012: xi). This can limit the ability of members of the public to have a seat the table when making relevant policy decisions (Mercer et al., 2014).

Although current evidence suggests that UOG production may provide communities with some economic benefits in terms of job creation and wage growth and can generate localized support (Mayer & Malin, 2018; Malin et al., 2017), these same benefits can generate their own secondary problems if rents, property values, and the cost of other necessities increase in tandem. UOG production may also generate significant tax revenue, but this revenue is typically moved upstream into state coffers and not always redistributed back to local host communities, potentially exacerbating the infrastructure strains created by local development (Newell & Raimi, 2018a, b). As a further complication, UOG production does not appear to address the seemingly intractable problem of persistent rural poverty, and does not seem to stop or slow human capital flight from rural areas (Mayer et al., 2017, 2018; Rickman et al., 2017). Indeed, UOG production might reduce much-needed human capital in rural places (Mayer et al., 2018). Finally, scholars have shown that, in some areas, civic science water monitoring projects conducted by residents concerned about fracking pollution are not located in the areas of greatest environmental injustice, and often are not coordinated with government datasets (or other citizen science data collection projects) nor in compliance with agencies' strict quality control standards (Kinchy et al., 2016). Additionally, such projects are designed and discussed in ways that constrain participants' democratic sensibilities, notably by focusing on preparedness for disaster rather than pollution prevention and by using data government agencies already deem valid rather than residents' experiential knowledge (Kinchy, 2017).

Environmental inequalities—from the distributive to the procedural—emerge for individuals and communities touched by UOG extraction. While the industry is still relatively young, researchers increasingly demonstrate its socio-environmental implications and related injustices.

## Socio-Environmental Impacts of Uranium Extraction & Nuclear Waste

Uranium production and nuclear technology propelled the U.S. to its status as a global superpower, but also generated a host of socio-environmental problems, including legacies of environmental injustice, nuclear sacrifice zones,

and environmental health outcomes still contested by the state.

Nuclear power has enormous decarbonization potential, and is framed by some as the most viable low-carbon energy source (International Atomic Energy Agency, 2016). Nuclear power currently supplies about 20% of the electricity in the U.S. (EIA, 2021) and about 11% globally (IAEA, 2017), with global demand projected to increase by about 1.6% annually, making it the second-fastest growing sector after renewables (US EIA IEO, 2017). While this climate-friendly framing has put a new shine on a controversial and risky technology, the industry remains plagued by serious environmental justice considerations at the beginning and end of the nuclear fuel cycle. Cleaner materials such as thorium are increasingly used for nuclear power generation, but uranium extraction and production continue to play central roles in nuclear power production. When extracted, milled, and enriched, uranium can propel a nuclear reaction for atomic weapons or energy production.

Uranium's public and environmental health consequences are well-documented and have been fought by communities seeking stronger regulatory protections as well as cancer screening and treatment (Brugge & Buchner, 2011; Malin, 2015; Shuey, 2007). After the rush of uranium's first two booms (Ringholz, 2002), uranium communities were often left with substantial legacies of environmental contamination, busted economies, and public health problems—such as cancer clusters, childhood leukemia, birth defects, and ongoing fears over residual contamination and its potential effects (Malin, 2015; Malin & Petrzelka, 2011). However, these inequities do not figure prominently in contemporary policy discussions about nuclear's sustainability, and government actors have claimed that that individual behaviors like smoking, rather than environmental uranium exposure, led to disease clusters (Malin & Petrzelka, 2010).

Poor, predominantly white communities such as Monticello, Utah, have dealt with these injustices. But the worst and most persistent environmental injustices were experienced by Native, Tribal, and Indigenous nation communities (Kuletz, 1998, 2001), forcibly removed and relocated—then often dismissed and actively disempowered through treaty rights violations and other injustices within settler colonies (Whyte, 2018). For instance, the Navajo (or Diné) reservation had numerous uranium reserves and currently has over 500 abandoned uranium mines. Residents experience lingering health impacts from exposure to contamination through their air, water, and hogans (spiritual spaces) and homes that were in some cases built with uranium tailings (waste) (Brugge & Goble, 2002; Brugge & Buchner, 2011; Brugge et al. 2007a; Johnston et al., 2010). The Church Rock spill, where the United Nuclear Corporation's uranium tailings pond experienced a dam breach and released 94 million gallons of radioactive sludge into the Puerco River, stands as the worst nuclear disaster in U.S. history (Brugge et al., 2007a, b). But the spill's location on Native nation land and its impacts to mostly Native populations rendered it all but invisible. Indeed, these ongoing environmental health disasters have led to deep psycho-social stress and reductions in quality of life in Tribal and Native communities still impacted by uranium (Johnston et al., 2010; Madsen et al., 1996)—part of the motivation for on-going activism against further uranium production, including the Diné Nation's moratorium on production.

Kuletz (1998) argues that the U.S. government-funded nuclear industrial complex is a form of internal colonialism, where Native nations and peoples have been particularly exploited and disregarded for the benefit of 'the nation'. At the same time, popular narratives about the desert as a wasteland frame these spaces of sacrifice as expendable and ignorable, justifying their "relentless plunder" (p. 13) and the dumping of waste. Even today, the only operational uranium mill in the U.S., the White Mesa Mill in predominantly white Blanding, Utah, has created environmental injustices for the Ute Mountain Ute, from increased exposure to environmental toxicants to destruction of sacred burial sites (Natori, 2013). In New Mexico, the Laguna Pueblo contends with ongoing water contamination concerns related to the Jackpile Mine. And in

northern Arizona, as uranium production renews on the Colorado Plateau, Tribal populations like the Havasupai fight to protect their sacred lands, sovereignty, and tribal water rights amid renewed uranium mining.

These outcomes have occurred globally, where uranium production had similarly concentrated impacts on Native populations. For instance, Keeling (2010) shows how Canadian uranium mining and milling took on the same feverish pitch and was accompanied by the same socio-environmental impact as in the US, including environmental health outcomes and inequitable risk exposure for marginalized groups, particularly First Nations peoples and communities. In Australian uranium mining operations, Aboriginal peoples were unequally exposed to the socio-environmental and public health risks of uranium production (Banerjee, 2000; White, 2013).

The other end of the nuclear fuel cycle is plagued by similar power disparities and environmental inequities. Nuclear waste storage debates have sparked significant activism (Masterson-Allen & Brown, 1990). Intergenerational justice figures prominently in this discussion (Shrader-Frechette, 2002), yet different worldviews and orientations to the natural world are frequently dismissed in favor of Western, technocratic views of nuclear waste storage problems. Yucca Mountain has been frequently identified as the most promising site for a permanent and centralized repository for US nuclear waste. Significant concerns about the integrity of the site are ignored, and 'nuclear colonialism' (Kuletz, 1998) has been allowed to continue, as the sacredness of Yucca Mountain for Native groups has not been authentically considered in policy and media discussions about the site (Endres, 2013).

Not all communities respond to the siting of nuclear facilities or renewed nuclear production for power generation with fear or opposition. Recent work has identified 'sites of acceptance' in the context of nuclear power and renewed uranium production (Malin, 2015; Malin & Alexis-Martin, 2020). In these communities, people do not necessarily mobilize against uranium extraction but instead embrace the industry's renewal due to a complex intersection of persistent poverty, natural resource dependence, cultural and community ties to the industry, and spatial isolation (Malin, 2014, 2015). Internalization of neoliberal norms encourages these sites of acceptance, as people privilege free markets, laud de- and re-regulation (especially of environmental rules), and trust corporations to regulate their own behavior.

Importantly, though, these outcomes are impacted by environmental racism, specifically as it affects procedural equity and sovereignty. For instance, in the cases where Native or Indigenous groups *approved* of nuclear waste storage, they were not allowed to store nuclear waste on their sovereign land. Specifically, in Skull Valley, Utah, the state of Utah prevented the Goshute tribe from storing radioactive waste on their sovereign land, despite being surrounded by the chemical, radioactive, and other hazardous wastes stored and incinerated in Utah's west desert (Ishiyama, 2003). In another case, the Mescalero Apache in New Mexico were treated with similar paternalism when they lobbied to store radioactive waste on their land (Sachs, 1996). Yet, the predominantly white communities that have supported the continued operation of the White Mesa Mill in Blanding, Utah, or permits for constructing the only new uranium mill in the U.S. since the end of the Cold War, have been supported by the state when considering inviting in these industries (Malin, 2015).

Nuclear power generation facilities pose pernicious existential risks to host communities (Beck, 1992), given their extraordinary capacity to generate catastrophic harm (Brugge et al., 2007a, b). Perrow (1984) demonstrated that, because of the extraordinary complexity of nuclear power generation and other highly complex technological systems, failures are inevitable. Moreover, he demonstrates how typical engineering approaches to mitigating risk actually exacerbate the chances of major accidents. Some of the worst technological accidents have involved radioactive releases from nuclear power plants, including Three Mile Island in the U.S., Chernobyl's record-setting release of radioactivity in 1986, and the 2011 Fukushima-Daiichi

disaster in Japan (Alexis-Martin, 2019; Hasegawa, 2012). Still, in some social settings, dominant social norms can mitigate against residents' abilities to effectively mobilize in the face of these risks. For example, Kimura shows that women concerned about radiation-contaminated food following the Fukushima nuclear disaster were labeled irrational and challenged for not complying with dominant, gendered norms of neoliberal responsible citizenship (2016).

Across the nuclear fuel cycle, from uranium mining and milling to nuclear waste storage and power generation, social scientists have documented the structural inequalities and persistent environmental injustices that accompany atomic technologies. When considering nuclear power's potential role in producing low-carbon energy, then, we can see how these inequities limit nuclear power's socio-environmental sustainability.

## Socio-Environmental Impacts of Refineries and Fossil Fuel Power Plants

Environmental sociologists have documented numerous environmental justice (EJ) issues at refineries and fossil fuel power plants. These are often disproportionately clustered in lower income, immigrant, black, Latinx, Native American, Indigenous, or other marginalized communities. Consequently, these populations bear the greatest burden of the hazards associated with such facilities—explosions, toxic emissions, polluted water, truck traffic, odors, and noise, which harm human health, cause suffering, impair educational attainment, and cause other problems. The poverty, racism, food insecurity, lack of access to health care, and other social stressors that characterize life in these communities render their residents disproportionately vulnerable to the effects of exposure to such hazards (Morello-Frosch et al., 2011).

Community-based, qualitative studies of the communities along the Mississippi River oil and chemical corridor—dubbed "Cancer Alley", with over one hundred oil refineries and petrochemical facilities—have provided striking insights into the hazards these communities endure (Allen, 2003; Kurtz, 2007; Lerner, 2005; Ottinger, 2013a; Taylor, 2014; Wright, 2005). Low-income African Americans suffer the greatest harm from these facilities, yet have been largely excluded from facility jobs and other economic benefits. At the same time, state officials and industry experts routinely dismiss residents' concerns as unsubstantiated and uninformed. In numerous cases, residents outraged about facility explosions and toxic air emissions have organized to fight for stronger environmental regulations, greater regulatory enforcement, research on the toxic impacts of these facilities, and, in some cases, paid relocation of residents out of their neighborhoods (Allen, 2003; Kurtz, 2007; Lerner, 2005; Taylor, 2014; Wright, 2005). Such studies show that industry and government actors undermine community concerns by downplaying risks inherent to complex energy-producing facilities.

Ottinger (2013a) shows why other residents who are harmed by these facilities do not mobilize against them. She demonstrates that industry engineers defined public debate about facility safety in terms of individual, responsible choice—framing themselves as *responsible*, enterprising individuals who *choose* to live and work near the plants, and framing other residents' health in terms of irresponsible individual behaviors like smoking, dietary choices, and exercise. This obscured the scientific uncertainties about plant safety and the well-documented hazards from these facilities. At the same time, neoliberal rollback of environmental and labor regulations and declining funds for basic social services created among residents a "need to be entrepreneurial" (p. 95)—a need to seek industry investments into basic community development projects and to make their neighborhoods attractive to upwardly mobile prospective home buyers. Many residents thus pushed for a friendly partnership with industry to fund neighborhood beautification projects and rejected EJ activists' assertions that their town was "unlivable" and should be relocated.

Pipelines move raw materials such as liquefied natural gas and petroleum from sites of extraction to refineries, power plants, and ports. While we do not have the room here to exhaustively review related research, social scientists continue to examine EJ aspects of pipeline siting and community responses—and focus on the growing public activism against pipeline proliferation amid increased UOG production. Some of the most high-profile EJ activism of this century has centered around pipelines, from the Standing Rock Sioux coalition for water protection (Whyte, 2018) to the on-going protests related to the Enbridge Line 3 (Black et al., 2014) and Keystone XL Pipelines (Bradshaw, 2015). In the context of UOG production, FracTracker Alliance (2016-present) continues to capture pipelines' EJ outcomes on the ground, as the oil and gas industry increasingly relies upon mechanisms such as eminent domain to claim land from members of the public for pipeline construction (Chalk & Harrison-Fincher, 2009). Broadly, activism along pipeline routes that cut through communities is increasingly well-documented (Boudet & Ortolano, 2010; Veltmeyer & Bowles, 2014), and First Nations People and Native and Indigenous nations have been at the forefront of public resistance (Gilio-Whitaker, 2015). At the same time, the media frames debates over energy development, like other industries, in terms of either jobs or environmental concerns, as Kojola (2017) found in the case of the XL pipeline controversy—which can create the same zero-sum 'jobs versus environment' dynamic discussed previously in the context of UOG production.

## Socio-Environmental Impacts of Renewable Energy

Given the tremendous socio-environmental and political problems inherent in fossil fuel and nuclear energy, many actors have advocated for an energy transition to renewable energy sources such as wind and solar. There is broad public support for renewable energy, but considerable community opposition to specific renewable energy projects (Wolsink, 2007), for reasons we review below. Moreover, while planners and state actors often deride community opposition to renewable energy projects as a selfish and parochial "NIMBY" (Not In My Back Yard) mentality, many scholars have shown communities' concerns are not so simplistic. Indeed, the forms of renewable energy development most likely to flourish have been shown to contribute similar environmental injustices as their carbon-based predecessors (Bailey, 2016; Bailey & Darkal, 2018; Devine-Wright, 2012; Ottinger, 2013b). Importantly, though, many of these concerns relate to scale and procedural inequity rather than stark socio-environmental and broader sustainability concerns presented by fossil fuel-based energy sources.

Scholars raise concerns about the inequitable distribution of costs and benefits from *industrial-scale* renewable energy projects. In these instances, host communities bear the greatest burdens in several significant regards. While the social benefits of utility/industrial-scale renewable energy projects are widely dispersed, the hazards they create are concentrated around the sites of production (Ottinger, 2013b). The mining of rare earth minerals essential for producing renewable energy technologies (e.g., solar panels), the manufacturing of renewable energy infrastructure, and exposure to toxic chemicals at waste sites where old renewable energy infrastructure is discarded all pose health risks to workers and communities, just as in fossil fuel production (Newell & Mulvaney, 2013; Phadke, 2018). Biofuels have also impacted global agricultural markets in ways that exacerbate inequity for developing nations and peasant populations (Borras Jr. et al., 2010). Many of those most affected are Indigenous and Tribal nations already harmed by air and water pollution, poverty, food insecurity, and flooded global markets.

Residents and researchers also point to public health and environmental impacts of wind turbine installations, whose low-frequency vibrations, noise, and flickering light can cause headaches, nausea, and other health problems for residents and perhaps wildlife (Ottinger, 2013b; Phadke, 2013). Additionally, industrial-scale renewable

energy projects on public lands have been found to appropriate and exploit land, water, minerals, and other resources without adequately compensating local people (Mulvaney, 2013, 2017; Newell & Mulvaney, 2013; Rignall, 2016). Renewable energy projects have damaged Native American tribal nations' sacred cultural resources, including burial sites, wild rice production, wildlife, and water quality (Lipschutz & Mulvaney, 2013; Mulvaney, 2013, 2017).

At the same time, given centralized, large-scale sites of production, corporate renewable energy project developers reap the projects' greatest benefits. Some "big solar" projects and rare earth mines used to harvest materials needed for producing solar and wind technologies are owned by some of the largest multinational corporations in the world, many of which are responsible for human rights violations internationally (Mulvaney, 2017: 18; Newell & Mulvaney, 2013; Phadke, 2018). These corporations use narratives of 'responsible' mining, manufacturing, and energy production to pressure communities and agencies to accept their projects. Phadke (2018) points out that developers' discursive focus on their new, "socially responsible" forms of mining "naturalize[s] the assumption that we need more and more raw metals to drive the production and consumption of clean energy technologies" and precludes conversation about alternatives such as "extended producer responsibility and economy wide materials recycling and recovery programs" (p. 172).

Additionally, scholars have highlighted the extensive neglect of basic elements of procedural justice during large-scale renewable energy planning and development. Key public participation practices have been abandoned in some renewable energy projects, such that residents feel that they have not been given a chance to help shape decisions about projects that affect their lives (Bailey & Darkal, 2018; Gross, 2007; Mulvaney, 2013, 2017; Newell & Mulvaney, 2013; Ottinger, 2013b; Ottinger et al., 2014; Phadke, 2013; Wolsink, 2007). Officials and other renewable energy proponents disregard lay knowledge about harms (Ottinger, 2013b). In many cases, regulators have not conducted thorough impact analyses required by law (Mulvaney, 2017). In the context of post-colonial nations in the global South, states' pursuit of renewable energy projects can violate communities' rights or aspirations for land and self-sovereignty (Rignall, 2016).

Again, scale and land ethics matter. The social outcomes of renewable projects are often a function of scale and private, consolidated ownership. Centralized renewable energy projects (e.g., utility scale solar) are often imposed upon communities by investors and utilities, raising concerns of procedural and representative equity (Mulvaney, 2013, 2017). Renewables, especially solar installations, can be deployed at a highly granular scale—as in the case of rooftop solar–and is also amenable to alternative models of ownership, such as community-owned solar gardens (Chan et al., 2017; Schelly, 2017). Although these sorts of projects represent only a niche of the U.S.'s current energy portfolio, appropriately scaled renewables can perhaps create spaces for more fulsome public participation and procedural equity.

## Conclusions: Emerging Trends & Steps toward a Unified Sociology of Energy

Globally, energy systems are always shifting. In recent years, increasing scientific evidence and public concern about climate change, as well as climate justice activism, have motivated calls to phase out fossil fuel-based energy production and put greater investment into renewable energy (Klein, 2014, Roberts & Parks, 2009). Visionary perspectives on building distributive and regenerative systems that (re-)embed economies in their socio-environmental contexts are vital and inspiring (Raworth, 2017)—but also need to be complemented by action and insight from environmental sociologists. Sociology of Energy can play an important role in capturing and analyzing these transformations and possible futures, identifying their implications for equity and other elements of justice, and helping inform energy policy measures at all scales of government.

As these transitions occur, social scientists have utilized numerous conceptual approaches to examine these shifting spaces and relationships attending to just sustainabilities (Agyeman, et al. 2003). For example, 'climate justice' scholarship foregrounds the inequitable dimensions of anthropogenic climate change (Ciplet et al., 2015; Schlosberg & Collins, 2014). Climate justice scholars demonstrate how those who contribute most to climate change bear the least of its harms, while the world's most vulnerable people are and will continue to be most harmed by the droughts, floods, forced migration, and other consequences of global warming. Studies have emphasized these injustices at various scales, such as between the global North and global South, and across and within nations. They showcase the work of climate justice activists, who fight for national and international policies that, among other things, mandate democratizing decision-making about energy systems, phasing out fossil fuel-based energy systems that make the greatest contributions to cliamte crises, and developing sustainable and smaller-scale renewable energy systems that help do the work of embedding economies in their social and environmental contexts. Many climate justice scholars and activists also insist that these energy transitions must hold industrialized countries to higher standards for greenhouse gas reductions and honor the rights of countries in the global South to profitably industrialize and develop as those in the global north have done.

Other scholars have taken on this task through the frame of 'just transitions'. The term emerged from labor justice activists in the U.S. and Australia committed to protecting the needs of energy and chemical sector workers and 'front-line' communities affected by industrial restructuring stemming from sustainability policy (Stevis & Felli, 2015). Scholars have used the just transitions concept to advocate for sustainability agreements in the U.S. and internationally that attend to economic and community development, equity, and other justice concerns that include and extend beyond the needs of chemical and energy sector workers (Ciplet & Harrison, 2019; Newell & Mulvaney, 2013; Olsen, 2010; Rosemberg, 2010; Stevis & Felli, 2015; Swilling et al., 2015).

Social scientists have also begun to discuss these issues of power, equity, and access from the perspective of 'energy justice'—an especially vibrant and promising area of inquiry. These scholars examine ways in which issues of equity, fairness, access, and other aspects of social justice are realized—or not—within current systems of energy policy decisions, energy production systems, and energy system transitions (Baker, 2016; Jenkins et al., 2016; Sovacool et al., 2017). Researchers also examine inequities experienced by households that must spend more than 10% of their (non-discretionary) income on heating and electricity services, creating much greater risk of staying in economic hardship or poverty (Bohr & McCreery, 2019). This work, which began about a decade ago, specifically focuses on equity in processes of decarbonization, responses to global climate change, and the energy transitions that have been occurring, especially toward appropriately scaled renewables accompanied by just transitions (Goldthau & Sovacool, 2012; Jenkins et al., 2017; Newell & Mulvaney, 2013; Sovacool, 2014; Sovacool & Dworkin, 2015; Sovacool et al., 2017). Energy justice scholars have proposed the idea of cosmopolitanism—or that each person is a citizen of the world and a stakeholder in these decisions about how we shape just energy systems (Sovacool & Dworkin, 2014). Yet, this work on energy justice does not fully engage with the decades of EJ research, much of it centrally focused the substantial and intersectional ways in which this participation can be limited by significant structural and historical barriers (e.g., Mohai et al., 2009a, b; Roberts & Parks, 2006; Pellow & Brehm, 2013). As such, the energy justice literature would benefit from drawing on EJ's rich body of empirical and theoretical work in order to more effectively identify structural drivers of the energy injustices and who

bears responsibility for remedying them (Jenkins et al., 2017).

## Steps Forward

How do we help shape this wealth of research, where studies often talk past or across one another, into a unified Sociology of Energy that attends to socio-environmental sustainability and justice? First, we can better use our sociological imaginations to help identify and analyze the hidden and invisible aspects of energy systems and transitions. The metabolic rift (Foster, 1999) between energy production and consumption may be due in no small way to the centralized and large-scale aspects of production and distribution of contemporary energy systems, which can contribute to people's separation from the energy they consume, its origins, and its socio-environmental impacts. As sociologists, we can both uncover these hidden dynamics and explore how smaller-scale energy production approaches or larger closed-loop systems, for instance, may reduce metabolic rift. Second, we encourage scholars to be in greater conversation with each other and with environmental justice scholarship. As we have shown above, energy systems—conventional and renewable alike—may exacerbate inequalities and disproportionately burden working class and poor communities, communities of color, Indigenous peoples, and other marginalized and environmentally overburdened groups.

The research reviewed here on centralized, industrialized, fossil fuel-based systems of extractive energy production highlights multiple intersecting and systemic environmental injustices they help generate. Sociologists of energy can utilize this knowledge to facilitate more unified, multi-scalar, and rigorous foci on power and inequity tied to extractive energy production. Sociologists of energy can help envision the next energy and economic systems—which can transform from neoliberal capitalism to systems that are distributive and regenerative by design (Raworth, 2017), where thick democracies, closed-loop systems, and community or communal resource management become the norm. And we can, perhaps must, move beyond the academy and translate our work for members of the public. We possess the skills to help design systems and policies that (re-)embed extractive energy systems and markets in their socio-environmental contexts, opposing attempts to dis-embed markets through de- and re-regulation, privatization, and other neoliberal approaches.

We suggest that the following are promising paths ahead for sociologists of energy:

1. Doing more public sociology and publicly accessible work. Sociologists of energy can help assess what environmental justice within energy systems and markets looks like. We can counter the tendencies of policy, especially over the last 40 years, to dis-embed markets from socio-environmental contexts, by reconsidering 'externalities'. This means working more meaningfully with communities by sharing knowledge, conducting participatory research when appropriate, and building long-term, genuine relationships with practitioners and members of the public—especially communities with environmental injustices. In doing this deep work, sociologists of energy can help illustrate how to build new, distributive, regenerative systems in the face of urgent pressures from the climate crisis.
2. Conceptualizing and leading interdisciplinary assessments of the environmental justice and health implications of fossil fuel-based industrial systems. This can begin as comprehensive meta-analyses of the hundreds of studies that already examine social disparities in health, pollution's impacts on marginalized populations, and their links to fossil fuel emissions and pollution. After the state of the field is assessed through these kinds of analyses, then more empirical research can ask questions specifically targeted to these EJ and environmental health components of fossil fuel production, linking sociology of energy to these well-developed literatures.
3. Offering more comprehensive assessments of the global/international, macro-level, political economic, and governance aspects of fossil

fuel production, and, in particular, conducting comparative studies of the sociological outcomes of energy systems across the world. Such research could include meta-analyses of existing studies to identify cross-national outcomes, comparisons of large-scale versus smaller-scale transitions to more renewable energy systems, and analyses of the political-economic impacts of the Paris Accord and the US's ambivalent role in it.

4. Drawing on a more robust set of theoretical traditions when analyzing energy issues. Environmental sociologists specializing in energy should draw not only on theoretical frameworks widely used in the sub-field, such as Treadmill of Production, but also other theoretical frameworks that contribute valuable insights into issues of inequality and power, such as those by and stemming from Polanyi, Foucault, and Bourdieu, among others. These can help sociologists of energy analyze power inequalities and potentials for liberatory transformation in novel ways. Bringing in 'renegade' and environmental economists and collaborating with other visionary social scientists will lead to richer, more engaged research.
5. Conducting spatial, multi-scalar, and intersectional EJ analyses, linking sociology more carefully to critical human geography. Energy systems center on multiple phases of production that impact communities in different ways, but those relationships are often not explored in depth by researchers.
6. Identifying and analyzing links to energy consumption and access, effects of scales of energy production and distribution, the role of private ownership versus public management, and, perhaps most importantly, aspects of energy poverty and barriers to access. As research on energy poverty and just transitions continues to develop, sociology of energy should more formally interrogate the ways in which various groups have access to affordable energy, the types and scales available, and multi-scalar environmental justice outcomes—and how equity can be realized through more distributive, regenerative energy (and economic) systems.
7. We acknowledge the need for additional, rigorous impact assessment and related empirical research to inform policy-making. However, we note that some of the community impacts of energy production, such as stress and the loss of sense of place, are not captured in traditional means of quantitative risk assessment. Further, we concur with Evensen (2016) and Cotton (2017) that moral and ethical reasoning is also necessary to understand the equity and other justice implications of any energy production. The climate crisis and all other inequities we examined above demand transformative, ethical solutions. Sociology of Energy can work to actively inform policy and conduct applied and community-based work, even as we push to have traditional quantitatively oriented risk assessments also capture quality of life impacts for individuals and communities over time.

Research on the sociology of energy has contributed valuable insights into the people and communities affected by energy production, the ways powerful actors and firms exert substantial influence on energy policy trajectories and discourses, and the multi-scalar ways in which these dynamics can shape, and be shaped by, environmental injustices. A distinct and robust Sociology of Energy would more coherently unify these three foci, systematically identifying how power plays out within the context of resource extraction and production in ways that contribute to environmental harm and injustices. With this knowledge in hand—and more publicly accessible—we can help build more equitable, distributive, and regenerative set of energy and economic systems.

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# Risk

9

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Risk is central to contemporary life and to virtually every environmental issue. Conceptually, risks motivate individual, institutional, and social actions by identifying the consequences of different decisions and trajectories. At a practical level, risk evaluations establish the boundaries for all kinds of environmental and health policies and practices, from clean-up levels at Superfund sites, to pesticide residues on produce, to building codes designed to prevent earthquake damage. Environmental regulations are often founded on understandings and calculations of risk. Risks are often unintended consequences of scientific and technological innovation, as advances produce new risks (Beck, 1992; Threadgold et al., 2018): the widespread use of pesticide leads to pesticide resistance in crops and illness among farmers; the extraction and consumption of fossil fuels causes global climate change; and the construction of dams harms fish populations and challenges the cultural and economic foundations of local and indigenous populations. Thus, an understanding of what risk is, how it is measured and perceived, and how it impacts social structures and processes is necessary for environmental sociology.

Far from existing as politically–and value-neutral calculations, risk perceptions, risk assessments, and any decisions made or actions taken on the basis of risk are in fact deeply social (Bradbury, 1989; Freudenburg & Pastor, 1992). Social, economic, and political questions are central to the scoping of risk inquiries, the selection of data, the interpretation of risk evaluations, and the implementation of risk management. While the formal process of risk assessment assumes that we have the knowledge and ability to calculate and predict conditions of relative risk and safety, risk processes are inevitably constrained by data-driven and socially-influenced uncertainties, inequalities, and information gaps. Furthermore, the ability to define and act upon risk is about power. In the words of risk theorist Ulrich Beck, "risk definition, essentially, is a power game" (1993:333).

I begin by presenting some definitions of risk and associated concepts. I then provide an overview of major theoretical approaches to risk, in sociology generally and environmental sociology specifically. While a full review of all scholarship on risk is beyond the scope of this chapter, I conclude by discussing major areas of risk-related research for contemporary environmental sociology and identifying theoretical and empirical research needs.

## Definitions of Risk and Related Concepts

The precise meaning of the term "risk" varies across academic disciplines and theoretical

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traditions (Althaus, 2005; Aven, 2012; Krimsky & Golding, 1992), but some general definitions are possible. *Risk* commonly refers to the expected danger of something, a quality that incorporates its inherent *hazards* (how dangerous something is), how likely that hazard is to occur (whether something is dangerous to a given population, often equated with *exposure*), and some evaluation of *uncertainties* related to hazards and likelihoods (Zinn, 2008). As such, risk almost always refers to negative or undesired outcomes (Lupton, 1999), except in cases such as finance and recreation, where "risk taking" is seen in a potentially positive light (Lyng, 1993). Risk is distinct from related terms like danger or fear, in that risks also imply the ability of individuals or society to understand, predict, and manage risks (Giddens, 1990; Zinn, 2008). In technical contexts, risk is often defined using a variation of the formula, Risk = *fx* (Hazard * Likelihood), though as I discuss below, social scientists have critiqued this formula for its presumed calculability and its lack of recognition of social factors.

The concept of risk implies a future event or threat that has not yet occurred, and the calculation or anticipation of that future risk drives understanding and action in the present moment. Risks (conceptions of possible future threats) are distinct from *risk events*, or the damaging events that actually take place. The experience and consequences of particular risk events depend not only on the hazards involved with the risk event and the likelihood that they occur, but also on the social *vulnerability* of the people impacted (Wisner et al. 2008). This is particularly important in research on hazards and disasters. Disaster risks are socially determined, not purely climatological or geological in nature, because they are dependent on the severity of a hazard, its likelihood of occurring, and the vulnerability of potentially impacted populations (Tierney, 2007; see also Chap. 11 in this volume).

In environmental policy arenas, the concept of risk is often subject to competing social and technical definitions, which vary across contexts, disciplines, and institutions (Beck, 1999). As Slovic's work on risk perception demonstrated, "the concept 'risk' means different things to different people" (1987: 283). These differences in how risk is conceptualized influence people's experiences of and responses to risks (Renn et al. 1992). For example, in my research on the risks of flame retardant chemicals, I found that stakeholders used six *conceptual risk formulas* to delineate the components that go into evaluating risk and the relationships between those components (Cordner, 2015a, b). The social definitions of environmental and technological risk determine whether certain courses of action are viewed as legitimate and preferable, and thus these definitions structure risk-based decisions (Renn 2008).

*Risk assessment* is the systematic practice of evaluating, calculating, and interpreting risk, typically using both quantitative information to arrive at numerical values and qualitative information to evaluate uncertainty. It involves ascertaining the hazards involved (*hazard identification*), any relevant *dose-response relationships*, and observed or expected exposure conditions (*exposure assessment*). This information is combined in a *risk characterization*. Risk assessment typically is preceded by *problem formulation and scoping*, and followed by the implementation of *risk management and communication* activities (NRC, 2009). Risk assessment is codified in and required by the major environmental statutes in the United States, including the Clean Air Act, Clean Water Act, and Toxic Substances Control Act. The ubiquity of quantitative risk assessment in environmental policy discussions is closely tied to the process of *scientization*, in which scientific logic is central to contemporary policy debates about environmental hazards, and science is increasingly required in the regulatory, legal, and social movement fields (Frickel, 2004; Kinchy, 2012).

Traditional risk assessment clearly distinguishes between risk and hazard. As an example, a chemical may be a hazard if it is able to cause a certain health endpoint, but it is defined as a risk only if the exposures are high enough to cause the toxic endpoint. Thus research may show that a chemical causes birth defects when animals are exposed at a certain dose, but that

chemical would not be identified as a risk in traditional risk assessment unless exposures are calculated to exceed that dose (or typically, that dose divided by a protective safety factor).

Uncertainty is inherent in the concept of risk (Luhmann, 1995). This is partially because risks refer to future, unrealized threats that can only be partially predicted, and partly because risks often result from unintended consequences and new technologies, so the scope and scale of hazards and likelihoods is never fully known. Uncertainty is incorporated into formal risk assessments in several ways. For example, chemical risk assessments use *uncertainty factors*, margins of safety that are used to extrapolate from experimental results (U.S. EPA, 1993). Uncertainty also informs qualitative risk evaluations. For example, the Intergovernmental Panel on Climate Change assigns each predicted climate change consequence a qualitative level of confidence that expresses "the validity of a finding, based on the type, amount, quality, and consistency of evidence and the degree of agreement" (IPCC, 2010:1).

Risk assessment is described by many as a scientific activity. As the EPA states on their website, "Risk assessment is, to the highest extent possible, a scientific process" (U.S. EPA, 2018a). This assumes that social, political, or economic factors should not influence the evaluation of risks. On the one hand, this perspective attempts to separate scientific evaluation from conflicts of interest, issues of inequality, or concerns about cost; for example, the identification and evaluation of risks associated with a certain mining activity should not be influenced by how much the mining company wants to pay to address those risks, as this would likely underestimate risk. On the other hand, presenting risk assessment as uninfluenced by social actors, processes, and concerns ignores the myriad ways in which those actors, processes, and concerns inform the risk assessment process in visible and invisible ways.

Early risk assessment procedures largely treated the practice as though it was purely a scientific calculation involving little to no social influence. The Environmental Protection Agency (EPA) began conducting risk assessments in the 1970s, and in 1983 the National Academy of Sciences released a guide to risk assessment, *Risk Assessment in the Federal Government*. This so-called "Red Book" (due to its deep red cover) formally delineated the risk assessment process and remains influential to this day (U.S. EPA, 2018c). The Red Book argued that the science of risk assessment "should be explicitly distinguished from the political, economic, and technical considerations that influence the design and choice of regulatory strategies" (p. 7). However, concerns over this bright line separating risk assessment from its broader context motivated the 2009 National Academy of Sciences *Science and Decisions: Advancing Risk Assessment*, commonly called the "Silver Book". The Silver Book includes a planning and scoping stage within the risk assessment process, arguing that if questions are clearly defined and expectations and values are taken into account from the start, risk assessments will be more relevant and useful to decision-makers. For example, the planning and scoping stage can recognize vulnerable populations, or identify which toxicological endpoints should be considered.

## Risk, Power, and Expertise

Questions of expertise, authority, and power are central to theories and understandings of risk. The ability to control or influence risk definition and evaluation is closely tied to the exercise and possession of social power (Beck, 1993, 2010; Cable et al., 2008). Environmental risks "are intimately related to structures of power globally and locally in policy and governance, as well as in everyday life" (Olofsson et al., 2016:346). Power in risk evaluation is often tied to forms of *expertise*, in-depth and credentialed technical knowledge and experience that is particular to a topic, sector, or discipline.

Identifying and understanding many environmental risks requires technical and scientific expertise; as examples, a high degree of technological manipulation and scientific understanding is required to identify levels of hazardous

chemicals in drinking water, or to develop and interpret models of climate change impacts. Environmental sociology is simultaneously dependent on the natural sciences to identify, track, and explain environmental phenomena of interest, and critical of the natural sciences' claims of objective and politically neutral "facts" (York, 2015:96). Additionally, many categories of experts play crucial roles in interpreting and framing risks for the public, though experts typically present the knowledge they produce as objective, rather than situated and subjective (Lupton, 1999). The centrality of formal expertise is a defining feature of contemporary society. A much higher level of knowledge and specialization is required for evaluating, managing, and responding to the risks associated with sophisticated technologies: consider the forms and depth of knowledge required for mechanized agriculture compared to hand-tool agriculture, or the risks related to heating a home with electricity derived from nuclear power instead of heating a home with a woodstove. The knowledge systems supporting these advanced technologies are often made "incomprehensible to the majority of citizens" by the experts who create those technologies (Cable et al., 2008:381). Highly scientized fields routinely exclude lay voices and the experiences of those directly impacted by risks, such as workers or residents who live near polluting facilities (Morello-Frosch et al., 2006). At the same time, stakeholders with high levels of expertise—including academic researchers, industry specialists, and regulators—generally overestimate the completeness of their understanding and their ability to accurately predict and respond to risks.

Questions related to who is able to contribute to policy and scientific debates have received significant attention in Science and Technology Studies (STS) and the sociology of knowledge. STS examines how science and technology are socially constructed, by whom, and with what consequences. Researchers have examined the attribution and conditions of assigning expertise. For example, Collins and Evans (2002) distinguish *interactional* expertise, signifying sufficient site–or topic-specific knowledge to meaningful interact with core participants, and *contributory* expertise, signifying sufficient knowledge to meaningfully contribute to the topic of investigation (p. 254).

More recent work on the New Political Sociology of Science studies how networks, institutions, and power structures impact the production and consumption of scientific knowledge (Frickel & Moore, 2006). This perspective assumes that science, including risk evaluation processes, inherently reflects unequal distributions of power and historical trajectories that define and proscribe scientific practices and interpretations (Cordner, 2015b; Kleinman & Suryanarayanan, 2012; Moore et al., 2011; Woodhouse 2006). A key finding in this tradition is that the production of ignorance, like the production of knowledge, is deeply influenced by regulatory, scientific, and political processes. For example, work by Frickel and colleagues identifies structural features of regulatory science that created data gaps in EPA risk assessments after Hurricane Katrina (Frickel & Edwards, 2014; Frickel & Vincent, 2007). Knowledge gaps or areas of *undone science* exist because research topics are overlooked or deliberately ignored, and because the priorities of civil society or the public can differ from the priorities of industry or the government (Frickel et al., 2010; Hess, 2009). Other topics, such as some archaeological research on human remains, are "forbidden" for social and ethical reasons, not scientific ones (Kempler et al., 2011). Research on *agnotology*, or the social and cultural production of ignorance (Proctor & Schiebinger, 2008), has shown that industries ranging from big tobacco to big oil have concealed evidence, called for additional but irrelevant scientific exploration, funded research that addressed different research questions, suppressed damaging findings, and paid experts to cultivate public uncertainty (Markowitz & Rosner, 2002; Michaels, 2008; Oreskes & Conway, 2010). In the climate change arena, significant, and often concealed, funding of the climate countermovement has contributed to ideological polarization about climate change (Brulle, 2014; Farrell, 2015). Additionally, research on the "funding effect" has shown that the industry-funded studies are much more likely

than independent or government funded studies to have results that favor industry interests (Krimsky, 2005; Smith, 2005; vom Saal & Hughes, 2005).

Risk assessments and other ways of understanding environmental threats are incomplete if they exclude the public and impacted communities (Brown, 2007; Wynne, 1992). Scientific experts typically lack local knowledge necessary for accurately identifying and understanding risks. For example, sheep farmers in England accurately traced their animals' illness to radiation from Chernobyl despite statements from risk assessors and government officials that such exposure was impossible (Wynne, 1992). Residents of numerous communities contaminated by industrial waste and pollution have identified local illness clusters before health problems are acknowledged or uncovered by researchers or regulators (Brown & Mikkelsen, 1990; Lerner, 2010; Levine, 1982). Brown (1987) terms this process *popular epidemiology*, in which lay people, often residents in contaminated communities, link illness rates and clusters with local pollution. The broader *civic science* (also called citizen science) movement recognizes the important contributions to research processes by members of the lay public (Corburn, 2005; Irwin, 1995; Kimura & Kinchy, 2019; Kinchy, 2017). Activists, impacted residents, illness sufferers, parents, and other involved lay people have demanded and received participation rights in decision-making processes (Epstein, 1996; Eyal, 2013). This is common in cases of *contested illnesses*, diseases with contested etiology, symptoms, and treatment options (Brown, 2007; Brown et al., 2012).

The exclusion of lay people from scientized debates about environmental and health policy has significant consequences for issues of inequality, since those most impacted by environmental hazards or decisions often have the least input into activities that create those hazards. For example, populations who will be most impacted by global climate change—poor residents of the Global South living in geographically vulnerable locations—generally have little influence over global debates about climate change policy (Harlan et al. 2015). This is a form of environmental injustice. *Environmental justice* (EJ) scholar David Schlosberg defines procedural justice as "fair and equitable institutional processes of a state" (2007: 25), meaning that all people have an equal ability to contribute to decision-making processes. Excluding lay people from environmental policy discussions because they lack formal credentials or do not communicate using jargon-filled expert discourse demonstrates a lack of procedural justice. (See also Chap. 3 in this volume.)

## Theoretical Approaches to Risk

Contemporary understandings of risk relate closely to changes and defining features in the social order. Current experiences of risk are fundamentally distinct from those of earlier societies due to several features of contemporary society.

First, the scientific and technological innovations that contribute to our style and quality of life also create unintended consequences and additional risks (Beck, 1992). Relatedly, the current political economic system of global neoliberalized capitalism has greatly increased environmental degradation (Foster et al., 2010; Schnaiberg & Gould, 1994). These risks also require high levels of expertise and specialized knowledge to understand.

Second, contemporary society is defined by high levels of rationalization and, as a result, efforts to control the natural world and its associated risks (Weber, 1905; Zinn, 2008). Thus contemporary societies have embrace their improved, though ultimately incomplete, ability to understand, calculate, and predict future risks produced by our scientific and economic systems.

Third, current modes of social organization have amplified risks and the perception of risks. The global population has increased dramatically in the last century and is increasingly urbanized (WHO, 2014), leading to concentrated human settlements that create new and exacerbate existing health and environmental hazards. Globalization has created "systemic instability and fragility" such that risks are embedded in the

global system (Centeno et al., 2015). A globalized, rapid-cycle mass media and proliferation of social media have increased the ability to quickly diffuse information about risks and risk events, so that it is possible to learn almost instantly about floods in Bangladesh, violence in Afghanistan, or chemical spills in West Virginia. This increases awareness of risk events and can heighten perception of risk likelihood and severity.

## Realist and Constructionist Perspectives

Epistemological approaches to risk exist on a spectrum from *realist* to social *constructionist* (Lupton, 1999). Realist positions see risks as representing real, objective forces in the world, and seek to identify risks through measurement, calculation, and models (Zinn, 2008). Techno-scientific approaches to risk on this end of the spectrum assume that risks are pre-existing in nature and require better, more precise technical models to be understood and controlled (Lupton, 1999:18). In this perspective, more accurate, expert-driven information can improve the understanding and prediction of risk events as well as the prevention and control of undesired consequences.

In contrast, constructionist approaches see risks as created through social processes, noting "the identification of risks takes place in specific sociocultural and historical contexts" (Lupton, 1999:13). A "strong constructionist" perspective reduces risks to socially and institutionally structured perceptions that influence people's interactions with the external world, arguing that no phenomenon is a risk on its own and, conversely, anything can be socially defined as a risk. A "weak constructionist" approach sees risks as real in their consequences, while our interactions with and understandings of them are socially produced. Weak or strong constructionist approaches are generally dominant in sociology, while realist approaches are more typical in the natural sciences, risk assessment, and environmental economics (Lupton, 1999). Sociology has been particularly influential in asserting and demonstrating the importance of values, knowledge, rationality, power, and emotion in theories of risk (Zinn, 2008:13). York (2015:96) argues that environmental sociology historically took a more realist approach to environmental risks, acknowledging the measurability and tangibility of risks in the physical world. However, most environmental sociology today also acknowledges the importance of the social construction of risk (Dunlap, 2010).

An emphasis on risk as somewhat socially constructed is important because perceiving, interpreting, and acting upon risk involve social factors beyond the calculated risk (Bradbury, 1989; Freudenburg & Pastor, 1992). As Kasperson and colleagues (1988) note, "hazards interact with psychological, social, institutional, and cultural processes in ways that may amplify or attenuate public responses to the risk or risk event" (p. 177). Other scholars have argued that risk is not just influenced by social factors, but is also *performed* by social actors, as with Olofsson et al.'s (2016) work on the "doings of risk." For example, parents perform the risk of sun exposure by covering their children's bodies with protective clothing and sunscreen, leading to an embodied experience of risk (Olofsson et al., 2016:348).

## Risk Perception

Research on risk perception and communication focuses on the factors that influence levels of perceived and relative risks. Often grounded in a dichotomy between "real" risk as measured by experts and "subjective" risk as understood or perceived by the lay public, this research has documented how risk perception is influenced by factors other than quantitative outcomes, including framing, emotional resonance, ethical issues, and economic or occupational interests (Baugher and Roberts 1999; Sandman 1989; Slovic 1987). Sandman (1989) suggests that public risk perception involves not just the likelihood and severity of an undesired outcome but also the social outrage associated with it (Risk = Hazard + Outrage). A prominent area of risk perception research, the psychometric model, focuses on

"risk heuristics," which map risk perception according to cognitive particularities of individuals and various features of the risks themselves. For example, Slovic (1987) argues that risk perception is influenced by two clusters of factors: whether the risk involves dread, and whether the risk is unknown.

Environmental sociologists have identified trends in risk perception related to major environmental hazards, such as climate change or pesticide use (Brulle et al., 2012; Leiserowitz et al., 2006). Survey data consistently find that environmental issues are not identified as top priorities for most people, listed far below economic or national security issues (Smith et al., 2017). Studies often identify the so-called "white male effect," in which lower levels of concern among white males about topics like climate change or chemical exposures are due to a subpopulation of white males who favor protection of status quo, prefer existing hierarchies, trust conservative think tanks and media, and self-identify with risk-denial spokespeople who tend to be white men (McCright & Dunlap, 2011).

## Risk Society

The *risk society* theory argues that, in contemporary society, social organization is structured by the potentiality of future hazards (Beck, 1992, 1999; Beck et al., 1994). Most associated with Beck's writings, risk society theory identifies a transition between modern, industrial society—or "first modernity"—and a globalized, networked industrial society—"second modernity"—in which probabilistic, technological risks are simultaneously real and perceived. The types of unpredictable hazards that people faced under first modernity, including natural disasters, disease epidemics, or nation-state conflict, were the hazards of "catastrophe," and are fundamentally different from the socially-produced hazards of "calculable risk" and "anticipation of catastrophe" faced today (Beck, 2014:40, 1993:32). Thus instead of unknowable natural disasters or "acts of God," contemporary society experiences risks (Giddens, 1990). The risks that epitomize the risk society, including climate change, nuclear meltdown, or genetically modified organisms, are directly created by second modernity (Zinn, 2008). As Beck writes, "the institutions of industrial society produce and legitimate hazards which they cannot control" (2014:26). Thus these problems are fundamentally societal, not ecological, because they arise from the structure and processes of contemporary society, not from the natural world.

These contemporary risks share several defining characteristics. First, risks are simultaneously created by expertise and science, and comprehensible through expertise and science, a "peculiar *synthesis of knowledge and unawareness*" (Beck, 1999:140, original emphasis). Risks of the risk society are scientific and technical in nature, created by experts who are often blind to those risks. This makes them relatively inaccessible to the lay public. Relatedly, risks are probabilistic yet incalculable in nature, suggesting that risks can be estimated but never truly known (Beck, 1993). Because their origins lie in scientific and technological systems, unintended consequences are commonplace, and solutions or interventions against risks "bear in themselves the seeds of new and more difficult problems" (Beck, 2014: 38).

The complexity of the technological and social systems that create these risks allows for conditions of *organized irresponsibility*, in which society simultaneously experiences greater environmental degradation, expanded environmental laws and regulations, and an inability to hold any individuals or institutions accountable (Beck, 1999). Beck argues that the risk society's *relations of definitions*, including the "rules, institutions and capacities that structure the identification and assessment of risk" (Beck, 1999: 149), preclude the assignment of responsibility.

A second main feature of the risk society, according to the theory's proponents, is that risks are simultaneously local and global in their impacts (Beck, 1992, 1999; Giddens, 1990). Everyone is impacted by climate change or by nuclear fallout: "environmental dangers 'know no boundaries'" (Beck, 1999:142). Thus contemporary risks are so major and pervasive that they

transcend social and geographic boundaries, and "have an egalitarianizing (or one might say 'democratizing') effect. They do not distinguish between the poor and the rich" (Zinn, 2008: 37). Beck (1993) writes about this as the "de-localization" of risks across space and time, as risks do not respect socially defined borders and often have long latency periods (p. 334).

Third, risks are simultaneously real and socially constructed (Beck, 1999:135). It is impossible to separate the risk itself from people's perception of that risk (Zinn, 2008:25). Beck distinguishes between tangible, material impacts of risk events once they occur, and socially constructed perceptions or understandings of possible future risks. Importantly, it is the socially constructed perception of risk that drives action in the current moment; as Beck writes, "Believed risks are the whip used to keep the present moving along at a gallop" (1999:137).

Change is possible in the risk society through *reflexivity*, society's active response to risks (Beck et al., 1994). For Beck (2014), reflexivity means that society becomes self-critical and engages in self-confrontation. Contemporary social institutions are susceptible to political rearrangement, and thus have the potential to turn inward on themselves, sometimes but not always entailing reform or change within those systems (Beck, 1999). A loss of faith in modern institutions, including science and the nation state, can lead to reevaluated priorities and identification of problems created by the risk society, including greater awareness of organized irresponsibility. This involves decision-making power being diffused to the general public, such that decisions about how to act are no longer left in the hands of experts but must involve broad democratic engagement (Beck, 1999:141). For example, climate change has the potential to inspire systemic change through what he calls "emancipatory catastrophism" (Beck, 2010, 2014). Giddens (1990) is generally less skeptical of scientific and technological systems, instead seeing reflexivity as a way to identify and avoid unintended consequences of those systems without fundamentally challenging the technocratic expertise that makes them possible.

Risk society has been widely used (and critiqued) in environmental sociology (Rosa et al., 2013). Scholars have interrogated the types of risks that characterize the risk society, conditions of reflexive modernization, and the risk society's assertion that risks cut across traditional lines of inequality, using environmental topics as varied as contested environmental illnesses (Cable et al., 2008), climate change (Alario & Freudenburg, 2010), agriculture (Stuart et al., 2012), regulatory science (Frickel & Vincent, 2007), and environmental decision-making (Howes, 2002).

## Governmentality

Unlike the risk society theory, which generally sees risk as something that is technocratically managed by society, *governmentality* approaches understand risk as a governance strategy for managing subjects, largely drawing on the work of theorist Michel Foucault (1980, 1991). For governmentality scholars, a defining characteristic of contemporary society is *neoliberalism*, a perspective on government that favors unregulated markets and a small state apparatus as the best way to allocate all resources, including social goods. As Lupton summarizes, "risk may be understood as a governmental strategy of regulatory power by which populations and individuals are monitored and managed through the goals of neo-liberalism" (1999:87). Following a strong social constructionist perspective, risks represent "a particular way in which problems are viewed or imagined and dealt with" (O'Malley, 2008:57). Similar to the risk society theory, governmentality sees the risks characterizing second modernity as probabilistic: "risk is a way… of ordering reality, of rendering it into calculable form" (Dean, 1999:131). Risks are also detached from the individual and are managed at the population level. For example, insurance pools assign risk factors to individuals in ways that eliminate individual distinctions and spread losses and benefits across a population. Risk events can allow neoliberal governments to enact dramatic

changes. For example, following devastating disasters like hurricanes, governments may change property law to privatize common resources or education policy to disempower public education (Klein, 2014).

The diffuse nature of power is central to a governmentality theory of risk. Beyond direct coercion, indirect strategies and surveillance rely on "individuals' voluntary compliance with the interests and needs of the state" (Lupton, 1999:87). According to Foucault, power is fragmented, "understood as dispersed among a multitude of agencies and exercised in diverse ways through many apparatuses, institutions, and architectures" (O'Malley, 2008:53). Risks individualize self-management and social control, creating subjects who will *self*-discipline rather than require active disciplining by the state (Althaus, 2005; Taylor-Gooby & Zinn 2006). A diffuse network of experts in government, academia, social institutions (e.g., the media), and the private sector all contribute to collecting, analyzing, and disseminating data to render risks calculable and thus actionable. This demonstrates that power is creative and generative, not merely coercive and constraining. Those in power will use risk to govern through the creation of social norms and expectations (Dean, 1999). Norms of "self-care" and "work-life balance," for example, place additional burdens on workers rather than challenging labor conditions of constant availability and precarious employment that benefit employers. The important thing is not a risk object or event itself, but rather the social "truth" of that risk and how that truth is produced and constructed (Lupton, 1999:85).

Research on "eco-governmentality," "environmentality," or "environmental governmentality" describes how self-disciplining individuals become "eco-rational subjects," pursuing certain types of environmental behaviors in line with state and corporate interests, in particular related to sustainable development and environmental governance (Darier, 1996; Foster, 2011; Luke, 2016). For example, Agrawal (2005) examines how governmentality strategies shifted residents of an Indian province from resisting all land use regulations to acting as model conservationists. Other research links biopolitics and market-based environmentalism on topics as varied as health seeking behaviors (Armstrong, 1995), population and forestry management (Nel, 2015), and pesticide risk assessment (Guthman & Brown, 2016).

## Cultural Perspectives

The cultural (or socio-cultural) perspective on risk is most closely linked to the writings of anthropologist Mary Douglas and her collaborators, whose work examined issues of purity and defilement, (social) pollution, and taboo (Douglas, 1985, 1992; Douglas & Wildavsky, 1982). This research highlights how individual and community expressions of risk are cultural constructs involving identity and boundaries between members and outsiders (Douglas & Wildavsky, 1982), focusing on how and why things come to be defined as risky. Douglas's primary argument is that "notions of risk are used to establish and maintain conceptual boundaries between self and Other," and that "the human body is used symbolically and metaphorically in discourses and practices around risk" (Lupton, 1999:24–25).

From the cultural perspective, risk understandings and perceptions do not function at the individual level. Rather, "institutional structure is the ultimate cause of risk perception" (Rayner, 1992:86). Risks are deeply tied to cultural ways of knowing and doing. The heuristics or risk categories that individuals use to evaluate risks derive from community-level understandings of the desirability and probability of different events and consequences, not individual or psychological understandings (Douglas, 1985). Although cultural theory recognizes that hazards do exist outside of cultural perception, it focuses on how those dangers are understood and politicized in different cultural contexts. For example, Douglas and Wildavsky (1982) examine how the U.S. environmental movement informed concerns about cancer risks from industrial pollution.

## Organizational Perspectives

Organizational scholars argue that risks and risk assessment practices are impacted by institutional form and function. Vaughn's work on the Challenger space shuttle explosion, for example, found that "mistake, mishap and disaster are socially organized and systematically produced" by an organizational culture that normalized deviance from safety requirements (1996:xiv). Risk evaluations vary because organizations are able to perceive and act on risk only with the resources and knowledge possessed in the moment (Clarke 1988). Power, organizational structure, and institutional culture significantly influence what counts as legitimate scientific evidence, which research trajectories are actively pursued and validated, and how decisions are made (Brickman et al., 1985; Frickel & Moore, 2006; Kleinman, 1995).

Perrow's work on *normal accidents* (1984) identifies how high-risk technologies, such as nuclear power plants or hydroelectric dams, are interconnected through tightly coupled systems that are incomprehensible to most observers, putting these technologies at risk of catastrophic failure due to small problems. He argues, "risk will never be eliminated from high-risk systems" (Perrow 1984:4). Because of the catastrophic nature of these high-risk technologies, their use is fundamentally irresponsible (Zinn, 2008:11). Other research has identified organizational features that contribute to risk reduction or amplification. For example, work on *high reliability organizations* identifies "commonalities among organizations that function under hazardous conditions but experience fewer than their fair share of adverse events" (Black & McBride, 2013:1), including a preoccupation with failure, reluctance to simplification, sensitivity to operations, commitment to resilience, and deference to expertise (Sutcliffe, 2011; Weick, 1995). This research has been particularly influential in research and practice on disasters and disaster response.

The organization of social institutions, government agencies, and private firms influences the public's knowledge and experience of risk. Neoliberal shifts in governance have left local, state, and federal agencies underfunded and constrained in their ability to adequately respond to risks identified by communities, particularly those already disadvantaged.

## Environmental Sociology and Risk

Beyond overarching theoretical approaches, risk is central to the research and writing of environmental sociologists across the subdiscipline. Although a full review of how risk matters for all topics in the field is beyond the scope of this chapter, I will describe how risk comes into play in two areas of contemporary environmental sociology scholarship: environmental health and environmental justice.

## Environmental Health

*Environmental health* refers to connections between human health and "exposures to human-made toxins and other harmful exposures in air, food, and water" (McCormick, 2015:181). Risk evaluation is fundamental to the use and regulation of chemicals in many ways, and thus environmental sociologists studying environmental health issues think and write about risk extensively.

Evaluating risk is a central feature of chemicals regulation. In the United States, the EPA regulates industrial chemicals through the Toxic Substances Control Act (TSCA), first enacted in 1976 and significantly revised in 2016. However, widely acknowledged problems with TSCA mean that the regulation of most chemicals, especially those in production before 1976, is inadequate in many ways (Geiser, 2015; U.S. EPA, 2012; Vogel & Roberts, 2011). Although the bipartisan revisions to TSCA include significant improvements in the prioritization and evaluation of chemicals, significant limitations remain (Cordner, 2016b). For example, risk-based evaluations are required for only

20 high-priority chemicals at a time, a fraction of the more than 80,000 chemicals currently on the TSCA inventory. Proposals to limit the types of exposure calculations that can be included in TSCA risk evaluations point to one of the fundamental limitations of risk assessment: ultimate determinations of risk and safety are only as complete as the data included (Denison, 2018; U.S. EPA, 2018b). Quantitative risk assessment generally favors the continued use of potentially hazardous products because of the high requirements for data and its general obfuscation of uncertainty and data gaps (Magnus, 2008). For this reason, technical risk assessment processes typically favor industry stakeholders at the expense of the public or exposed populations such as workers or residents of nearby communities (Winner, 1987). Without complete data on exposure and hazard, risk assessors can only use speculation or information about similar chemicals to calculate risks. Thus the absence of data regarding either exposure or hazard can be interpreted as affirming the absence of risk (Cordner, 2015a).

Risk evaluation processes can identify concerns associated with specific compounds, but provide little guidance for decision-makers who may want to avoid chemicals of concern. A process of *regrettable substitution* is common, described by environmental health advocates and researchers as a process of "chemical whack-a-mole" (Cordner, 2016a). For example, the use of the plasticizer Bisphenol A in many consumer products has largely been replaced with compounds such as Bisphenol S or Bisphenol F, which are similar in chemical structure and ability to disrupt hormone systems (Rochester & Bolden, 2015). As an alternative to risk assessment, many scholars and public health advocates support greater focus on chemical hazard through *alternatives assessment*, which identifies the relative hazard of chemicals used for the same performance use (Hogue, 2013; Lavoie et al., 2010; NRC, 2015; U.S. EPA, 2011). These assessments are designed to inform chemical decision making: if a company wants or needs to stop using a certain chemical because it has been restricted or because of health or environmental concerns, but needs a replacement chemical that fulfills the same function, alternatives assessments identify less hazardous replacement chemicals. Alternatives assessments are conducted by federal governments (e.g., the EPA's Design for the Environment or Safer Choice programs), state governments (e.g., Washington State's Department of Ecology), and nonprofit groups working on safer chemistry (e.g., Clean Production Action). Although chemical industry representatives participate as voluntary stakeholders in some alternatives assessment processes, they are generally quite critical of this hazard-based approach because means that chemicals can be evaluated as high hazard—and thus undesirable for use—even if exposure is predicted to be low (Jack, 2012).

Chemical risk assessment and evaluation processes assume complete information about hazards, exposure profiles, and dose-response relationships. Yet given the high levels of uncertainty and data gaps in all environmental health cases, this assumption of complete information is fundamentally flawed. In many ways, uncertainty "is an inherent property of scientific data" (NRC, 2009:4)—for many reasons (Cordner & Brown, 2013). People are exposed to hundreds of chemicals every day, which may act in synchronistic, antagonistic, or cumulative ways. Documenting historical and current chemical exposures is scientifically complicated and resource-intensive. Numerous exposure pathways exist for any chemical, and health effects of chemical exposure have long latency periods. Toxicological experiments generally are not permitted on humans, the effects of animal studies do not align perfectly with human health effects, and all studies are limited in scope. Complex chemical exposures interact with other individual factors, like genetics, to influence health outcomes (Weinhold, 2006).

Areas of ignorance can also be institutionally produced through structural features of social institutions that produce and use scientific evidence (Frickel & Edwards, 2014; Frickel & Vincent, 2007; Gross, 2007; Kleinman & Suryanarayanan, 2012; McGoey, 2012). In other cases, as was described above, ignorance and

uncertainty are themselves *strategically* produced and used, challenging conventional expectations that knowledge will inevitably be communicated and applied (Markowitz & Rosner, 2002; Michaels, 2008; Proctor & Schiebinger, 2008). Thus through both intentional and unwitting control over the production, dissemination, and use of scientific information, stakeholders in government and industry deploy and produce ignorance to discredit or ignore exposure-health linkages (Richter et al., 2018). Similar patterns exist with corporate funding of climate denial (Oreskes & Conway, 2010). High levels of methodological, data-driven, and conceptual uncertainty result both from scientific practices and from the political, economic, and social forces that influence the production, interpretation, and use of research findings (Cordner, 2016a). My research on *strategic science translation* explains how stakeholders interpret and communicate scientific evidence to intended audiences to advance certain goals and interests (Cordner, 2015b), ranging from selective use of evidence to summarize the state of the science, to inaccurate communication of scientific findings for strategic purposes.

Environmental sociological research on environmental health controversies has also focused on social movement organizing. This has been a topic of interest for the field since its early days, as environmental sociology emerged along with the environmental, anti-toxics, and EJ social movements of the 1970s and 80s (Cable & Cable, 1995; Dunlap & Catton, 1979; Dunlap & Mertig, 1992; see also Chap. 24 in this volume). *Social movements* are "collective challenges to systems of authority" (Snow, 2004) that traditionally targeted the state and advocated for regulatory interventions. Contemporary social movements have expanded beyond the state and now target a broad "field of contention," including political structures at all levels, market institutions and companies, the media, other social movements, and scientific and medical institutions (Armstrong & Bernstein, 2008; Taylor & Zald, 2010). Environmental health movements in particular can involve a broad *multisector alliance* of traditional and unexpected allies, including scientists, regulators, other social movements, journalists, filmmakers, business and industry representatives from along the supply chain, workers, military and veterans groups, and other health and disabilities advocates and professionals (Cordner & Brown, 2013). Social movements also leverage scientific authority in various ways, by recruiting and working with scientists on staff or as direct allies (Allen, 2003; McCormick, 2009; Ottinger & Cohen, 2011), collaborating with less visible "shadow" experts (Frickel et al., 2015), directly participating in scientized debates about exposure and health concerns (Brown et al., 2012), and producing their own research through citizen science initiatives (Corburn, 2005; Irwin, 1995; Kinchy, 2017).

Environmental social movements are concerned with the existence and distribution of environmental risks, including climate change, ocean pollution, and electronic waste (Little, 2014; Longo & Clark, 2016; Pellow, 2007; Roberts & Parks, 2007). Indeed, the formation of locally based social movement organizations is often precipitated by the identification of environmental risks. From buried industrial waste in the working class community of Love Canal, NY (Levine, 1982), to air and water pollution from industrial scale hog farming in North Carolina (Wing & Wolf, 2000), communities have identified environmental risks in their backyards and pushed for industry or government intervention and remediation (Allen, 2003; Bullard, 1999; Lerner, 2010; Mohai et al., 2009; Perkins, 2012). Illness sufferers and their families have organized around contested illnesses with contestation around environmental etiology or treatment (Brown et al., 2012). These *embodied health movements* involve the direct experiences of people who have either a disease or a disease precursor or contributor, typically collaborating with scientific allies (Altman et al., 2008; Brown, 2007; Brown et al., 2004). People also have greater awareness about their routine exposure to chemicals, though this awareness may drive self-protection measures that are largely ineffective and can detract from more systemic change (MacKendrick, 2018; Szasz, 2007).

Workers often play significant roles in raising the profile of environmental health hazards, since they may be the human equivalent of "canaries in the coalmine." When occupational groups align their advocacy with environmental activists, the resulting *blue-green coalitions* can be particularly influential (Estabrook, 2007; Obach, 2004). While labor and environmental groups are often assumed to have contradictory approaches to industrial decision-making and different positions in political and regulatory debates, health issues contribute to successful coalition-building between unions and environmental health activists (Mayer, 2009).

These examples show how social movements conceptualize risks as structural features of industry and government, and take collective action to reduce those risks. Many social movements identify hazards as the most central facet of environmental exposures, arguing that reducing hazards is a more protective way to address harm. This approach aligns directly with EJ principles (Bullard, 2005), demonstrating the strengths of possible EJ-environmental health collaborations.

## Environmental Justice and Inequality

Inequality and EJ concerns have also been central to environmental sociologists' engagement with risk. EJ is fundamentally about the distribution of environmental hazards and the rights of all people—in particular those most affected by environmental hazards—to be recognized and participate in environmental decision-making processes (Agyeman et al., 2016; Mohai et al., 2009; Schlosberg, 2007). EJ is guided by deep and meaningful involvement of marginalized populations, the protection of all populations from environmental hazards, an emphasis on prevention and precautionary approaches, and redress of disproportionate exposures (Bullard, 2005). EJ scholars and advocates have long examined the uneven creation and distribution of environmental risks, including hazardous waste sites, various forms of pollution, agricultural risks, chemical exposures, and climate change impacts (Bullard, 1999; Downey, 2015; Faber, 2008; Harrison, 2011; Mohai & Saha, 2015; Pellow & Brulle, 2005). This work consistently demonstrates that people of color and low-income people are exposed to a higher burden of environmental risks because of both intentional and systemic factors influencing the siting of environmental hazards, and experience a higher burden of disease-causing pollution (see also Chap. 3 in this volume).

Political economy theories provide insight on the causes and consequences of environmental risks, in particular why high levels of environmental degradation and inequality are so prevalent in contemporary capitalist society (Gotham, 2016; Rudel et al., 2011). The *Treadmill of Production* perspective argues that there is an unavoidable conflict between the capitalist mode of production and environmental protection (Foster et al., 2010; Schnaiberg & Gould, 1994). Regardless of the actions of individual actors or steps taken by the state or social movements, capitalism's need for growth and profits will always lead to greater environmental destruction, because the drive for expansion requires greater withdrawals from the environment (extraction of natural resources) and additions into the environment (pollution).

Seeing inequality as inherent to environmental risks is incompatible with seeing risks as transcending existing lines of inequality. The risk society theory has been critiqued for ignoring people's different abilities to anticipate, mitigate, and respond to risks (Freudenburg, 2000). Alario and Freudenburg's "Titanic Risks" approach (2010) compares global, technologically-inspired risks to the sinking of the Titanic ocean liner. They note that the Titanic was viewed as a technological achievement beyond failure, when in fact it was a high-risk technology. Additionally, casualties were highly unequal by socioeconomic and sociogeographic location, as most wealthy passengers survived while most people killed were from the third-class cabins.

Environmental sociology is increasingly drawing on theoretical and empirical work from critical race studies, indigenous studies, and intersectionality to examine inequality and environmental risks (Lockie, 2018; Malin & Ryder,

2018; see also Chap. 2 in this volume). This scholarship notes the urgency of environmental injustices and unequal distribution of hazards and opportunities: "Environmental justice struggles intensify, as do related risks to socio-environmental equity and environmental health" (Malin & Ryder, 2018:1). Noting that experiences with environmental hazards vary across multiple sociodemographic and sociogeographic lines adds a further critique to traditional risk evaluation, because quantitative risk assessments are unable to account for the full diversity and complexity of people's lived experiences. Instead, "intersectional risk theory shows that risk is constituted and produced in social and geographic spaces" (Olofsson et al., 2016:346). Critical indigeneity research identifies additional sites and causes of distributive and procedural injustice (Hoover, 2018; Kojola, 2018). For example, Norgaard (2014) shows how ignoring and devaluing the traditional forest management practices of the Karuk tribe has led to increased wildfire risk on tribal and public lands, along with numerous other social, cultural, and ecological harms.

## Conclusion

Risk is a central feature of the contemporary world with undeniable salience for environmental sociology. Topics as varied as health and social outcomes for coal miners, sea level rise from climate change, and rock climbers' interactions with the outdoors all involve risk. Environmental sociologists have drawn on multiple theoretical perspectives to understand and evaluate risk and risk evaluation processes, often with critical eyes to claims of expertise and authority, and with necessary sensitivity to inequality and justice concerns. To conclude I will highlight three concerns with which the field must continue to engage: the scale of contemporary risks, the transdisciplinary nature of risk understanding, and social responses to risks.

The question of scale matters greatly for studies of risk. Is the appropriate scale for evaluating environmental risks primarily the *micro and interpersonal*, as psychological and heuristic studies of risks would suggest; the *institutional* level, as advocated by governmentality research; or the *macro* level, reflecting the overarching organization of contemporary life described by risk society and political economy theories? While certainly individual level reactions to risk matter greatly, it is undeniable that contemporary environmental risks are not purely individual in nature, but are informed by cultural and social understandings as well as institutional and state processes that filter and inform risk perception. Future theoretical and empirical scholarship would do well to examine how these scales overlap and interact.

Additionally, the creation and management of risks operates at increasingly large scales across time and space. Our global political economic system ensures that risks are rarely created and experienced in the same location. Instead, rifts exist between the sites of production, consumption, and disposal, so that different populations and geographies will experience risks caused by the extraction of raw materials, the processing of those natural resources into finished products, the consumption of consumer goods, and the disposal of waste products (Foster, 1999). While earlier environmental sociology work on risk (like risk theories in the social sciences generally) focused almost exclusively on the United States and Europe, scholars are paying needed attention to other parts of the world (Centeno et al., 2015). This holds significant promise for interrogating and revising influential theories of risk to better incorporate non-Western perspective and experiences, trace the legacies of colonialism and resource exploitation on the creation and experience of environmental risks, and identify the risks that are most salient to multiple sociogeographic and technological situations around the world.

Understanding contemporary environmental risks nearly always demands analysis and knowledge that crosses traditional disciplinary boundaries. For example, evaluating the risks and potential impacts of climate change severity requires many types of knowledge, including the natural and physical sciences to understand

climatic and geologic patterns; advanced mathematics and computational sciences to develop and interpret sophisticated models; and social sciences to understand individual-, social-, and government-level responses and feedback loops (e.g., IPCC, 2014; Young et al., 2006). Similarly, sociologists are collaborating on toxicological, epidemiological, and exposure science projects in the environmental health field (e.g., Finn & Collman, 2016; Hoover et al., 2015; Matz et al., 2016). With a strong focus on intersecting environmental inequalities, research has moved away from disciplinary silos toward engaged transdisciplinary work in partnership with impacted communities (Cordner et al., 2019). In such approaches, sociologists can become active members of transdisciplinary research teams rather than just observers or translators of research findings.

The transdisciplinary nature of environmental risks requires environmental sociologists to seek out atypical areas of training and expertise. Whether studying toxicology and exposure monitoring as part of their research on chemical risk assessment, learning advanced computational programs to study climate modeling, or becoming proficient in forest management strategies in their research on logging, environmental sociologists must seek training and knowledge in areas distant from traditional sociological instruction. This is particularly important for those scholars whose research involves critical understanding of formal risk assessments and evaluations, because they need to understand the assumptions, data sources and gaps, and calculations used in technical risk documents and policy practices.

A final concern for environmental sociologists studying risk is the social response to risks. Whether the issue is nuclear power generation, agricultural runoff, or earthquake hazards, how should individuals, social institutions, and governments prepare for, prevent, and respond to environmental risks? In the United States, regulation of environmental issues is generally *reactionary*, meaning it is pursued only after negative impacts have been more-or-less proven. For example, industrial chemicals cannot be banned or removed from commerce until researchers produced significant evidence of harm, and even then regulation is often delayed or denied. This approach, often described as "risk-based" because it is anchored in formal risk assessments, is criticized for data gaps, long delays, and disconnects between available data and knowledge needed by decision makers (NRC, 2015). Risk-based standards require levels of scientific certainty that are difficult to achieve, and, as biologist and advocate Sandra Steingraber notes, "uncertainty is too often parlayed into an excuse to do nothing" (1997:72–73).

A contrasting model, the *precautionary principle*, suggests that when an activity or substance poses a significant potential risk, action should be taken, even when uncertainty exists (Carolan, 2007; Commonweal, 2013; Raffensperger & Tickner, 1999). Under the precautionary principle, the burden of proof shifts from those who suffer the harms of an activity to demonstrate harm, onto those who benefit (typically financially) from an activity to demonstrate no expected harm (Sachs, 2011). This approach is already institutionalized in many areas of life, such as public safety or pharmaceutical development, though it is rarely practiced in environmental or health fields. European chemicals regulation generally takes a more precautionary approach, requiring greater evidence of safety for chemical evaluation (Karlsson, 2010).

Advocating for action ahead of certainty is challenging for scientists, including sociologists. Yet the severity of environmental risks and attendant social impacts necessitates ambitious and sociologically informed responses to address and alleviate inequality, suffering, and irreversible ecological devastation. Feagin advocates for an explicitly social justice-oriented sociology committed "to social justice in ideals and practice" (2001:10), a perspective that should be extended to an *environmental and social justice-oriented sociology*. Armed with an understanding of environmental risk that is theoretically and empirically grounded, sociologists can contribute to improved environmental and social conditions through careful scholarship, appropriate critique of risk evaluations, contributions to those evaluations and to risk policy processes, and advocating for impacted communities, populations, and ecological systems.

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# Sociology and Climate Change: A Review and Research Agenda

10

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## Introduction: Changing Sociology

For nearly four decades, scientists warning of the likely impacts of global warming put substantial efforts into educating the public about the increasing dangers and the actions that would be needed to respond. The prevailing, if unstated, theory of change was that more information about the gravity of the risks would drive people, and policymakers, to act. Despite four decades of delay and even rollback in many countries, this "post-political" stance remains nearly universal among many natural scientists and educators (Dunlap & Brulle, 2015). To social scientists, in particular sociologists, it should be clear that economics and politics are central to climate change: to its causes, its consequences, and to the difficulty of mustering adequate climate action. Scientific facts are indispensable, but deeper understandings of the social systems and structures in which climate change has emerged as an issue and in which it is addressed are just as urgently needed.

Sociology is uniquely situated to speak to the causes and consequences of climate change. Many environmental sociologists have led the way, but there is ample room for other subfields to transform and be transformed by climate change research. This chapter seeks to highlight the advances that environmental sociologists have already made in the literature on climate change, and to identify avenues in need of further research that require engagement and expertise from other subdisciplines. Most importantly, we aim to elaborate both how sociology can transform climate change research, and how climate change research can transform sociology (Elliott, 2018). In particular, with its central attention to issues of inequalities and justice, sociology can critically consider the unequal sources and impacts of human-caused climate change, along with the politics of the solutions that are being proposed. Klinsky and co-authors have argued that attending to equity in climate solutions is fundamental to their ambition and success (Klinsky et al. 2017). Likewise the field's attention to social institutions and social movements make it hugely useful in understanding human response to climate change, filling the holes left by individualizing explanations in economics, public opinion/communications, science, and psychology (Dunlap & Brulle, 2015).

The sociology of climate change is very new and is still a small subfield. For decades, natural

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scientists and economists controlled the discourse on climate change and climate policy. Human geographers have been quicker to address issues regarding adaptation to climate change, and Gramscian geographers have usefully taken up the political economy of society's response. The Environmental Sociology section of the American Sociological Association is relatively small, and there has been a strong perception that it has had relatively little traction in influencing the core of the discipline (see Scott & Johnson, 2017). But in 2013, after a similar effort by the American Psychological Association (Swim et al., 2009), the ASA organized a Task Force on Climate Change. The group confronted a field barely mobilized to study this area. Still, led by Riley Dunlap and Robert Brulle, the effort of assembling writing teams and holding sessions at successive annual meetings drove significant advances on a number of fronts in just a couple of years (Dunlap & Brulle, 2015). Since then, the pace of research in the field has accelerated, but major gaps remain. Here we seek to not just review what sociology can bring to addressing climate change, but also how sociology can benefit from incorporating studies of climate change into the broader field.

Climate change presents new challenges and opportunities for sociological research. Fortunately for environmental sociology, the subfield already has a number of theoretical and analytical tools that can serve as a strong foundation to its study. These consist of structural critiques that primarily identify capitalism as the key mechanism for ecological destruction, theories of global risk, questions of hybridity and nonhuman agency, as well as notions of modernization through technological solutions, and the role of organizations and markets in both leading to and potentially leading us out of potentially catastrophic changes in the climate.

Industrialization and the emissions from industrial production, and the energy demands of lifestyles in industrialized countries, have been well-established as the primary drivers of climate change. Therefore, the socio-ecological transformation that took place with the transition to industrialization under capitalism should be central to any analysis. This includes the reinterpretation of nature as natural resources (Scott, 1998) as well as the false commodification of land (Polanyi, 2001[1944]). What Marx refers to as the "metabolic rift," characterizing the disconnection of the social metabolism between humans and nature as people move from country to town, has already been scaled to the climate crisis (Foster, 1999).

Foster (2010) expands Marx's concept to the *ecological* rift in which humans have become not only alienated from nature, but from the Earth itself, acknowledging that the global expansion of capitalism is literally destroying the planet (Foster, 2010). The *treadmill of production* theory also elaborates the impact of capitalism's intrinsic logic of continuous growth as a factor in environmental devastation (Foster, 2010; Schnaiberg, 1980; Schnaiberg & Gould, 2000; York et al., 2003). As individual firms are driven by the need to compete with others to "externalize" as many ecological and social costs as possible, the treadmill of production hastens, and ecological and social destruction increases. Furthermore, we know that it is primarily global elites that keep this treadmill going. As Downey (2015) explains, there are organizational, institutional, and network-based mechanisms by which global elites maintain and expand their power and simultaneously degrade the environment. These elites are positioned advantageously in economic, political, military, and ideological power networks, and benefit directly from not only avoiding action to mitigate climate change, but from actually exacerbating it. This helps us understand how an issue of this magnitude can emerge and fail to be addressed.

Environmental sociologists have also found ways to productively challenge the human exceptionalism assumed by many other sociological subfields, to better understand ecological crises. These theories also propose a new way of thinking across a human/nature divide that can inform policy-making and political economic accountability (see Dunlap & Catton, 1979). For example, Moore (2015) argues that, rather than thinking of nature as something from which we extract value and exploit to the point of depletion and catastrophe, we must invert this idea to think of now nature does work in and for the capitalist

mode of production. Through this shift in narrative, we can see climate change not as a looming crisis in which Nature exacts its revenge after decades of human-caused destruction, but rather as an exhaustion of nature's work in the capitalist mode of production.

Relatedly, work on non-human agency and hybridity can provide the basis for complicating our examination of the causes and consequences of climate change (White et al., 2015). This work stems primarily from the work of Bruno Latour and Donna Haraway. Like Moore's work, Latour's Actor Network Theory (ANT) refutes the dualism of society and nature, focusing on the ways in which humans and non-humans are inextricably intertwined and mutually constituted (Latour, 1993, 2005). Haraway has taken this approach a step further, revealing the blurred line between human and non-human, as people's lives have become co-produced with technologies—such as prosthetic limbs and pacemakers—and interwoven with nature—companion pets, for example (Haraway, 1985, 2003). These approaches enable us to think more creatively about the intertwined human and non-human impacts of climate change. We can also explore the human and non-human actants that have produced climate change, similar to Timothy Mitchell's exploration of how the material properties of carbon influenced the rise of industrialization and democracy in the West, and simultaneously led to military intervention and imperialist politics in much of the rest of the world (Mitchell, 2011).

Environmental sociologists have also theorized how society might find its way out of ecological crisis. Along with his theory of world risk society, itself a useful tool for examining the era of climate change, Ulrich Beck writes of a "cosmopolitan moment" in which people become alert to the universal and unknowable risks that technology and industry pose in our current age (Beck, 1999, 2009). He predicts that people will begin to think reflexively, and will be compelled to action in a democratized "subpolitics."

Ecological modernization scholars have also asserted that people will not only recognize but adjust their practices in the face of environmental destruction, through societal change and technological development (Mol & Spaargaren, 2000; Mol et al., 2009). On the subject of addressing climate change, this might help us better understand approaches from clean energy technologies to geo-engineered counter-balances to limit the effect of emissions on warming, advanced broadly by think tanks such as the Breakthrough Institute and the group responsible for the Ecomodernist Manifesto (Asafu-Adjaye et al., 2015). This goes against the more Marxist theories that call for a transformative, systemic change to capitalism in order to address the problem (York & Rosa, 2003; York et al., 2003).

These and other theories are already in environmental sociologists' toolbox for incorporating and centralizing climate change in our studies. This chapter is organized into four main parts. First, we review the existing literature in two sections on the drivers of climate change, including the factors contributing to emissions through globalization, development, and industrialization. Next, we explore consumerism and public opinion on climate change, also drivers of climate change and climate action. The third section ends with a discussion of how public opinion on climate change and how it is shaped. We then summarize the literature examining how inequality shapes the experiences of different social groups that are exposed to climate change impacts. Here we further emphasize the potential for sociologists from varied subdisciplines to make contributions to the climate change literature, and to incorporate climate change into their own work. In the third section, we identify three types of responses to climate change, namely, policy responses, social movements, and counter-movements to suppress climate action. Once again, we review some of the literature in each of these areas and suggest avenues for further sociological contribution. Finally, we conclude with a research agenda for advancing sociological engagement with climate change. In particular, we highlight the need for sociologists to ensure that our research enters the public arena, influencing policy and public understandings of climate change and its impacts.

## Drivers of Climate Change: Globalization and Industries

Before going any further, we want to be explicit about some of the most basic parts of climate science and climate policy. Humans have been measurably warming planet Earth since the industrial revolution; about four-fifths of the problem is due to the combustion of billions of tons of fossil fuels (IPCC, 2014, 2018; National Climate Assessment, 2018). Most of the rest is due to clearing of forests, methane releases from farming, ranching, landfills and pipelines, and $CO_2$ from the production of cement (IPCC, 2014). Since industrialization took off in the mid-1800s, the atmosphere has already warmed by an average of one degree Celsius (about 1.8 degrees Fahrenheit), oceans are warming and acidifying, and life on land and in water is being threatened by these massive shifts. Sea levels are rising, storms are getting more intense, droughts and heat waves are worsening. These impacts will be most acutely felt by marginalized populations both within and between countries, with the least capacity to prepare for and recover from disasters, while many of the world's wealthiest profit off of highly polluting industries (Roberts & Parks, 2007).

As the theoretical literature described in the previous section suggests, the rise of industrial development and a capitalist economy both spurred increasing emissions of greenhouse gas emissions driving climate change. But what exactly is the relationship between capitalist growth and emissions, and does this relationship decouple as ecological modernization scholars and models such as the environmental Kuznets curve suggest (Grossman & Krueger, 1995). Environmental sociologists have already done significant work in this area. Some of the earliest work on the drivers of emissions developed the identity, examining how the interaction between population size (P), affluence (A), and technology (T) produced a certain impact (I) on the environment. This interaction is better known as the I = PAT formula (Ehrlich & Holdren, 1971), and can be usefully applied to greenhouse gas emissions. Based on observations that increases in population size are not always directly proportional to increases in impact, and that the effect of affluence reaches a peak and then declines, Dietz and Rosa (1997) produced a more nuanced, stochastic model later known as STIRPAT (STochastic Impacts by Regression on Population, Affluence, and Technology) (York et al., 2003). The formula has been used to demonstrate the relative merits of human ecology, the treadmill of production theory, and ecological modernization, finding the most support for human ecology and the least support for ecological modernization (York et al., 2003).

Other scholars have focused on the relationship between emissions and characteristics of development. Using country stratification outlined in World Systems Theory (core, semi-periphery, periphery), Burns et al. (1997) demonstrate that greenhouse gas emissions are most prevalent in countries in or near the core. Interestingly, they delineate that carbon dioxide production is more closely associated with core countries, while methane (a more potent greenhouse gas than $CO_2$), is more closely associated with upper-semi-peripheral countries, which they term the semi-core. Roberts and Grimes (1997) showed that the lower emissions per unit of GDP in the wealthiest nations was not the result of countries passing over the top of the inverted U of an environmental Kuznet's curve, but was the result only of reductions in the corn nations with rising service sectors and offshoring industries (see also Roberts & Parks, 2007). Building on this work, scholars investigating decoupling between economic growth and emissions have noted varied trends between "developed" and "least developed" countries, where the two have appeared to periodically decouple in "developed" contexts while the growth continued alongside a rise in emissions in "least developed" contexts over time (Jorgenson, 2012). York (2012) then notes that, even when growth is curtailed, there is not a proportional decrease in $CO_2$ emissions, pointing out that built infrastructures that produce emissions persist even during periods of negative or no growth.

Sociologists have further complicated the relationship between emissions and growth by drawing on additional measures of development and factors driving emissions. For example, decision-makers' political positions on climate change has been shown to influence US states' relative $CO_2$ emissions (Dietz et al., 2015), while global, political, and organizational factors have been found to interact in complex ways to influence the $CO_2$ emissions from countries' power plants (Grant et al., 2018). Steinberger and Roberts (2010) and Steinberger et al. (2013) have shown that human well-being has largely decoupled from carbon emissions, and that many countries have long life expectancies while emitting very little. Jorgenson (2014) has also identified world-wide regional variations in the carbon intensity of human well-being as it is impacted by development, however his findings reveal that further economic growth will likely lead to increasing carbon emissions, despite its positive effects on well-being. Finally, Fitzgerald et al. (2018) examine the interesting relationship between working hours and carbon emissions between US states, finding a strong positive relationship between working hours and emissions.

Together, these studies have presented foundational and complex findings for the drivers of emissions and the relationship between emissions and growth, which sociologists are well-poised to develop and disentangle. Sociologists can also draw from the existing literature on organizations and markets to understand both what is being put forth as the primary solutions to climate change, as well as the practices and politics determining their role in either promoting or preventing action to combat it. First, market solutions to climate change rose in popularity by making greenhouse gas emissions reductions and minimizing environmental impact a potentially profitable endeavor (Meckling, 2011). The increasing role that the private sector can and should play was included in agreements leading up to the 2015 Paris climate accord, and continues to be promoted in conversations on climate change mitigation and finance. Regardless of position on those elements of climate change action, capitalist markets are arguably not well-suited to take on the task of climate adaptation, due to their primary interest in maximizing profits and tendency to externalize environmental harm (Abadie et al., 2013; Pauw, 2015).

Second, work on markets and organizations tells us that they can both influence environmentally unfriendly practices, and be simultaneously constrained by the norms of the field in which they are located, and the politics of the place where they are based (DiMaggio & Powell, 1983; Freudenburg, 2005). So, while markets and organizations direct consumers to purchase new products, without regard for the impact of the production, use, and disposal of those products on the environment, they also must follow state environmental regulations. Finally, organizations and market actors have the ability to lobby for their interests and prevent or compel political inertia toward efforts like limits on emissions reductions.

A series of societal trends have driven the recent increase in emissions of greenhouse gases around the world; another set of trends is making it more difficult to govern these emissions. In the first batch are the rise of the "global assembly line" producing material goods through global supply chains reaching from far-flung extractive regions to pollution havens for primary processing, export processing zones in low-wage labor havens, and retail marketing in wealthy and poor nations alike (Frey, 1998; Fröbel et al. 1981; Newell & Roberts, 2017; Pellow, 2007). The impacts of this progressive spatial separation of production and consumption are ominous for climate change, and the fossil fuel intensity of transportation makes the structure of these networks difficult and important to address. Substantial research in environmental economics has debated whether firms move to "pollution havens" to escape regulation, creating a "race to the bottom," or whether lower wage rates drive their migration. In terms of carbon emissions and climate change, globalization of production has weakened the ability of states to address the problem (Roberts & Thanos, 2003). Moving extraction and processing and manufacturing "out of sight" makes it extremely difficult for traditional methods of social control to operate (Loomis, 2015). Loomis argues this

effort was intentional, and the lack of a "global state" or even binding international agreements on climate change make this an area without effective regulatory system or "social pact" (see Aglietta, 2000; Lipietz, 1986).

As production chains have expanded, so has consumerism, including the spread of values by the advertising industry pushing new needs around the globe and to previously excluded social classes. The importance of elites in driving the expansion of human desires for material goods is critical to understand, and sociological analysis might be tied back to Thorstein Veblen's (2017[1899]) landmark work on "conspicuous consumption." That is, Veblen's conspicuous consumption and conspicuous leisure have gone global with global brand marketing, with devastating climate consequences.

An important earlier literature at the intersection of world-system theory and environmental sociology charts the "ecologically unequal exchange" (EUE) inherent in global trade. The idea is that massive volumes of raw materials are exported from developing countries to the wealthier nations of the global North, causing ecological devastation in one region, without social benefits of well-paying jobs or investment in communities (Bunker, 1984; Hornborg, 2009; Jorgenson, 2012; Jorgenson & Clark, 2009; Roberts & Parks, 2007; see also Moran et al., 2013). Empirical work from the Vienna-based Institute for Human Ecology showed for example that Africa was exporting seven times the volume of material to the EU than it was receiving, and was being compensated at only a fraction of the value (Giljum, 2004; Giljum & Eisenmenger, 2004). The implications for climate change are again that global production chains are creating zones of poverty and wealth, removing impacts from the sight of the powerful and high-consuming class in the core of the world system. This inequality drives divisions and resentment, worsening the already existing difficulty in generating collective global action and binding agreements (Ciplet & Roberts, 2019; Ciplet et al., 2015; Roberts & Parks, 2007). The unloading of environmental bads onto developing countries also increases their vulnerability to climate change by depleting their environments, impacting their health, and reducing their ability to adapt on their own.

## Consumerism, Green Consumerism, and Public Opinion on Climate Change

Meanwhile, "green consumerism" has often been suggested as a way to address the impacts of the materials we consume; buying local to reduce "food miles," buying "rainforest certified" coffee, or purchasing carbon offsets for our airline flights. While it is true that individual consumption does have a significant environmental impact, sociological insight reveals individuals do not develop their consumption habits in a vacuum. Rather, resource-intensive lifestyles are normalized socially (McMeekin & Southerton, 2012; Shove, 2003), such as the necessity in many contexts of driving personal cars for transportation or the constant use of air conditioning, and businesses work to ensure that consumers continually consume. Products, particularly electronics, are increasingly made to break or become obsolete within a few short years, because of their poor construction and innovative updates of new models (Schor, 2010). Concerns about excessive consumption are also assuaged through green labeling practices and newly constructed standards for ethical consumption (Conroy 2007; Schor & Thompson, 2014). Individuals and households even turn to consuming more products to shield themselves from the health hazards from potentially toxic sources in what Szasz (2007) refers to as "inverted quarantine." The ability of the wealthy to avoid the impacts of climate change, at least for now, through consumption (using air conditioning to get through a heat wave, for example) may be a powerful deterrent to or distraction from their participation in climate action. The trend toward individualist schemes to combat climate change and reduce environmental impact are arguably efforts by capitalism to assuage worried consumers, in a way that avoids binding regulations (Roberts, 2001).

Climate change is also being driven by factors that make it difficult to manage the issue of

climate change in a way that is technical, knowledge-based, or democratic. After the rise of environmentalism in the 1960s and 1970s with its spectre of regulation imposed upon private industry (Szasz, 1994), the capitalist class organized to undermine specific governmental action and state-centered approaches overall. In the United States, the Koch brothers network, the Tea Party, Libertarianism, and Neoliberalism all led to the devolving of power away from paralyzed and hollowed-out federal regulatory agencies; confidence in the government to solve social problems was explicitly targeted in a decades-long campaign (Antonio & Brulle, 2011). In recent years, all kinds of "multi-level governance" of climate change are seen as manifestations of neoliberalism's hegemonic control over the imagination of populaces and policymakers alike (Bond, 2012; Ciplet & Roberts, 2017; Levy & Egan, 2003; Newell & Paterson, 2010). The need to rapidly transition off of fossil fuels has arguably been delayed by the focus on individual level approaches to consumerism, so that carbon footprints become central to conversations that might be about carbon taxes or direct regulation (Maniates, 2001).

The erosion of the belief in state-led approaches to climate change are enabled by polarization on the issue of climate change, well-documented for the case of the United States and mentioned above (Dunlap et al., 2016). That these opinions have been influenced by highly organized campaigns funded by fossil fuel industries is being increasingly well-understood by sociologists (Brulle, 2014; Dunlap & McCright, 2015; Farrell, 2016a, b; McCright & Dunlap, 2003). These trends impact public beliefs and opinions about climate change, and thereby public support for action.

Much of the research on *individual* beliefs, knowledge, and action regarding climate change has borrowed heavily from psychology and social psychology (Marquart-Pyatt et al., 2011; Shwom et al., 2015). This literature has identified four major factors that influence individual level public opinion on climate change. First, the lack of public concern regarding climate change can be attributed to a lack of scientific literacy on the issue (Bauer et al., 2007; Bord et al., 2000). This approach can be summarized under what critics call the "Information-Deficit Model," under which gaps in public understanding of climate science leads to a fundamental misunderstanding of it, influenced by personal experience and individual mental models (Bulkeley, 2000; Weber & Stern, 2011). While some have found that more information, especially when conveyed in a way that is culturally and socially appropriate, can positively affect social concern (Pidgeon & Fischoff, 2011; Reynolds et al., 2010; Sterman, 2011; Zhao et al., 2011), others found no direct impact (Brulle et al., 2012; McCright & Dunlap, 2011).

Secondly scholars have found that weather events impact concern over the threat of climate change (Weber, 2010). Several studies have shown that increasing temperatures or local weather (Brooks et al., 2014; Egan & Mullin, 2012; Hamilton & Lemcke-Stampone, 2014; Howe et al., 2013; Krosnick et al., 2006; Shao et al., 2014), floods (Spence et al., 2011), and other extreme events such as hurricanes, winter warming in snow country and droughts (Borick & Rabe, 2010; Hamilton & Keim, 2009; Hamilton et al., 2013) are associated with individual recognition of climate change and increased salience of the issue. Li et al. (2011) also show that the impact of temperature on public concern over climate change is a form of attribute substitution, in which individuals with low levels of partisanship and limited knowledge of climate change use the immediate outside temperature on which to base their opinion on climate change. Hamilton and colleagues have shown in a series of studies how political party identification strongly predicts the extent to which residents attribute recent weather to climate change (e.g. Hamilton et al., 2015) and that greater education did not increase acceptance of anthropogenic climate change among Republicans. To date, empirical evidence assessing the relationship between extreme weather conditions and beliefs about anthropogenic climate change is mixed. Deryugina (2013) found that while there was no relationship between short-run temperature fluctuations (<2 weeks) and global warming beliefs,

longer-run fluctuations (1 month to 1 year) are significant predictors of beliefs on this issue. McCright et al. (2014), however, found that individuals did not attribute local temperature anomalies to global warming, and the media coverage of weather events plays a major role in these trends (Donner & McDaniels, 2013).

The third major factor influencing public opinion about climate change is the influence of political discourse, which takes the form of elite cues that shape media coverage. In this approach, members of the public use media coverage, and the positions of political elites (often found in the media) to form their opinions based on these signals (Darmofal, 2009; Habel, 2012; Lenz, 2009; Yin, 1999). There is a growing body of literature that documents the empirical influence of political elite cues on media coverage, which then translates into the formation and maintenance of public opinion. In the US, partisan views of climate change mean that elite cues from politicians are particularly salient in shaping public opinion (Carmichael & Brulle, 2017; Guber, 2013).

Finally, the fourth factor is media coverage. In general, media is seen as a link between external events and collective perceptions. Since most individuals do not have direct exposure to political elites or scientific research, their knowledge of climate change is filtered through media coverage (Bolin & Hamilton, 2018). As Yin (1999:71) argues: "The media are most influential in shaping public attitudes toward problems that are out of reach and out of sight—the aspects of the world with which the mass public does not have regular direct or meaningful contact. Because most environmental problems depend on the mass media for their public visibility, the media influence on public attitudes toward these problems should be very important." Thus media acts as an intervening variable in the formation of public opinion (Capstick et al., 2015). There are also several factors that are seen to drive media coverage of climate change, including the provision of scientific information, weather events, advocacy efforts, and political discourse. Schäfer et al. (2014) show that while increased levels of scientific information and weather events have no impact on media coverage levels, activism raises levels of media coverage. However, this research omitted several important factors, including economic shifts and political discourse by politicians.

In addition to the four key factors discussed above, it is necessary to account for economic and political factors. It is well known that economic factors exert an important influence on public opinion, either directly or via media coverage. Kahn and Kotchen (2010) found that the business cycle influenced levels of environmental concern; Scruggs and Benegal (2012) found that concern about climate change decreased during times of unemployment. Likewise, increases in unemployment and lower levels of income both had a negative impact on measures of public concern regarding the environment. Bolsen and Cook (2008) show that energy prices have a significant negative impact regarding public acceptance of alternative energy sources over conventional, carbon-based energy sources. Additionally, external political conditions, especially armed conflict, shifts attention to foreign affairs and away from internal concerns (Gelpi et al., 2009). This section shows that a vast amount of sociological research shows that public opinion on climate change is not at all simple, being driven by a series of political, economic and climatological forces. What most of this work does not demonstrate is that public opinion is important in driving adequate action by political and economic elites on this critical issue. That idea remains firmly entrenched in popular belief and "theories of change" of many social movement organizations seeking to advance ambitious climate action.

## Inequality and the Social Dimensions of Climate Impacts

Sociologists are experts in the study of inequality and the disparate experiences of social groups. Climate change is poised to alter and exacerbate existing inequalities, so sociologists are uniquely positioned to analyze such changes. At the same time, it is crucial for all sociologists to consider climate change in their work, as it is increasingly

becoming a factor that shapes the social world. This section will explore various avenues for the sociology of power and inequality as they relate to climate change. Here we consider not only how sociology can impact the study of climate change but also the inverse, posed by Elliot (2018): how climate change can impact sociology. In reviewing existing sociological work on disasters, food and water resources, conflict, urban vs. rural contexts, migration/displacement, and health, we highlight how scholar's existing expertise to illuminate the inequalities and impacts of climate change, and identify some clear avenues for sociological inquiry that can benefit from the incorporation of this issue.

It is already well-known that climate change will have the greatest impact on already marginalized communities around the world. These are also the groups that have contributed least to climate change and benefited least from the economic activities that created it (Kasperson & Kasperson, 2001; Roberts & Parks, 2007). Furthermore, many of the same processes that led to our current global crisis began as colonial and imperial domination over what is now considered the Global South. Sociologists then may approach climate change as yet another stage in the patterns of wealthy global elites working to expand their wealth by extracting resources and well-being from colonized people and from the places in which they reside.

We know from work in development sociology that today's economically powerful nations built their wealth largely by taking resources and people from the Global South, often by force (e.g., Cardoso & Faletto, 1979). This accumulation of wealth also allowed them to develop and expand their industry, which eventually grew into the massively polluting companies with environmentally destructive production practices that we are familiar with today. Simultaneously lifestyles in the industrialized world emerged that relied increasingly upon the use of fossil fuels, such as for heating and electricity, or fueling personal vehicles.

While wealth and unsustainable production practices increased in the Global North, communities in the South suffered the destruction of their lifestyles and their land, as well as the violent suppression and exploitation of their people (e.g., Bunker, 1985; Galeano, 1997[1973]). Ultimately, this has left them disproportionately vulnerable to the impacts of climate change (Kasperson & Kasperson, 2001; Roberts & Parks, 2007), due to geographic vulnerability, highly unequal social structures, oppressive governance, and a lack of resources. Indigenous communities are among those affected most by climate change, both due to their proximity to extractive industries and their relative lack of power in the nations where they reside (Dunlap & Brulle, 2015; Frey et al., 2019; Ishiyama, 2003). However, because of (in general) their epistemological orientation ascribing inherent value to nature and non-human entities (see Vinyeta et al., 2015; Whyte, 2017; Wildcat, 2009), indigenous communities can provide crucial insights for transitions to sustainable societies. For example, in 2009, after a failed meeting of the UN climate negotiations, indigenous communities, led by indigenous Bolivian president Evo Morales, convened the Indigenous Peoples' Global Summit on Climate Change emphasizing the role that their traditional knowledges can play in planning for climate change and demanding the fulfillment of existing pledges for climate change mitigation by nation states (Galloway McLean et al., 2009).

Sociologists have also demonstrated that this inequality is reproduced and exacerbated in international policy-making on climate change. The United Nations Framework Convention on Climate Change (UNFCCC) has been the primary site for generating international climate policy since it was agreed in Rio de Janeiro in 1992. Though it lauds the ideals of inclusivity and participation, the UNFCCC has also been repeatedly critiqued by scholars and participants alike who assert that the most marginalized countries, most at risk from climate change, are unable to adequately promote their interests in negotiations (Ciplet et al., 2015; Dryzek & Stevenson, 2014; Fisher & Green, 2004; Gupta, 2005;). Furthermore, many groups do not have representation at all. Indigenous communities, because they are not recognized as nations, cannot participate as

formal negotiators. Instead they must present their interests in side events that run parallel to the negotiations and at specified moments when civil society organizations are given the chance to make statements. Along with indigenous peoples, Ciplet (2014) identifies women fighting for gender equality and waste pickers (representing those for whom climate solutions may mean loss of livelihoods) as groups that also struggle for representation and rights in the climate negotiations. Though there have been improvements in recent meetings of the UNFCCC (including a Gender Action Plan and an Indigenous Platform), the issue of inequality of representation and participation in the negotiations is still highly salient. Ultimately, it may mean that the interests of those industrial nations causing climate change are upheld at the expense of those experiencing the worst impacts because they had a consistent, well-resourced seat at the table.

In addition to these global dynamics, climate change disproportionately impacts marginalized populations *within* nations in both the Global North and the Global South. This includes racial, class, gender, sexual, cultural (indigenous vs. non-indigenous), and religious minorities, as well as differences based on age, ability and the various intersections of these identities. As Macgregor (2009) and Nagel (2015) argue, there are several ways in which sociologists can consider the gendered impacts of climate change: (1) highlighting the feminization of poverty that puts women particularly unable to preserve their livelihoods in the face of crisis; (2) considering the gendered division of labor that puts women disproportionately in the role of caretakers; and (3) exploring the gender differences in climate-related risk perception which could have differentiated effects on individuals' psychologies or resilience. Others have suggested that social norms that lead to women having less education, fewer skills (such as the ability to swim), and less access to economic wealth are also important contributors to the disparate impacts of climate change based on gender (e.g., Nagel, 2015). Sociologists have a wealth of experience from which to draw in researching gender, and climate change provides an opportunity to expand this research and intersect it with new areas of the discipline.

Scholars of race and indigeneity are also needed to shed light on the ways in which global racism and climate change are connected. It is not a coincidence that the majority of the Global South consists of people of color and that these communities are the most vulnerable to the impacts of climate change, even in nations in the Global North. Scholars have even begun to argue that we must begin thinking about the Anthropocene, or the geologic epoch in which humans have dramatically altered the planet, as beginning with colonial conquest (Davis & Todd, 2017). Yusoff (2018) argues that with colonialism came the racialization and dehumanization of black and indigenous populations in order to extract their labor and resources for the benefit of the colonizer. This laid the foundation for the massive exploitation of people and resources that fueled industrialization, industrial capitalism, and climate change. Deciding where we place the "golden spike" of this epoch matters because it determines what is considered a *casualty* of the Anthropocene, and how we will imagine *solutions* to the climate crisis (Yusoff, 2018). If we date it at the time of colonialism, we can better understand the magnitude of human impact on the Earth, the complexity of the required solutions, and the possibility for decolonizing the Anthropocene (Davis & Todd, 2017).

In addition to gender and race/ethnicity, there are several other crucial areas in which sociologists can contribute. Here we highlight disasters, health, migration, conflict, food, and urban and rural studies, but this list is certainly not exhaustive. Climate change will reshape the existing social dynamics in all of these areas, and so it will be critical for sociologists studying these topics to consider climate change in their research going forward. Sociologists already studying these topics will also have important insights into the changes that come about due to the impacts of climate change, and will likely prove to be invaluable resources to understand what climate change will mean for society.

It is now broadly accepted that anticipated anthropogenic changes in the climate will make disasters worse and more unpredictable. For example, in recent years, the increasing frequency of devastating storms and droughts around the world has made this trend almost undeniably evident. Sociologists are already attentive to the impacts of disasters, including differential social vulnerability based on demographic characteristics (such as race, class, and gender) (e.g., Bolin, 2007; Enarson & Morrow, 1998; Fothergill & Peek, 2004; Harlan et al., 2006), factors influencing risk perception (e.g., Freudenburg, 1993; Tierney, 2007; Trumbo et al., 2014), and the ability of a community to recover (e.g., Erikson, 1976; Hite & Fussell, 2015). In order to plan for climate change through adaptation measures, which partially aim to reduce the impact of disasters on populations, we can potentially operationalize existing sociological insights into how people are affected by disaster to lessen those effects. For example, Eric Klinenberg (2003) in his study of the 1995 heat wave in Chicago, emphasized the integral role that social ties can play in reducing disaster-related deaths. Attention to the drivers of social isolation and efforts to support social interconnections in communities may then be an effective step in making people more resilient to the impacts of climate change.

Displacement and planned migration are also expected to become growing and increasingly thorny issues due to the impacts of climate change. Climate change will bring both rapid-onset disasters, such as cyclones, as well as new slow-onset disasters such as sea-level rise and drought that will present enormous challenges for populations living in affected areas. While some policy-makers are presenting migration as an adaptive solution to climate change, others have argued that this is a neoliberal reframing of unjust displacement that serves the interests of capitalists and the global elite (Faber & Schlegel, 2017; Paprocki, 2018). Many of the world's most marginalized will be the first forced out of their homes. For example, citizens in island nations such as Kiribati and the Maldives, in coastal and delta regions such as Bangladesh and the Nile delta, and in the Western Sahara facing desertification such as in Nigeria are all poised to become climate refugees (or climate migrants, depending on whether they cross international borders) (Biermann & Boas, 2012; McAdam, 2010). This issue becomes extremely complex legally, because international law does not currently protect peoples migrating due to climate change under existing refugee or humanitarian agreements (McAdam, 2012). Furthermore, because most migrants will be displaced within their own country or to countries in their regions, which may not have the resources to adequately support them, support from wealthy countries in the Global North will be required to assist these populations.

This is not to say that there will not be displacement due to climate change in the Global North. For example, native communities in Alaska are already being forced to relocate from their island and coastal homes (to which they were originally relocated by European settlers) due to worsening storms and increased erosion (Marino, 2015; Shearer, 2011). As intense hurricanes increase in frequency, the patterns that we have already seen in the aftermath will worsen. In 2004, Hurricane Katrina displaced primarily poor Black residents from New Orleans, which has had lasting impacts on the mental health and growth of these communities (Fussell & Harris, 2014; Paxson et al., 2012; Peek & Fothergill, 2008). Hurricane Sandy in 2012 revealed that even wealthy communities are at risk of loss as the storm battered coastal homes in New Jersey and on Long Island and left Lower Manhattan in the dark. The US government's neglect in emergency response following Hurricane Maria in Puerto Rico in 2017 further demonstrates the inequality in resilience and disaster recovery. Sociologists have insights across these issues, and are equipped with the tools to study these movements of populations, as well as the causes and consequences of their displacement.

People will also experience the health consequences of climate change due to its impacts on food and water availability. Droughts, storms, and unpredictability in weather patterns

will disrupt agricultural production, which could be devastating for food access. This could potentially lead to greater global hunger and even famine, particularly in areas that are already facing these problems (Bohle et al., 1994; IPCC, 2019). These changes in weather will also combine with glacial melting and the salinization of groundwater as sea levels rise, having an impact upon some major populations' access to fresh water. All of this will have a significant impact on the health of human populations, as well as the health of the rest of the non-human environment.

Another area ripe for sociological investigation is the issue of security and conflict from perceived threats such as resource scarcity and climate migrants. As refugees flee from conflict zones, the reaction from destination countries in North America and Europe has already spurred a rise in nationalism and authoritarianism. Concerns are already being raised, including by the U.S. Department of Defense (2014), that climate change is a threat to national security, warranting a securitization of borders to prevent an influx of migrating populations. This response is not limited to the global North: India, for example, is already closing and securitizing its border with Bangladesh in expectation of displacements due to climate change impacts (Gowen, 2018; Jones, 2016). In addition, some analysts have argued that resource scarcity, and the changes in food and water access described above may lead to conflicts (e.g., Buhaug et al. 2014). However, Bonds (2016) warns that narratives of increasing conflict due to climate change potentially enforce racist, colonial stereotypes about violence in the Global South and could be used to justify foreign military intervention. While the direct link between climate change and conflict is still tenuous and in need of further study, researchers examining conflict and climate change should be reflexive about the potential implications of their work.

Climate change is also expected to have drastic impacts on human health. Of course, there will be health impacts from disasters and displacement already discussed. On top of these, slow-onset changes in weather patterns and local climates will present a number of physical and mental health challenges (Berry et al., 2010; Haines et al., 2006; McMichael & Woodruff, 2005). Changes in average temperatures and greater temperature extremes can also influence mortality rates. While studies have suggested that in some areas the net mortality may improve due to decreases in cold-related deaths and smaller increases in heat-related deaths (Vardoulakis et al., 2014), but in regions with already extreme temperatures these differences may be life-threatening. The migration of plants, animals, and insects due to these temperature changes are projected to cause a rise in vector-borne diseases such as malaria and dengue (Gamble et al., 2017; Githeko et al., 2000) and disruptions in food provisioning systems.

Finally, the social impact of climate change will likely mean very different things for communities in urban versus rural contexts. Accordingly, urban and rural sociologists have the opportunity to contribute their existing knowledge and expand the scope of their work to help us better understand the impacts that climate change will have on these places. Rapidly increasing urbanization around the world has meant that most of the global population now lives in cities. The unique challenges that climate change presents to the urban environment, and to different groups within the urban environment, is thus crucial. For example, Harlan et al. (2006) reveals that populations that are already vulnerable and marginalized in cities face greater risks due to the "urban heat island" effect. Increasing temperatures will only exacerbate this effect, further harming those (disproportionately people of color) populations and making others more vulnerable.

Likewise, cities can be made sites of climate action; Cohen (2018) articulates the potential for combined efforts to increase residents' "right to the city" while also addressing climate justice, and Agyeman (2013) emphasizes the necessity of building urban sustainability and justice simultaneously. Urban spaces come with unique challenges in that they already produce environmental inequality and injustice, but scholars have shown that they be reimagined as critical sites to address vulnerability and promote adaptation

(Caniglia et al., 2017; Carmin et al., 2012). Cities are already showing leadership in proposing ambitious climate action and attempting to pressure states and nations to move faster. In the wake of the US decision to pull out of the Paris Agreement, US cities have joined together to make their own plans to meet the Agreement's goals (Holder, 2018). Understanding these patterns suggests the need for sociological insights on urban-based social movements, governance, and planning.

In rural areas, farmers' and farmworkers' livelihoods could be drastically affected due to the effect of climate change on agriculture. Farmers are already losing their crops to drought, flooding, and unpredictable changes in growing seasons that disrupt the practices and annual routines on which they have depended for decades or generations. A substantial literature geography and other social sciences of climate adaptation (which space precludes our reviewing) has focused on vulnerabilities in rural areas and strategies taken up to address them (see Adger et al., 2003; Paavola & Adger, 2006; Sova et al., 2015). In Bangladesh, for example, many farmers have had to abandon their crops and move to cities, living in slums or working precarious and labor-intensive jobs such as pulling rickshaws (Paprocki, 2018). In wealthy nations such as the United States, already socially marginal farmers are also suffering from these seasonal changes and crop losses (Stuart, 2018). Other rural livelihoods like lumbering and collection of natural products are being altered and endangered. Though these contexts are not equivalent, the threats of climate change to rural livelihoods around the world are undeniable.

So, what does this all mean for the sociological study of climate change? Sociologists have an abundance of knowledge and insight on the issues for which climate change will have the greatest impact. We can bring novel insights about how intersectional and layered inequalities and identities will further complicate the effects of climate change on populations beyond the impacts that are most evident, such as mortality, displacement, and homelessness. This also presents new opportunities to environmental sociologists to engage more actively with different areas of the discipline. A sociological perspective is crucial both in terms of understanding the full range of the social impacts of climate change, and in shaping policy-making to promote informed and holistic approaches to climate adaptation. Climate change is rapidly becoming a topic that sociologists of all flavors will find impossible to ignore.

## Responses to Climate Change: Policy Responses, Social Movements, and the Opposition to Climate Action

Moving beyond differentiated impacts of the rapidly warming Earth that supports societies, sociologists have world-leading expertise in understanding human responses, spanning individual actions, institutions like families, churches and schools, governance structures and politics, and especially how civil society organizes into social movements to address the issue. The fact that the human response to climate change has been completely inadequate—in spite of scientific consensus on the issue in the thirty years since about 1990—means that social science needs explain that inaction. We here take up policy and social movement responses to the climate crisis, and then move on to efforts focused on understanding the successful counter-movement that has emerged to defeat and delay ambitious climate action.

### Policy Responses to Climate Change

There are several ways in which climate change can be confronted through public policy. The first is sharply reducing emissions of carbon dioxide, methane and other greenhouse gases, called *mitigation*. Second, given the fact that human response has been too little and probably too late, there is increasing discussion and experimentation in *carbon capture and storage*, which might pull $CO_2$ out of the air (but is currently too expensive), and *geoengineering* (which carries its own potentially irreversible risks) (e.g.,

Hamilton, 2010a, b). Because we cannot fully mitigate climate change at this point in time, policies must also work to mitigate its effects through *adaptation* measures. Adaptation efforts, however, will not be sufficient to complete protect communities from the impacts of climate change, and so policymakers are now working to generate mechanisms to handle any *"loss and damage"* that communities experience (Huq et al., 2013). Each of these policy pathways bring up issues of agency, politics, equity, cooperation, and the pertinence of political economy and technological solutions.

Mitigation as an action in itself is perhaps the least obvious of these policy responses in its potential for sociological investigation. While decisions about how and whether to reduce emissions leading to climate change have social influences and effects, mitigation itself has traditionally fallen within the scope of natural science. However, sociologists have made important contributions that can enhance its study (see Ehrhardt-Martinez et al., 2015). For example, the literature on the drivers of emissions discussed above can influence the approaches taken by policy-makers in making action to reduce emissions effective and efficient (Dietz et al., 2015; Jorgenson & Clark, 2009; York, 2012). Building on this, scholars writing in the World Society tradition have demonstrated positive links between the cultural diffusion and expansion of national and international environmental institutions as parts of local integration into world society, and reduced levels of carbon emissions and deforestation (Hironaka, 2014; Schofer & Hironaka, 2005; Shandra et al., 2004). Embeddedness in environmental world society specifically has been found to reduce the emissions consequences of development (Longhofer & Jorgenson, 2017). In addition to this macro-level work, sociologists have also produced useful work in contribution to mitigation at the micro scale, exploring variations in household and individual energy consumption (Allcott and Mullainathan 2010; Lutzenhiser, 1993; Stephenson et al. 2010), and decisions related to self-protection or denial (Norgaard, 2011; Szasz, 2007). Future research on this topic might include national and subnational variation in policy-making and mitigation responses, as well as the effectiveness of these approaches (e.g., Stokes, 2020).

Adaptation to climate change presents another range of issues with which sociologists can engage (see Carmin et al., 2015). Scholars have already examined what resources and social structures are needed to adapt to climate change (Brooks et al., 2005; Eakin & Lemos, 2006; Engle, 2011), how the political economy of adaptation finance operates (Ciplet et al., 2015; Hicks et al., 2008; Huq et al., 2007; Khan and Roberts 2013), and the relationship between adaptation and existing initiatives in development (Carmin et al., 2013; Halsnæs and Trærup 2009; Li et al., 2011) and disaster risk reduction (Cutter et al. 2003; Harlan et al., 2006). This includes critical work on equity in adaptive capacity (Nelson et al., 2007; Parry et al., 2007) and in the distribution of costs (Paavola & Adger, 2006; Parks & Roberts, 2010; Schlosberg, 2012). However, there is still much for us to contribute on this topic. For example, this research might examine how different agendas are shaping climate adaptation initiatives through various forms of authority and knowledge (Eriksen et al. 2015), how vulnerable communities adapt on their own in the absence of abundant resources, how adaptation projects impact communities in unexpected ways (Paprocki, 2019), and how disasters may spur adaptation actions, even without an explicit acknowledgement of climate change as a contributing factor (Koslov, 2019). Because adaptation can be so broadly conceived, there are numerous angles and contexts from which sociologists can draw to advance its study.

Finally, loss and damage is an emergent area in international climate policy, but one that can benefit greatly from sociological inquiry. Already, the executive committee on loss and damage within the UN climate negotiations has identified several areas, including economic loss and damage, non-economic loss and damage, slow-onset disasters, displacement, and finance, all in need of attention in policy-making on this issue (UNFCCC, 2017). Non-economic loss and damage in particular may be of interest to

sociologists, who are already attentive to non-quantifiable social, cultural, and psychological features characterizing different communities (Falzon & Batur, 2018; Serdeczny, 2019; Serdeczny et al., 2016). Furthermore, how the loss of such features might be compensated or repaired is a complex issue that requires the expertise of scholars with experience in these areas. Scholars have also already begun exploring how the potential for economic loss and damage is already shaping the decisions of property-holders and policy-makers in coastal communities (Fu et al., 2016; McAlpine & Porter, 2018), an issue that may actually impact countries in the Global North more than those in the Global South.

Climate policy is being formed right now, in ways that often neglect understanding of social inequality and vulnerability, in ways that sociologists could inform and be deeply involved (Roberts, 2018). The opportunities for intervention are endless—from submitting testimony to local siting boards for fossil fuel or renewables infrastructure to educating legislators and agency personnel on social elements of the issues, to entering submissions to international treaty and economic organizations. The task of the Intergovernmental Panel on Climate Change is to summarize the science on the issue, but it routinely lacks meaningful participation by sociologists (Brulle & Dunlap, 2015). Underlying these interventions should be peer-reviewed scholarly research when possible, and lacking that, sociologists need to work with research institutes, think tanks, NGOs and agencies to pull together meaningful inputs in a timely fashion for key decisions and documents (see e.g., Ciplet et al., 2013). The rapid uptake of climate plans and efforts at better inclusion of subaltern voices at local and state levels suggests that sociologists of all specialities could make a difference.

## Social Movements

Social movements have sprung up to fight battles over climate change, both on the sides of rapid action and to resist government interventions for climate protection. However these movements did not enter an arena without existing organizations: the field was already populated with environmental organizations with other missions (Boscarino, 2015). For example mainstream groups like World Wildlife Fund, The Nature Conservancy, Natural Resources Defense Council and Environmental Defense Fund make up the core of the "Green Group" that attempt to align their positions for lobbying in Washington DC (Jenkins et al., 2017). These groups, however, were built for other issues: clean water, toxic waste, biodiversity, for example, and continue to spend significant resources on them. They also bring old strategies, tactics, and overhead developed in different eras, and assumptions that climate change can be addressed in similar, often incrementalist ways. The case of climate change provides fertile ground for advancing social movement and organizational theories, and our understanding of the human response to climate change requires we understand their dynamics.

Crucially, philanthropic foundations have targeted nearly all their funding on mainstream organizations (Brulle, 2000; Jenkins et al., 2017), and most of their work is *not* oriented to political action (Brulle, 2018). Rather, most of the substantial funding goes to nature programs, education on the environment broadly, and other efforts. By contrast, fossil fuel firms and their supporting organizations spend four times as much on lobbying, ten times as much on campaign contributions, and 19 times as much on public relations campaigns (Brulle, 2018). Only once did environmentalists match the polluters on advertising spending, a single year in 2008, led by Al Gore's campaign. The explanation for the lack of spending by environmental groups on climate political work is simple: private foundations—mostly built on corporate family money—are reticent to support overtly political acts, and many fear crossing the limits imposed or believed to apply to 501(c)3 tax-exempt organizations. Few climate groups are 501(c)4 organizations and therefore able to make political endorsements and do overt lobbying. NGOs risk losing funders if they step out, and many groups self-censor, tempering their language, demands,

and tactics to stay in the good graces of foundations that favor incrementalist approaches, not radical ones. The more radical wing of the climate movement and climate justice groups remain largely unfunded (Brulle & Jenkins, 2005).

Like any social movement, certain causes are taken up with energy while others—which objectively might seem more important—are left unattended (Lash et al., 1998). The sociology of social movements is of fundamental importance in helping us understand these decisions. Resources, political opportunities, the salience of identity categories, and various other contingent circumstances are important for driving the direction of climate change policy. For example, during the neoliberal period since Ronald Reagan and Margaret Thatcher, most American and European environmental organizations have advanced market-based solutions (Ciplet & Roberts, 2017; Wetts, 2019). These include cap-and-trade emissions reduction policies in the Kyoto Protocol (the Clean Development Mechanism), and in the U.S. Congress (the Waxman-Markey bill in 2009), and the EU-Emissions Trading System (the EU-ETS), and even carbon pricing through tax and dividend programs.

Internationally, the climate movement has been divided among more radical and more moderate approaches to action. Some of the more cautious "mainstream" large environmental groups have maneuvered to be leaders in the international umbrella organization "the Climate Action Network-International" (CAN-International), which coalesces around the UN climate negotiations each year (Ciplet et al., 2015; Nagel, 2015; Newell, 2006). The mainstream groups were first on the scene, and had better resources to attend and build expertise for the complex issues under discussion at the climate negotiations (Hadden, 2015; Newell, 2006). When the climate justice movement began to arise around 2001, the groups often conflicted on whether to take insider (technocratic attention to details of the negotiations) or outsider (protesting with strong demands for a whole new system) approaches.

Recently, however, climate change has been trumpeted as an urgent issue that intersects with a variety of other social concerns, and requires the full participation from all sides. Energy and other environmental issues are prominent among these intersecting concerns, but issues such as economic justice, indigenous rights, and public health are gaining attention as well. The 2014 People's Climate March (PCM), held in New York City with hundreds of solidarity marches occurring in cities and around the globe, was a clear display of how the climate movement has begun to approach the issue intersectionally and from a variety of standpoints (Fisher et al., 2005, 2017). Bringing together individuals with radical perspectives who connected climate change to the greed of capitalists, with more moderate interfaith groups, renewable energy companies, and advocacy organizations, the PCM focused on inclusion (see Falzon et al., 2018).

In the US more recently, particularly with the beginning of the Trump administration, climate conscious activists have brought the issue forward at a number of other marches and demonstrations, including the Women's March, the March for Science, and subsequent Climate marches. Fisher (2019) demonstrates this convergence of social movements in the United States, including the climate movement, into a broad counter-movement to the Trump agenda she terms "the Resistance." the rise of youth-led movements, such as the Sunrise Movement and Fridays for Future, as well as more radical groups like Extinction Rebellion, demonstrate unique and novel approaches to social movement organizing that will surely provide fruitful avenues of research for sociologists. These, coupled with the bold and substantive policy proposals for which they advocate, such as the Green New Deal, signal a new wave of climate activism. Social movement scholars should be among the key figures bringing to light the progression of the climate movement (as well as those counter-movements blocking climate action), including the overlaps and convergences

bringing climate change activism together with other social movement groups. The election of Donald Trump has also driven a fluorescence of climate change organizations in the country, which is still unfolding and which has yet to be fully documented and described by Sociologists. In our own tiny state of Rhode Island, a half dozen new groups sprung up after the Trump election, including ones focused closely on disruptive action, ones targeting state bureaucracies to fill the gap left by the federal government in addressing the issue, and subcommittees on climate change growing up from bigger anti-Trump groups like Indivisible and Resist Hate.

Important fronts in the battle for cultural hegemony about what approach should be taken on climate change have erupted in print and electronic traditional media, and on new social media platforms. For example Farrell has documented the impact of Exxon/Mobil corporation and the Koch Brothers on Twitter discourses about climate change (Farrell, 2016a, b), and shown that corporate spending in the area has led to more polarized positions. Op-ed pages of newspapers, news and editorial content on Fox News and NPR present starkly different approaches to the problem. Boykoff has for 15 years documented patterns in mainstream media coverage of climate change, revealing rises and falls and what drives them (e.g., Boykoff & Boykoff, 2004; Boykoff et al., 2019). Pearce et al. (2018) reviewed 35 studies of social media and climate change, noting that nearly all focused on Twitter (28), because of its ease of analysis of text-based posting, hashtags, and user/retweeter links. They identify some key trends in those studies, and a series of areas needing development. One of the most interesting is their plea "that researchers must go beyond big data research in order to identify climate imaginaries circulating on social media" (p. 9).

Sociologists have studied social movements and the interplay between movements and the state for decades. We have a vast literature upon which to draw to build theories and inform analyses of movements for climate action and efforts to control and block effective policy-making. It is clear that sociologists have a number of topics on which they can weigh in. Now we must work to actively incorporate climate-related social movements into our research repertoire.

## Opposition to Climate Action

A number of organizations make up the organized opposition to environmental sustainability efforts in general and climate change action in particular. These include corporations, trade associations, conservative think tanks, philanthropic foundations, advocacy groups, lobby groups, and public relations firms, promulgated by a network of blogs and media outlets (Dunlap & McCright, 2015). One critical component of this opposition to climate change action was a major effort to build and maintain coordinated political and cultural opposition to proposed climate change mitigation actions through the creation of coalitions of fossil fuel related corporations and their affiliated trade associations, which played a critical role in the development of organized opposition to climate change (Brulle, 2019a; Downie, 2019). These various organizations act in different political and cultural arenas and employ different time horizons to achieve a range of objectives. For these reasons, we cannot refer to the organized efforts to block or delay climate action in monolithic terms. Rather, these efforts form an amalgam of loosely coordinated groups that can be understood as a counter-movement. Counter-movements are "networks of individuals and organizations that share many of the same objects of concern as the social movements that they oppose. They make competing claims on the state on matters of policy and politics and vie for attention from the mass media and the broader public" (Meyer & Staggenborg, 1996:1632). As Gale (1986) notes, counter-movements "typically represent economic interests directly challenged by the emergent social movement" (p. 207).

However, the climate counter-movement is not simply made up of industries attempting to preserve their market position. There is also a strong component of ideologically motivated action that reflects its historical development. As the conservative/libertarian movement expanded, opposition to climate change action became a critical

component of its political program. What emerged was a well-developed effort composed of a number of conservative foundations connected to nearly one hundred conservative think tanks (Brulle, 2014) that took on opposition to climate change action as part of their mission. For conservatives, climate change is seen as an issue that provides license for wholesale government intervention into the economy, and is thus a major threat to economic liberty. Coordinated by peak meetings of funders, such as the annual Koch Brothers summits or meetings at the Philanthropy Roundtable, the conservative network of institutions has become one of the core components of institutionalized opposition to climate action. Opposition to climate change action has now become the countermovement's pivotal issue in battles against environmental regulations.

A key element in the struggle for cultural and political hegemony is the institutional capacity of organizations to develop and conduct advocacy efforts. A number of authors (Barley, 2010; Brulle, 2014, 2018; Covington, 1997; Dunlap & McCright, 2015; Farrell, 2016a, b) have examined these organizations and their relationships. They include corporations, trade associations, conservative think tanks, philanthropic foundations (Brulle, 2014), advocacy groups, lobbying organizations (Brulle, 2018), and public relations firms (Dunlap & McCright, 2015; Oreskes & Conway, 2011). This integrated network of organizational relationships (sometimes termed the "denial machine") exists to influence the public, media, and political arenas to slow or stop climate action. This countermovement is highly sophisticated, operates in multiple institutional arenas, and pursues a wide variety of coordinated tactics.

The other component that developed into an institutionalized opposition to climate change action was the refinement of promotional campaigns by industrial interests in an effort to influence public opinion and thereby combat regulation of their industries. As media increasingly influenced political action, organizations with sufficient economic, political, or organizational capacities to generate publicity campaigns maintain a distinct advantage (Cooper & Nownes, 2004; Greenberg et al., 2011). Rather than enter into political debates to ascertain the common interest, institutions could use publicity techniques to intervene in civil society and secure a political and cultural advantage through the manipulation of communications and media (Knight, 2010; Magan. 2006). The consensus that results is one based on persuasive appeals through the application of psychologically advanced advertising techniques (Sievers, 2010; Walker, 2014). Given their potential for competitive advantage, advertising and other forms of professionalized advocacy are used by powerful organizations and community groups alike, though the latter groups have a tiny fraction of the ability to purchase advertising of any sort (Brulle, 2019b; Howard, 2006; Karpf, 2012).

A growing body of sophisticated sociological research has emerged that can help us to better understand the dynamics of opposition to climate action. This research can serve as the basis for developing a more coordinated set of strategies across four related areas: public inoculation to misinformation campaign, legal strategies including climate litigation efforts, informing political campaigns to be able to counter these efforts, and political mechanisms and financial transparency to expose the funders of climate opposition efforts (Farrell et al., 2019).

## A Research Agenda/Way Forward

The current spectrum of what might be included in "the sociology of climate change" incorporates all sorts of methodologies to answer a vast array of questions, guided by different visions for the role of sociology, and how we should be engaged in this struggle. Environmental sociologists in particular have the advantage of being in a subfield that utilizes a range of methodological approaches, considering or directly guided by practitioners and communities working on this issue, and often utilizing data and findings from the natural sciences and other social sciences to pose our research questions and generate new ideas. We would argue, therefore, that this

diversity is a strength: it is not in Sociology's interest to limit our methodological approaches to studying climate change. For example, climate change can serve as an opportune catalyst for studying the factors influencing public opinion. The question, "How and why do people come to the conclusions they do regarding climate change?" can be engaged in multiple ways. The process by which climate change is addressed in policy is an area ripe for sociological analysis, and our research experience in ethnographic methods, document analysis, interviewing, network analysis, quantitative statistics and survey research allow us to delve into such an issue.

Regarding methods, climate change is an issue for which space and time are extremely salient. Knowing this, climate change studies incorporating spatially—and temporally-driven methods can bring sociological research in innovative directions. Sociologists can build on insights from geographers in many ways. For example, physical data and social indicators can be used to understand regional variation in vulnerability to climate change and related impacts (Marquart-Pyatt et al., 2014). Harlan et al.'s (2006) work on urban heat islands in Albuquerque and their relation to ethnicity and poverty is a good representation of what this sort of research can look like. Studies may also engage with longitudinal data to gauge the effects of climate change over time. This includes time series analysis, popular in econometrics, which may prove to be a useful way for sociologists to track the social impacts of changes in the weather over an extended period. Furthermore, thinking creatively about the sociology of climate change over space and time should also lead us to challenge disciplinary methodological norms. Moving our attention beyond and outside of the boundaries of nation-states, for example, may allow us to better capture the spatial arrangements of inequality, while imagining climate change impact over the *longue durée* and to other species can extend our social analysis over multiple generations, including those that are yet to come. That is, scenario-building could become a bigger part of our discipline's contribution to addressing this unfolding crisis.

A normatively-inspired research agenda on the political sociology and political economy of climate change has to answer the question: is society moving to greater sustainability in a way that is adequate to what science tells us is needed and addresses equity and justice in its process and outcomes (Roberts, 2018)? What are the barriers to "just sustainabilities" (Agyeman et al., 2003) and to a "just transition" off of fossil fuels? What are the conditions under which climate justice is likely to advance? What are the potential insights from past environmental thinking, and from futuring in fields like design, architecture, feminist and queer theory, and from science fiction (White, 2019; White et al., 2017)? Sociologists must work to identify what is needed for successful action on climate change locally, nationally, and globally. This includes analyzing the key actors working to advance and delay action and the strategies and tactics they are using to influence policy-making. The politics of delivering well-being and low-carbon economic development is a promising new area of work (Brand-Correa & Steinberger, 2017; Lamb & Steinberger, 2017; O'Neill et al., 2018; Rao & Baer, 2012). Can national economies be refocused on delivering well-being to their residents, rather than simply greater consumption, inequality, and GDP growth? On building a "reconstructive environmental sociology" (White et al., 2017), a series of visioning questions arise to move us beyond the critique and doom of much climate natural and social science. How can production systems be redesigned to include meaningful, low-carbon livelihoods that can survive in a global economy, without simply outsourcing the carbon emissions to other countries? What roles do design and visioning "imaginaries" play in moving us to new worlds?

Some practical questions about transparency also raise profound directions for sociological theory. For example, what accountability mechanisms can support efforts to build just solutions? Transparency has been put forward as a tool for communities and nations in subordinate positions in climate struggles to hold dominant players (corporations, local state governments,

other countries) to account (Ciplet & Roberts, 2017). However these approaches often fail, because of profound inequalities in capacity to monitor and ability to levy restrictions on the other actor under globalization and neoliberalism. What role can transparency play in improving participation in climate governance? These are areas of crucial future research.

For a little over a decade Roberts' Climate and Development Lab focused on international policy and climate justice, particularly on the mobilization of funding for adaptation and mitigation projects in the Global South. This is but one avenue for sociological inquiry that reveals broader questions about the possibility for addressing global crisis transnationally. Observing the process of United Nations negotiations firsthand revealed states as actors in what is now described as "multi-level governance," a scenario where corporations, international organizations and civil society groups and networks are doing much of the "regulatory" work, in the absence of a global state (e.g., Biermann et al., 2012). In all these cases, sociology should be a partner to international political economy from the fields of political science and human geography, anthropology, law and public policy. Our sociological frames, theories, and methods can open wide fields of questions incompletely addressed by these sister disciplines.

Sociologists' decades of research and theorizing on social movements is a crucial contribution that needs advancing and translating. What are the divisions and strengths among national and international climate change social movements? What explains those strengths and shortcomings, and in what circumstances are they most able to succeed? This includes following the funding flows that are influencing climate action and denial, especially by powerful individuals in the U.S. government. Expanding this research beyond the national scale, to understand how special interests guide decision-making on climate change in local, regional, national, and international arenas, and how these arenas vary, also offers promising avenues for sociological analysis. This is especially critical during this period of resurgent national populism and rollbacks in climate efforts by deregulatory regimes.

Finally, there must be a new agenda for academic departments and scholarly journals, to encourage and support young scholars to flourish in this area. It is our belief that to advance impactful research on climate change, high-impact journals, including those inside traditional disciplines, need to publish more policy-focused work. Disciplinary departments will need to be open to both hiring interdisciplinary scholars, and to supporting and rewarding engaged research by sociologists. These changes will require revisions of formal and informal tenure expectations, written and verbal assurances to young scholars that these pledges will be met, and institutional restructuring.

Sociologists can also work to build relationships with NGOs, government agencies, international organizations, law firms, research groups, political organizations and think tanks. To make our work on climate change impactful, there is major attention to be paid to collaboratively planning research and co-publicizing our findings. We must also amplify the work of other engaged climate scholars, especially those in the Global South and marginalized communities living on the frontlines of climate change. To do this, we must be visible to the public: speak to the media, publish policy briefings, produce videos, write blogs, tweet. We need to support elevating voices of those on the frontlines of climate change. Ultimately, a sociology of climate change can be profound but it cannot exist in a vacuum. There is much this discipline has to contribute to the global movement to address climate change in a just and timely manner.

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# Sociology of Disasters

# 11

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## Introduction

*There is no such thing as a natural disaster.* Not only is that phrase in the title of an influential volume published in the aftermath of Hurricane Katrina (Hartman & Squires, 2006), it has also long served as a rallying cry among social scientists who strive to focus attention on the social processes that turn natural hazards into human disasters (Hewitt, 1983; O'Keefe et al., 1976; Tierney, 2014). As Olson (2018) argues, the problem is that the term "natural disaster" puts the emphasis on the word natural, subtly shifting the responsibility for disaster losses away from their historical, economic, and political root causes. Bullard (2008:757) writes that "what many people often call 'natural' disasters are in fact acts of social injustice perpetuated by government and business on the poor, people of color, the disabled, the elderly, the homeless, those who are transit dependent, and non-drivers—groups least able to withstand such disasters."

Of course, forces of nature such as hurricanes, tornadoes, floods, earthquakes, heat waves, and so forth can trigger disaster. The severity of the crisis that follows, however, is not simply a function of wind speeds, rainfall amounts, ground motions, or temperature extremes. It is the *interaction* between the natural hazard, the condition of the built environment, and the status of the social structure that shapes the landscape of risk. It is also this interaction between the environment and society that influences whether a disaster will follow.

This chapter focuses on the contributions of sociologists who study the root causes and social consequences of everyday emergencies, disasters, and large-scale catastrophes. For the sake of brevity, we use the terms disaster or disasters throughout much of the chapter. We want to be clear at the outset, however, that researchers in this field tend to treat emergencies, disasters, and catastrophes as analytically distinct and socially constructed phenomena. These terms have been debated extensively (Perry & Quarantelli, 2005; Quarantelli, 1998), although there is general agreement that they are associated with differences in the spatial scope of an event, the seriousness of impacts to human and other environments, the entities who respond and how, the level of public participation in providing

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assistance, and the degree of recovery challenges that follow (Tierney, 2019:5–6). Further, what gets viewed as a disaster arises from "a contested terrain in which various actors. . . make assertions about events and hope their definitions of those events prevail" (Webb, 2018:114). Indeed, what gets defined as a disaster by researchers is as much a consequence of how disciplinary culture has come to conceptualize such harm as it is a consequence of how our broader culture does or does not respond.

For our purposes here, an *emergency* is defined as a narrow-scope incident such as a house fire, vehicle accident, or limited hazardous material release. Fire departments, police departments, emergency medical services, and other public sector agencies are trained to handle these smaller-scale and more easily contained events, and therefore the public is typically not involved significantly in the response. Recovery times may vary for individuals, but the longer-term impact of emergencies on communities is typically minimal (Quarantelli, 1996, 2008; Tierney, 2019).

A *disaster* is an event in which societies or their larger subunits (such as communities or regions) incur damages, losses, and disruption of their routine functioning. A disaster is observable, although may not necessarily be concentrated in time and space. Members of the public and formal emergency response agencies converge to help disaster survivors, and some individual autonomy may be lost given the emphasis on community needs. Major recovery challenges tend to follow (Fritz, 1961; Kreps, 1984; Quarantelli, 2008; Tierney, 2019).

A *catastrophe* has a large scope of impact that can affect multiple communities, states, or nations. Such events produce high levels of physical damage and social disruption, which sharply and concurrently interrupts essential services. The challenges of response tend to exceed those envisioned in disaster plans, and the broad scale of impact impairs each community's emergency response system, limits extra-community support, and often necessitates a central government response because localities and entire regions are devastated. Large-scale evacuation and long-term displacement or exodus from affected areas is possible. Massive and socially uneven recovery challenges often affect people and geographic regions for years or even decades after the initial event (Clarke, 2002; Kroll-Smith, 2018; Kroll-Smith et al., 2015; Perry & Lindell, 2007; Quarantelli, 2008; Tierney, 2019; Wachtendorf et al., 2013).

The distinctions between emergencies, disasters, and catastrophes are ideal types, and therefore researchers recognize that all of the features mentioned previously do not have to be present for an event to be classified in a particular category (Wachtendorf et al., 2013). Consider, for example, the COVID-19 global pandemic. It would certainly be classified as a catastrophe based on the scope of impact, number of lives lost, and enormous social and economic disruption caused globally, even though the pandemic has led to negligible physical damage to the built environment.

To date, most of the available sociological research has focused on disasters or large-scale catastrophes (Peek, Champeau, et al., 2020a) and this, too, is where we draw many of the case study examples that are highlighted throughout. We organize the remainder of the chapter into four sections that describe *why* sociologists study disasters, *what* this work has revealed regarding human and organizational behavior during times of collective upheaval, *how* disasters both reflect the existing social order and may forever alter it, and *where* the field might be heading in the future.

We build upon—and encourage readers to consult—overviews of the field that have previously been published in the *Annual Review of Sociology* (Arcaya et al., 2020; Kreps, 1984; Quarantelli & Dynes, 1977; Tierney, 2007), the first and second editions of the *Handbook of Disaster Research* (Rodríguez et al., 2007, 2018), and various other books, book chapters, and encyclopedia entries on the sociology of disaster and environmental sociology more broadly (Drabek, 2009, 2017; Herring, 2013; Lindell, 2013; Matthewman, 2015; Peek & Mileti, 2002; Phillips, 2015; Thomas et al., 2013; Tierney, 2014, 2019; Webb, 2007). While our primary focus is on the discipline of

sociology, we also acknowledge the key contributions of many other disciplines in the social sciences, public health and medicine, the humanities, and engineering to the multidisciplinary and increasingly interdisciplinary study of disaster (for a review of such contributions, see Peek & Guikema, 2021; Tierney, 2019). Moreover, much of the work that we cite in this chapter was produced by U.S.-based sociologists. This is due in part to the number of disasters that have affected millions of Americans over the past several decades as well as the large number of social scientists concentrated in the United States who study disasters (Peek et al., 2020a). We acknowledge, however, that there is a robust and ever-growing body of knowledge being generated by our colleagues in other contexts, and we hope that readers will consult many of the available overviews of such work (Aguirre, 2002; Britton, 1992; Danielsson et al., 2015; Miura, 2016; Okabe & Hirose, 1985; Porfiriev, 1998; Quarantelli & Yamamoto, 1982; Schorr, 1987).

## Why Sociologists Study Disasters: A Brief History and Overview

Samuel Henry Prince wrote the first English language social science dissertation focused on disaster while he was a doctoral student at Columbia University. His project, *Catastrophe and Social Change,* draws on observational and interview data that he collected in the aftermath of the deadly 1917 munitions ship explosion in Halifax Harbor in Nova Scotia, Canada. His research foreshadowed many of the concepts and concerns that would eventually become central to the sociological study of disaster including, for example, the assessment of short- and longer-term impacts on survivors, mutual aid and helping behavior, the role of blame and rumors in shaping emergency response and recovery efforts, social disorganization and the re-establishment of the social order, and social change (Prince, 1920).

Although Prince's dissertation remains an influential founding document in the field, teams of social scientists did not begin systematically studying disasters in the United States until the late 1940s and early 1950s (Anderson, 2014; Tierney, 2019). Social science disaster research began in earnest during this Cold War period, when the U.S. military funded a small cadre of university-based field research teams to examine how American civilian populations would respond under conditions of extreme duress (Quarantelli, 1987). Tornadoes, fires, plane crashes, train derailments, hazardous chemical releases, and several other unexpected, acute onset emergencies and disasters served as natural experiments for the study of individual and collective behavior (Knowles, 2013). Interestingly, in the 1970s, another important stream of disaster sociology emerged in Europe with the formation of the Disaster Research Group in Sweden. Sociologists Jan Trost and Örjan Hultåker led these efforts, which were supported by the Swedish government and, as in the United States, were also funded primarily by the military (Danielsson et al., 2015).

In the U.S. context, concerns surrounding American civil defense and the impact of wartime stress remained a strong motivator for military support of disaster research, even while sociologists were keen to use disasters as occasions to understand broader sociological phenomenon (Quarantelli, 1987). Based on the questions that the U.S. military wanted to have answered, however, officials seemed to believe that people would panic in disasters, behave in aggressive ways, or become immobilized by fear. Enrico Quarantelli, who was a member of the early National Opinion Research Center (NORC) field research teams and who would become one of the early founders of the sociology of disasters, wrote that "The intent of the work was to find out how social control could be exercised by the authorities, and the assumption was made that disaster problems were primarily social psychological in nature" (Quarantelli, 1987:290).

As the number of post-disaster case studies began to mount, so too did the evidence that many of the prevailing beliefs at the time were unfounded at best and wholly inaccurate at worst. While the mass convergence of people and supplies to the scene of a disaster was framed as

a problem to be managed (Fritz & Mathewson, 1957), most of the other early studies overwhelmingly pointed to altruistic, prosocial, and highly adaptive behaviors among disaster survivors and first responders (Barton, 1969; Fritz, 1961; Merton, 1963). The early field studies provided answers to the relatively limited scope questions, and the military soon lost interest in funding the social science research teams.

Fortunately for the progression of the field, the National Academy of Sciences and the National Science Foundation picked up where the military left off. Both scientific bodies recognized the importance of the disaster setting as a strategic site for learning about social phenomena, examining social relationships and group-based patterns, and revealing social problems. Indeed, disasters offer a realistic laboratory for testing the integration, stamina, and recuperative power of large-scale social systems and communities (Fritz, 1961:654). Thus while environmental sociology grew from a recognition of societal impacts on the environment, the sociology of disaster emerged largely in response to an interest in how environmental extremes shape society. Sociologists who study disasters contend that social processes are more visible in times of disaster because they are compressed in a short time span and in a dramatic way. Pioneering scholars wrote that such events "break the cake of custom" and serve to "strip away the veil" that typically obscures social relations during less stressful times (quoted in Fothergill, 2004:26).

From the inception of the field, disaster researchers were driven by a strong curiosity and a desire to contribute to sociological knowledge by learning from collective stress situations (Anderson, 2014; Bates & Peacock, 1987; Bates & Pelanda, 1994; Britton, 1987). At the same time, the initial funding sources and applied orientation led to a heavy emphasis on acute onset disasters such as floods and tornadoes that are prevalent in the United States versus more diffuse emergencies such as famines or epidemics that occur more frequently in developing countries (Quarantelli, 1987). The pioneers recognized the need to broaden this initial emphasis, even as the study of disasters has remained heavily event driven (Dyson, 2006). Traditional typologies that focus on the commonalities and differences between various disaster agents—natural hazards, technological disasters, episodes of mass violence, and riots—gave form to this burgeoning field and are still used today (McFarlane & Norris, 2006; Peek & Sutton, 2003; Quarantelli, 1993).

Sociologists predominated in those early research teams and they strongly influenced the theoretical and methodological orientation of the nascent field (Dynes et al., 1987; Quarantelli, 1987). The much broader study of natural hazards and disasters, however, has its deepest disciplinary roots in sociology and geography (Anderson & Mattingly, 1991; Mileti, 1999; National Research Council, 2006; White & Haas, 1975). Sociologists—at least initially—focused heavily on the emergency response period while geographers historically concentrated on hazard vulnerability and hazard mitigation. In reflecting on the evolution of the field, Anderson (2014:4) observed that, "Such domain distinctions would erode in the years ahead as researchers from across the social science disciplines began to collaborate and exchange perspectives." Those disciplinary and methodological boundaries have continued to morph and expand in new directions as the field continues to grow and has become ever more integrated (Peek et al., 2020a, b).

The turn of the twenty-first century has led the social scientific and cross-disciplinary study of disasters to take on a newfound sense of urgency, due in part to a number of landmark events that have caused widespread human suffering such as the terrorist attacks of September 11, 2001, the 2004 Indian Ocean earthquake and tsunami, Hurricane Katrina in 2005, the 2010 Haiti earthquake, the 2011 triple disaster in Japan, Hurricane Maria in 2017, and the COVID-19 global pandemic. Sociologists and other social scientists who study disasters continue to use extreme events as a mirror to reflect the realities of society while also working to effect change in the social conditions that turn hazards into disasters.

## What the Sociology of Disaster Has Revealed: Human Behavior in Collective Stress Situations

We have already alluded to some of the foundational contributions of sociologists who participated in initial disaster field research teams. Quarantelli (1988:305) summarized in no uncertain terms what these sociologists did, and did not, observe in the various communities researchers studied:

> Self-control is maintained in extreme threat situations. Panic or wild flight, hysterical breakdown, affective immobility are almost nonexistent... Those in danger try to help one another. Because persons are very frightened or afraid does not mean that they will fail to try and take protective actions... Passivity is not characteristic of the immediate post-impact period. The initial and by far the greatest amount of search and rescue is undertaken on the spot by survivors... Severe mental health problems are not occasioned on any scale by disasters... Convergence on a disaster site is a major problem... There may be widespread stories of looting, but actual cases of looting are very rare in post-impact situations.

As knowledge accumulated and the sociology of disasters matured as a field, sociologists began to push back more forcefully against "disaster myths" that did not accurately reflect human behavior in moments of collective stress (Fischer, 2008; Quarantelli, 2008; Quarantelli & Dynes, 1972). These myths are often rooted in public perception of human behavior in disaster, and the media and popular culture have often contributed to furthering disaster-related myths about the prevalence of panic, looting, price gouging, and other forms of antisocial behavior (Wilson, 2014). Because most people do not witness a disaster firsthand, the frames that media generate have a powerful influence over what people think happens (Kappeler & Potter, 1996; Quarantelli, 1991; Wachtendorf et al., 2015).

There are understandable reasons why media frames may not always match observed reality. Reporters are almost always working under exceptionally tight deadlines, and they tend to be unfamiliar with the fundamentals of disaster-related behavior. This issue is exacerbated because reporting conventions tend to emphasize dramatic events or unusual behaviors (Tierney et al., 2006). Moreover, social segmentation of media audiences strongly influences media messaging, which can lead to a narrow scope of representations of complex human activities (Campbell, 2010; Klinenberg, 2002).

Disaster myths are not just problematic because they are untrue—although that itself is cause for concern in this era of fake news and deeply contested scientific knowledge—but also because the transmission of misinformation can influence organizational, governmental, and public responses during disasters. This point was perhaps most tragically illustrated in Hurricane Katrina, when the news media reported unverified and deeply racialized rumors from the disaster zone regarding violence and mayhem that was purportedly taking place in the majority African American city of New Orleans (Campbell, 2010). As a consequence, life-saving resources were diverted and search and rescue efforts stalled as emergency responders were told to police the very people they were supposed to be helping (Dyson, 2006; Tierney et al., 2006). In that long pause, people died, suffered, and lost the illusion that they could depend on the good will of their city, their state, and their country. The cost in human life and human dignity was tremendous and continues to this day (Erikson & Peek, 2022).

As researchers have worked to counter such potentially deadly disaster myths, they also started to reflect more deeply upon their own narratives, and in so doing, to challenge what Tierney (2007) refers to as the "good news" frame that took hold of the field in the early decades. Disaster researchers created this frame, in part, as an empirical antidote to the disaster myths that were being reported (Tierney, 2019). But this good news frame—and the attendant focus on altruistic behavior, organizational problem-solving, and disasters as status levelers—also served to obscure important social phenomena that was revealed in later studies with a wider range of disaster settings and more diverse population groups in different cultural contexts. For example, more recent research has

identified early onset and enduring mental health challenges among some segments of the population (Fussell, 2015; Van Landingham, 2017), loss of community and increases in intergroup conflict (Erikson, 1976), increased levels of interpersonal violence against women (Enarson, 2012; Fothergill, 2004), educational disparities among children (Fothergill & Peek, 2015), backlash and discrimination against communities of color (Peek, 2011; Peek & Meyer, 2016; Rivera & Miller, 2007), and a deepening of economic inequality (Dash et al., 1997; Howell & Elliott, 2019; Peacock et al., 1997; Siders, 2019; Tierney, 2014).

Disasters clearly bring "bad news" as well as "good news." But the question still remains: How do humans actually behave in disasters? There is, of course, no simple answer. Human beings are as complex as they are diverse. Their behavior and how they are impacted by disaster is influenced by countless situational, demographic, environmental, political, economic, cultural, social, and other variables. What we see as researchers is also shaped by our own social and cultural positions and theoretical lenses. Early disaster researchers were often working from a structural functionalist or symbolic interactionist frame (Barton, 1969; Fritz, 1961; Quarantelli & Dynes, 1977); more recent generations of researchers have drawn from a more robust theoretical toolkit and have increasingly used conflict theory, critical race theory, feminist theory, or an intersectional lens in the study of disasters (Enarson et al., 2018; Freudenburg et al., 2009; Luft, 2012; Penta et al., 2019; Stallings, 2002; Tierney, 1999).

The disaster context and the time frame being studied matters, as well. Consider, for example, the meta-review conducted by Norris et al. (2002) that assessed the psychological harm experienced by 60,000 disaster survivors. Their work revealed that those who experienced episodes of mass violence, such as terrorism, were more impacted than survivors of natural hazards or technological disasters. It is worth noting, however, that the severity of exposure and the scale of destruction and disruption mattered as much, if not more, than the precipitating disaster agent. They also found that children suffered more severe psychological impacts than adults and that people in the developing world were more adversely affected than those in wealthier countries. Among the adult samples assessed, being female, middle aged, or a member of a racial or ethnic minority group; having other life stressors; and/or having a history of mental illness were all linked to more severe mental health consequences. While most disaster survivors in the analysis did not develop long-term mental health issues, some did, and that has led to calls for more robust interventions after disaster and more longitudinal disaster research (Fothergill & Peek, 2015; Kroll-Smith, 2018; Kroll-Smith et al., 2015; Picou & Nicholls, 2019).

It is difficult to characterize human behavior and disaster impacts, but part of our primary responsibility as sociologists is to identify patterns. In that quest, we find it useful to ask the following types of questions: How do diverse groups of human beings behave before, during, and after disaster? What personal, environmental, and structural factors influence the behavior or outcome in question? Does the behavior or outcome hold across cultures and contexts? How and why does human behavior vary? We raise these questions not to challenge the existing body of research, but rather to honor the diversity and intricacy of human response to disasters in a rapidly evolving world that is increasingly punctuated by more intense and severe disasters.

In that spirit, we now turn to a brief review of available evidence regarding three enduring areas of study on human behavior in disaster—convergence behavior, panic and prosocial behavior, and crime and conflict. It is important to emphasize that the sociology of disasters extends well beyond these three areas. Our purpose here, though, is to use these examples to illustrate the power of sociology in revealing social processes and group-based patterns, while also shedding light on the complicated, sometimes contradictory, and ever-expanding body of knowledge that characterizes the sociological study of disaster.

## Convergence Behavior

With the support of the National Academy of Sciences, Fritz and Mathewson (1957) published the first comprehensive report on convergence behavior in disasters. They defined convergence as the "mass movement of people, messages, and supplies toward the disaster struck area" (p. 1). Fritz and Mathewson (1957) were especially focused on understanding how to control these forms of personal, informational, and materiel convergence at the scene of a disaster. They characterized the convergence of people and supplies as a social problem to be studied and as a disaster planning and management problem to be solved.

Their initial report and the additional work of other members of the pioneering field research teams spurred generations of research on convergence behavior in the context of natural hazards, terrorist attacks, humanitarian emergencies, and various other disasters (for a recent review and theoretical statement, see Penta et al., 2019). Moreover, researchers have offered various typologies to delineate the personal characteristics and behavioral motivations of "informal and unofficial convergers" (Fritz & Mathewson, 1957:29). These are the people who may physically move toward the epicenter of a disaster, move toward other areas associated with the disaster response milieu, or engage in actions that otherwise contribute to post-disaster convergence (Kendra & Wachtendorf, 2003; Scanlon, 1991) (see Table 11.1).

Research on convergence behavior in disasters now spans many decades, and some of the most recent work has expanded our understanding of these categories. For example, Subba and Bui (2010, 2017) have identified *detectives* as helper convergers, who by performing surveillance activity—either in person or online—enhance information management among authorities and the private sector. Their purpose is to serve and protect the public, to deter criminal behavior, and to report on or respond to suspicious activity. Others have taken a close look at *researchers* themselves as convergers who might constitute a form of the curious (Gaillard & Gomez, 2015; Gaillard & Peek, 2019; Kelman, 2005). Researcher convergence is especially likely in the case of large-scale disasters, where individual researchers and research teams from many different disciplines and geographic locations often travel to the disaster zone to collect perishable data (Gaillard & Peek, 2019; Peek, Tobin, et al., 2020b). The curious can also include journalists, dignitaries, and celebrities (Kendra & Wachtendorf, 2003). In all cases, it is important to note that a person might occupy more than one convergence category or move between them.

Beyond the work that we have cited here, there are many dozens if not hundreds of other reports, journal articles, book chapters, and books on the topic of post-disaster convergence. This research has verified Fritz and Mathewson's early assertion that convergence is a "virtually universal phenomenon following disasters" (1957:1). It has also helped to extend their initial typology to more carefully consider both the problems and possibilities associated with convergence.

Consider, for example, that certain types of convergence continue to be described in the literature as social problems to be studied and solved—this is especially true of materiel convergence, or the convergence of supplies, donations, and equipment, which can create massive and long-term logistical problems in disaster affected areas (Holguín-Veras et al., 2007, 2012; Neal, 1994; Penta et al., 2019; Wachtendorf et al., 2013). Years after the 2011 Joplin tornado, for instance, the school district had to continue to use staff to sort through the countless donations and supplies that were shipped to the city after the disaster. But other forms of convergence behavior have been carefully recast as legitimate, even vital, to disaster response and recovery efforts (Kendra & Wachtendorf, 2003). Survivors who converge after disaster rescue other survivors (Barsky et al., 2007; Kendra & Wachtendorf, 2016; Meyer et al., 2020). The supporters, mourners, and memorializers who converge encourage emergency responders, assist survivors, and contribute to the emergency response and healing of others (Kendra &

**Table 11.1** A typology of disaster convergence behaviors

| Typology of Disaster Convergers | Brief Definition and Description of Motivations | Source |
|---|---|---|
| The returnees | Disaster survivors who have evacuated from the disaster area and return to assess losses and retrieve, guard, or salvage property from their residences, schools, or businesses. They may also be motivated by a desire for a permanent return to place. | Fritz & Mathewson, (1957, p. 30) |
| The anxious | People, such as separated nuclear and extended family members or members of friendship groups, who have close ties with those in the disaster zone and are actively seeking out information about affected loved ones. | Fritz & Mathewson, (1957, p. 36–37) |
| The helpers | Spontaneous, informal, often uncoordinated volunteers from inside or outside the disaster zone who try to bolster the efforts of formal response and relief organizations. This category also may include formal emergency responders and those who are affiliated with established organizations or groups and choose to self-deploy to the disaster zone. | Fritz & Mathewson, (1957, p. 40–41); Kendra & Wachtendorf, (2003) |
| The curious | People who are typically detached from the immediate personal danger of the disaster and the overriding concerns for the safety and welfare of other people. They converge because the disaster itself—an unusual and dramatic event—has excited their attention. | Fritz & Mathewson, (1957, p. 46–47) |
| The exploiters | People who seek private gain from the public misfortune caused by disaster. Exploitation, although relatively rare, may come in various forms such as looting, price gouging, or otherwise taking advantage of disaster-stricken people and places. | Fritz & Mathewson, (1957, p. 50) |
| The supporters | People who come to show their gratitude for and solidarity with survivors, emergency responders, and other rescue and relief workers. | Kendra & Wachtendorf, (2003) |
| The mourners and memorializers | People who come to commemorate or remember those who have perished in the disaster or to recognize those have sacrificed to help victims and survivors. | Kendra & Wachtendorf, (2003) |

Wachtendorf, 2016; Steffen & Fothergill, 2009). Research in the area of post-disaster convergence has helped to paint a more textured portrait of human behavior in disaster, showing how the movement of people, information, and goods can both help and harm during the height of an emergency.

## Panic and Prosocial Behavior

One of the most common, and longstanding, misconceptions about human behavior in disaster is that people will panic. The reality is that panic, or a state of confusion triggering unreasonable behavior, is rare in disaster, but many otherwise understandable behaviors can be labeled as panic (Fischer, 2008). For instance, some people who are not actually facing an impending threat, such as a hurricane landfall, might still choose to evacuate in an effort to move out of harm's way (Dash & Gladwin, 2007). Similarly, when the COVID-19 pandemic took root and began to spread across the United States, people were roundly criticized for "panic buying" groceries and other household goods rather than being recognized for their attempts to prepare in the face of a historic crisis (Wachtendorf, 2020). These examples, by definition, are not indicative of panic but instead are normal reactions to perceived danger and uncertainty. In fact, running away from threats is typically an advisable protective response, although in disasters such behaviors are often derisively referred to as panic (Clarke, 2002).

Issues arise when officials believe the panic myth. This can cause them to delay issuing warnings or to otherwise withhold vital risk information from the public (Drury et al., 2013; Nogami, 2018). Moreover, the focus on individual behavior and the potential for panic can shift critical attention away from more systemic failures that can actually generate catastrophe (Wachtendorf, 2020).

Decades of research has shown that during the immediate crisis period, people do not typically panic, nor do they descend into a state of shock and helplessness. The much more common behavioral response is for those in the path of harm to help one another as summarized here:

> In the wake of disaster, most people experience a newfound sense of urgency, purpose, and solidarity. Indeed, the earliest disaster researchers were so struck by the high levels of empathy and mutual helpfulness that they observed following catastrophic acts of nature, they used such terms as "altruistic community" and "therapeutic social system" to depict the heightened sense of camaraderie. These communities of compassion and care play an important role after disaster: They can lead to improved psychological functioning among traumatized victims and may even impel the entire disaster-stricken population toward a state of recovery (Peek, 2011:176).

Such altruistic or prosocial behavior can take many different forms during and in the immediate aftermath of disaster. Neighbors and friends provide shelter, supplies, and financial support through their social networks (Aldrich & Meyer, 2015; Meyer, 2018). People often line up at blood donation stations and philanthropic giving tends to surge (Meyer et al., 2020). Children and adults may organize donation drives or fundraisers to help fulfill unmet needs (Fothergill, 2004; Peek, 2008). And spontaneous volunteerism almost always occurs as people try to serve others during times of great loss and upheaval (Kendra & Wachtendorf, 2016; Lowe & Fothergill, 2003; Steffen & Fothergill, 2009; Wenger & James, 1991).

Following Hurricane Katrina, Rodríguez et al. (2006:82) concluded that prosocial behavior "was by far the primary response" to the catastrophe. Researchers who were located in the affected regions and those who traveled to New Orleans and the Gulf Coast after the storm shared countless observations of how family members were helping each other, friends were joining together, and strangers were offering mutual aid and support in the time of Katrina. A small sampling of such stories from the field, follows:

> A 51-year-old woman, badly injured before Katrina, was stuck with no way out of the city as the hurricane advanced. Her daughter-in-law came by to check on her, and she promised the ailing woman, "I'm not going to leave you... because I know you're here by yourself and you don't have any way to get out... So we're either going to get out or we're going to be here together" (Mason, 2012:186).

> A 12-year-old boy placed his 4-year-old brother, his grandmother, and his wheelchair-bound uncle onto a mattress and floated them out the window to a house with a second story when the floodwaters from Katrina got too high (Kirschke & Van Vliet, 2005:389).

> Appalled by the conditions just outside the Superdome and fearing what was occurring inside, two parents and their five children stayed on an interstate bridge for five days after Katrina. They joined forces with a neighboring family, looking out for one another and foraging for food and water when their meager supplies ran out (Lein et al., 2012:50).

> The New Orleans Convention Center, without any planning, became a makeshift shelter for thousands of people. When everyone was finally evacuated from the facility, the chairs left behind were arranged in hundreds of small circles—people had, on their own, formed up into small groups of families and friends, protecting each other (Quigley, 2008:377).

Examples like these could stretch on for many pages. The point to be made here is that most credible research and reliable journalistic accounts emphasize that Katrina survivors did just what generations of disaster victims had done before them. They looked out for and cared for each other. They improvised and made clever use of the scarce resources available to

them. They were heroic in many ways as they sacrificed in the face of grave danger. This is what sociologists mean when we refer to prosocial behavior in disaster and it is worth emphasizing how often this occurs in the immediate term aftermath of crises of all different kinds.

## Crime and Conflict

The mortar that holds human communities together is made up, at least in part, of a sense of trust, respect, decency, and, in moments of emergency, of charity and concern. But disasters, as previously mentioned, may also become sites of conflict and social division. When and under what conditions certain types of crime, violent victimization, and other forms of antisocial behavior occurs has been a longstanding focus of sociologists who study disasters.

Although looting is often framed by the media and in popular culture as a common criminal occurrence in disaster, it is actually highly unusual (Green, 2006). When looting has happened in U.S. disasters, it is almost always carried out in secret, involves isolated individuals or small groups rather than large numbers of people, and is widely condemned by affected residents (McEntire et al., 2003; Tierney et al., 2006). In instances where widespread looting has been documented, such as in St. Croix after Hurricane Hugo in 1989, the following conditions influenced the observed behavior: dramatic disparities between the rich and poor, high levels of pre-existing petty crime and gang activity, ineffective and corrupt police agencies, and a catastrophe that caused massive destruction with little hope for the quick arrival of humanitarian aid (Quarantelli, 2008).

Beyond looting, most crime and disaster literature has historically focused on a limited range of behaviors such as price gouging or property crime that might be perpetrated during the impact and emergency phases of disasters. This narrow emphasis has resulted in a divide in the research literature. Those in one camp contend that disasters strengthen norms of reciprocity and altruism and leads to a reduction or stabilization in crime rates. Those in the other camp argue that disasters weaken the mechanisms of formal and informal social control, giving rise to opportunities to commit crime and increased rates of unlawful behavior (see Zahran et al., 2009) including activities associated with white-collar crimes (Aguirre & Lane, 2019).

In a series of edited volumes on the topic, Harper and Frailing (2010, 2012, 2015) have helped to bridge the divide by drawing together contributions that consider a wider range of criminal behavior that can occur in the immediate and longer-term aftermath of disaster. The chapter authors explore the conditions that drive various criminogenic effects of disaster and use diverse data sources to examine instances of rape, domestic violence, homicide, hate crime, illegal drug use, and fraud that have occurred at varying rates after different disaster types. Contributors also explore what happens to people and communities when the disaster itself is a crime, such as was the case in the Exxon Valdez Oil Spill and the BP Oil Spill (Gill et al., 2016). In 9/11, the principal crime—the terrorist attacks—prompted cascading criminal activity in the form of retaliatory hate crimes that were leveled against Muslims, Arabs, and members of other religious and ethnic minority groups (Peek, 2011; Peek & Meyer, 2016).

Sociologists have made important connections between mass incarceration and disaster management activities, as well. This line of research describes how the criminal justice system, which unequally targets low-income communities of color, is used to expand emergency management capacity during times of disaster (Purdum, 2019; Purdum & Meyer, 2020). For example, Goodman (2014) shows how inmates are regularly placed in harm's way when they are forced to fight wildland fires. Scholars have also posited that mass Black death is an ongoing disaster, a form of violence against Black bodies rooted in the very systems that sometimes purport to protect communities (Henry, 2020a).

As the study of crime, victimization, and disaster has expanded in new directions over the years, so too has the exploration of why communities break down in certain disaster

situations. This research often draws on conflict theory and has moved the field more squarely into the study of technological disaster and chronic environmental hazards. In a now classic work, Erikson (1976) examined the loss of communality that followed the 1972 Buffalo Creek dam collapse and resulting flood. The community, which was a company mining town, became embroiled in extensive litigation, and the surviving residents were moved to higher ground and away from the floodplain. The officials who relocated the community did so, however, without consideration of pre-existing family and social formations that were the invisible bonds that held Buffalo Creek together before the disaster.

Later work in this same vein demonstrates that the disaster agent itself can predict whether community consensus or conflict is observed (Erikson, 1994). Chronic crises involving clear human culpability are more likely than those perceived as purely acts of nature to result in a "corrosive community" response (Cope et al., 2016, 2020; Parks et al., 2020; Couch & Kroll-Smith, 1985, 1991). Civil disturbances (Hewitt 1997; Warheit, 1976), riots (Quarantelli, 1993), terrorist attacks (Peek & Sutton, 2003), and technological disasters (Couch & Kroll-Smith, 1985, 1991; Kroll-Smith & Couch, 1990; Neal, 1984) are especially likely to lead to conflict, blame attribution, and protracted litigation that can create or deepen already existing fault lines in communities (Mayer et al., 2015; Picou et al., 2004). Natural hazard events that generate technological failures and cascading, complex disasters, such as Hurricane Katrina, can also lead to prolonged recovery processes among marginalized populations and corrosive community responses (Laska et al., 2018; Mohammad & Peek, 2019; Parks et al., 2020).

## How Disasters Reflect the Existing Social Order: Social Inequality and Group-Based Patterns

Disasters do not cause indiscriminate harm, and while they may involve forces of nature, they are not external to our social systems. This recognition has not only spurred sociologists to challenge notions of "natural" disasters. It has also led to a vitally important body of scholarship that clearly documents what Matthewman (2015:13) refers to as "vastly uneven landscapes of risk."

Social scientists from a range of disciplines have found that disaster risk, like other forms of environmental injustice, is patterned in ways that reflect pre-existing social and economic inequalities. Groups that are marginalized have less power and fewer resources, and in turn, they often have the hardest time preparing for, responding to, and recovering from disaster (Hewitt 1997; Wisner et al., 2004). This means that disaster losses tend to be distributed along the familiar lines of race, ethnicity, gender, social class, and age (Peacock et al., 1997; Phillips et al., 2010; Thomas et al., 2013). It also means that public and private sector regulation of risk—or lack thereof—can reproduce and create inequality (Giritli Nygren et al., 2017; Montelius & Giritli Nygren, 2014; Petridou et al., 2019).

The patterns that disasters both reveal and reinforce are apparent in who lives and who dies in a disaster event. A recent global report showed that, of the 1.3 million people killed in natural hazards events in the past 20 years, people in the world's poorest nations were more than seven times more likely to die than equivalent populations in the richest nations (Wallemacq & House, 2018). The United States and other high-income countries have dramatically reduced overall disaster mortality, largely due to enhanced building codes and standards, stronger government enforcement of mitigation policies, advanced early warning systems, and other interventions. Still, when disasters have caused large loss of life in the United States—including in the still unfolding COVID-19 pandemic—those at the margins of society have suffered disproportionately. Other recent examples include Hurricane Maria in 2017, Hurricane Katrina in 2005, and the Chicago Heat Wave in 1995. These events resulted in higher death rates among the elderly, people with pre-existing medical conditions, low-income people, those with limited social networks, and people of color

(Klinenberg, 2002; Santos-Burgoa et al. 2018; Sharkey, 2007).

In the first comprehensive examination of children's mortality from forces of nature in the United States, Zahran et al. (2008) discovered that while children's overall risk of death is relatively low, differential risks exist depending on the hazard agent and the demographic characteristics of the child. Their analyses of the Centers for Disease Control and Prevention's WONDER database revealed that risk of death among youth cohorts ages 0–24 is highest for infants and the death rate for male children is higher than the death rate for female children. Data on race indicate that African American male children between the ages of 0–4 are most at risk for death by disaster, while White male children between the ages of 5–24 are most at risk. In terms of risk by age by hazard type, their analyses revealed that infants and very young children age 0–4 are most likely to die of exposure to extreme heat, 5–14 year-olds are most likely to die in cataclysmic storms and flood events, and youth ages 15–24 are most likely to die of excessive cold.

Adams et al. (2020), also drawing on the CDC WONDER database, conducted similar analyses to examine disaster mortality patterns among older adults (60+ years) in the United States. They found that older adults have a 3.84-fold increase in mortality caused by natural hazards compared to those under age 60. Among older adults, males have higher mortality rates than females. American Indians/Alaska Natives have the highest mortality rate of any racial/ethnic group and are particularly impacted by excessive cold. Mortality is also high among Black males, especially in the context of cataclysmic storms. Differences in mortality rates among racial/ethnic groups widen with age.

While we have focused on disparate patterns in terms of disaster-related mortality, group-based inequalities are apparent across the disaster lifecycle (Mileti, 1999). Sociological research has repeatedly shown that those who are at the margins of society almost always have a harder time preparing for disaster and, in turn, suffer more severe physical and mental health outcomes, are more likely to be displaced, and are more likely to experience protracted and uneven recovery processes (Arcaya et al., 2020).

Sociologists have always played a central role in identifying disaster-related disparities among particular groups of people (Elliott, 2015; Elliott & Pais, 2006; Enarson, 2012; Howell & Elliott, 2019; Luft, 2016). Of course, many of these unequal and negative *post-disaster outcomes* are shaped by the *pre-disaster circumstances* of the groups in question. Consider the following examples from the social science literature that illustrate the power of pre-disaster context in shaping post-disaster outcomes (adapted from Peek & Domingue, 2020:67–68, Table 5.1):

- *Poverty:* People in poverty or near-poverty are more likely to experience bouts of homelessness and to live in the most vulnerable housing (Vickery, 2017). The poor and near poor tend to lack the resources necessary to relocate or to retrofit their dwellings, especially when they are renters. Even though they may have higher risk perceptions, they are less likely to receive warning messages and to be able to act appropriately to the messages they do receive (Dash 2013; Peacock et al., 1987). The poor are less likely to apply for and receive post-disaster recovery aid, and policies that are ostensibly meant to spur recovery may actually deepen the wealth gap (Fothergill & Peek, 2004; Howell & Elliott, 2019).
- *Race and Ethnicity:* African Americans, Latinos, Native Americans, Asian Americans, and other communities of color in the United States have been subjected to overtly racist and discriminatory policies that have institutionalized their exclusion and segregation and led to the denial of various rights and opportunities. Formal policies and the informal practices associated with race and ethnicity have resulted in centuries of unequal allocation of resources, as well as present-day racial disparities that influence the harm of disasters (Fothergill et al., 1999; Peacock et al., 1997, 2014). Recent research demonstrates the difficulty communities of color experience even as they mobilize to

overcome deeply entrenched inequalities (Rivera et al., 2015; Santos-Hernández, 2006), as they continue to face unjust recovery policies (Gotham, 2014; Hamideh, 2020).

- *Gender:* Gender roles, expectations, and norms often lead to differential vulnerability between men and women (Alston & Kent, 2008; Fothergill, 2004; Haney & Gray-Scholz, 2019; Houghton, 2009; Hyndman, 2008; Parkinson & Zara, 2016; Tobin-Gurley & Enarson, 2013). In most places around the world, women are less likely to have political representation proportionate to their share of the population, sustain financial and social independence, and earn wages and salaries commensurate with their male counterparts (Enarson, 2012). In turn, women and girls are more likely to experience violence and abuse, be politically and socially marginalized and economically exploited, to live in poverty, and to be ignored or excluded in decision-making processes (Enarson et al., 2018; Jenkins & Phillips, 2008; Villarreal & Meyer, 2020).
- *Age - Older Adults:* Older persons may be more susceptible to harm and suffering in disaster under certain conditions, such as when they experience physical or medical conditions that limit their mobility, depend on devices or medical treatments that require power or access to prescription medications, have physical disabilities that limit their ability to receive warnings or take necessary protective actions, have fewer social connections or smaller social networks, and lack access to the Internet, a computer, or other resources necessary to apply for and receive pre- or post-disaster aid (Campbell, 2019; Klinenberg, 2002; Meyer, 2016; Peek, 2013).
- *Age - Children and Youth:* For children and youth, their vulnerability is influenced by their age as well as other factors such as family structure; exclusion from the public sphere and decision-making bodies that influence them; lack of voting rights; cultural systems that devalue their perspectives and ignore their voices; stigma or stereotypes against young people; and high rates of child poverty (Anderson, 2005; Fothergill, 2017; Fothergill & Peek, 2015; McDonald-Harker et al., 2020; Peek, 2008; Peek et al., 2018).

Sociologists have also made important contributions in identifying how occupational status (Adams & Anderson, 2019) and particular institutions such as the family, schools, government, religion, the healthcare system, and the economy shape the *context* in which people live and work, which in turn, influences the risks that they face (Phillips, 2015). Often, disasters are the predictable outcome of years if not generations of short-sighted decision-making, typically motivated by profit-seeking or a focus on other forms of political or economic gain, that translate into environmental degradation, poor land use planning, and other unsustainable development practices. These contribute to what Mileti (1999) calls "disasters by design," which leave entire groups of people unprotected from the various shocks and setbacks that accompany disasters.

## The Future of the Field: Disaster Sociology for a More Turbulent and Unequal World

Disaster losses are on the rise globally. According to recent analyses of data from the Emergency Events Database (EM-DAT) maintained by the Centre for Research on the Epidemiology of Disasters (CRED), in the span from 1998 to 2017, countries experiencing natural hazards that became disasters reported $2.9 trillion in economic losses (Wallemacq & House, 2018). Due to higher asset values, the United States alone accounted for about one-third, or approximately $945 billion, of worldwide losses in the study period. Although high-income countries bear the brunt of absolute economic losses in disasters, low- to middle-income countries suffer disproportionate losses that can erase decades of development progress (Wallemacq & House, 2018).

Economic indicators obviously represent just one measure of the mounting toll of disasters. The same report found that during the period from 1998–2017, 1.3 million people died in disasters and 4.4 billion were injured, rendered homeless, displaced, or left in need of emergency assistance (Wallemacq & House, 2018). Sociological research has helped reveal the root causes of such disaster losses and has identified many additional personal and collective consequences. Indeed, research in the sociology of disasters provides an important window into the harm and suffering caused by disasters, as it reveals the complicated interconnection between environmental conditions and social processes and systems. This work has advanced our understanding of human behavior during times of immediate crisis. It has also focused attention on the role of rising social and economic inequality, environmental degradation, mounting population pressures and unsustainable development in hazard-prone areas, climate change, and other environmental and social forces that collide to ultimately create catastrophe.

The twentieth century gave rise to both disaster sociology in the 1940s and 1950s and environmental sociology in the 1970s. The losses already incurred in the twenty-first century have demonstrated repeatedly how vital these areas of study are and how necessary it is to respond to recent calls to better integrate disaster studies with the sociology of climate change, the intersectional study of environmental injustice, and environmental sociology more broadly (Dunlap & Brulle, 2015; Malin & Ryder, 2018; Ryder, 2017; Tierney, 2007).

Wachtendorf (2019) has encouraged bold action among the disaster research community, challenging us to rethink the field and organize ourselves around the grand challenges that we now face. We believe that it is possible to respond to this call through adopting a *convergence research framework*—here defined as an approach to knowledge production and action that involves diverse teams working together in novel ways, transcending disciplinary and organizational boundaries, to address vexing social, economic, environmental, and technical challenges in an effort to reduce disaster losses and promote collective well-being (Peek, Tobin, et al., 2020b:2). This framework, which is problem-focused and solutions-oriented, can help mobilize researchers and practitioners to respond to the many urgent environmental and social challenges that confront humanity and especially the world's poorest and most marginalized people (also see Prasad, 2018). To move in this direction, we conclude with the following ideas that we would like to see advanced in the sociology of disaster over the coming decade.

First, disaster sociologists need to take a central role in interdisciplinary and transdisciplinary teams that are converging to study and respond to society's grand challenges. At present, most convergence research efforts (and here again, we are referring to a distinct approach to *doing research*) that are focused on major environmental problems are led by engineers, biomedical scientists, and others from traditional STEM disciplines. The social and behavioral sciences, as well as the humanities, have been largely excluded from the convergence revolution that has taken root in this century (Peek et al., 2020b). This is problematic because there is a strong chance, based on historical precedent, that these teams could move forth in issuing technical fixes for what are actually social problems (ibid:4). Sociologists and other social scientists should help lead the convergence revolution so that we can broaden the horizons of scientific inquiry and respond most effectively to increasingly complex environmental and social challenges.

Second, ethical considerations should be centered alongside our research questions and given the same primacy. We take a broad and inclusive approach to research ethics, moving beyond institutional review board requirements to think deeply about the rights and obligations of researchers to one another, as well as to those whom we study (Browne & Peek, 2014). This means that as the field progresses, it is crucial that the rights and interests of researchers (Kendra & Gregory, 2019) and research participants (Gaillard & Peek, 2019) are equally respected

and protected. This will help ensure that evermore critical and lifesaving disaster research can continue unimpeded by overly bureaucratic restrictions (Kendra & Gregory, 2019). At the same time, researchers should engage in their work by centering ethics and respecting the dignity of their participants, even when they must sometimes simultaneously identify actions and beliefs of participants that contribute to systemic inequalities and social vulnerability. While there are limitations in relying solely on people's own personal experiences, the same can be said of relying only on numerical data (Perez, 2019). The key, according to Perez (2020), is to figure out where the two can meet and inform each other in ways that actually work to improve the lives of those most impacted by disaster and injustice. This assertion is as true in disaster sociology as it is in the discipline more broadly. Greater use of participatory engagement practices can be one effective way to better address the complex needs and desires of the people whom we study (Hendricks et al., 2018; Meyer et al., 2020).

Third, disaster sociology should focus on the possibility for disaster justice in the twenty-first century. We believe such a shift could strengthen the ties to environmental sociology more broadly and studies of environmental justice specifically (Mohai et al., 2009; Pellow & Nyseth Brehm, 2013), advancing stronger theoretical and applied frameworks. Long-understood inequitable disaster impacts based on race, ethnicity, income, gender, and other facets of social stratification should be aligned with the theoretical lineage of environmental justice and climate justice literatures (Perez & Egan, 2016; Ryder, 2017). Taylor (2014), for example, centers the processes of historical and ongoing racial and economic marginalization that generate environmental injustices around toxic exposures. These same processes, such as discriminatory redlining practices that relegated African American neighborhoods to flood-prone areas and what have now become urban heat islands, can result in disaster injustices. Similarly, strategies to contend with the potential impact of climate change can generate inequities in implementation, outcomes, and benefits (Mach et al., 2019; Siders, 2019). Environmental sociology and the sociology of climate change have furthered our theoretical understanding of development, urbanization, and capitalism in ways that intersect directly with disaster. When the powerful insights of these different areas merge, we see the possibility not just for exposing the roots of environmental harms, but also for illuminating a more just and sustainable future.

Fourth, we call on disaster sociologists to focus on the strengths and capacities of the people whom they study. Sociologists have pointed out that those affected by disaster are not just "helpless victims" waiting to be saved (Fothergill & Peek, 2015:4). Children and adults also have enormous strengths and capacities that can transform disaster preparedness, response, and recovery efforts (Peek, 2008; Rivera et al., 2015). Even with that frame in mind, sociologists continue to focus overwhelmingly on disaster-related disparities and inequities. This is understandable given our training to look for patterns in society, and anyone who looks carefully can clearly see that the already disadvantaged often suffer first and worst in disasters. But there are also other local and global patterns emerging. This includes the mobilization of the poor, people of color, children, and other groups that have been historically marginalized who are rising up in response to the risks they face. Sociologists should investigate these patterns of progress and action in areas of risk just as diligently as we study disaster-related disadvantages.

Fifth, there needs to be a major investment in promoting public disaster sociology alongside a public environmental sociology (see Caniglia et al., 2021, this volume). From the earliest days of disaster sociology, researchers have been driven by the desire to make contributions both to knowledge as well as to practice. Sustained engagement by sociologists, working with personnel from emergency management agencies and non-governmental organizations, disseminating findings in non-academic forums and through newspaper op-eds, and making calls over the decades to continue to bridge the gap between researchers and practitioners are examples of such outcomes of this motivation.

Yet many of these efforts have been ad hoc or on an individual level.

Research shows large gaps and potential opportunities for furthering the integration of disaster research into practice (Fothergill, 2000; Williams & Webb, 2019). This means that investments in formal institutional mechanisms and funding for public disaster sociology and public environmental sociology training programs for researchers at all career stages are crucial. Such programs could help researchers learn how to *translate* what they already know to broader media, policy, and practitioner audiences. Greater emphasis on open-access publications (such as Laska, 2020) and continuing the legacy of readily available white papers and other online publications such as those from the Disaster Research Center at the University of Delaware, the Hazard Reduction & Recovery Center at Texas A&M University, the Natural Hazards Center at the University of Colorado Boulder, and the many other academic hazards and disaster research centers that now exist globally can help continue to democratize access to knowledge (see Hines et al., 2020). Moreover, taking advantage of novel, diverse, and accessible dissemination methods such as social media, blogs, podcasts, videos, training modules, and other mediums can help expand the reach of research. As the speed at which information is produced and consumed has evolved in the twenty-first century, so too have the actions of researchers as they increasingly combine their activism and advocacy in ways that transform disaster scholarship (Henry, 2020b).

While disaster sociology is an ever-evolving field, we have a tremendous legacy of information that can and should be applied to ensure that our policies do not lead to a deepening of inequality and disadvantage the already disadvantaged. Sharing the enduring lessons of this field, while focusing anew on twenty-first century challenges, offers great promise and possibility for more just and equitable futures.

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# Environmental Factors in Health

# 12

Elisabeth Wilder and Phil Brown

Health outcomes are shaped by a complex interaction of individual and societal-level factors, including: where we live and work, our ability to access health care, genetics, race and ethnicity, income and educational background, lifestyle choices, social support, and cumulative exposure to hazards. The World Health Organization (2016) estimates that environmental factors contribute to nearly a quarter of all deaths worldwide. Yet discussions of the causes of illness and disease are often limited to genetics and individual lifestyle factors, while past and current environmental exposures remain invisible (Brown, 2007). Think about the kinds of questions that you were asked the last time you needed to see a doctor. You were probably asked about your family history of disease and how often you smoke, drink alcohol, and exercise. You were probably *not* asked about your daily and cumulative exposure to air pollution, how close you live to hazardous waste sites or polluting industries, whether your water pipes have been tested for lead, or what kinds of chemicals are used in your home, school and workplace. Yet these factors are at least as important as genetics and lifestyle in determining your overall level of health and wellness.

In this chapter we examine environmental sociology's engagement with environmental health as a research topic and as a growing form of activism, as well as with environmental health scientists and community advocates. We rely heavily on the work of environmental health advocates and scientists, environmental historians, and public health scholars, whose pioneering work in this area has provided a foundation for environmental sociologists concerned with health. Throughout the chapter we show that a commitment to public sociology, advocacy, and activism are often intertwined with the environmental health research carried out by environmental sociologists. This highly engaged approach to environmental concerns places the needs of affected people and communities in the primary position of importance and contributes to the creation of alternative epistemologies and practices.

Environmental health is still a relatively understudied topic within environmental sociology, even though many of the topics that are central to environmental sociology have very clear environmental health implications. The study of climate change and climate justice has become a foundational part of the subdiscipline—though few sociologists address or engage with the health conditions and hazards that are exacerbated by climate change, including heat

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stress, morbidity and mortality from climate-induced disasters, spread of infectious disease like the Zika virus, discovery of contaminated sites after disasters, increases in air pollution, and the ramifications of dietary changes necessitated by the changing climate. For example, in a recent edited volume summarizing existing sociological perspectives on climate change and society (Dunlap & Brulle, 2015), there is no chapter dedicated to the health impacts of climate change—although health issues are sometimes included in environmental sociologists' examination of climate-related inequities (c.f. Harlan et al., 2015). Similarly, environmental sociologists who study the power of the petrochemical sector and its closely allied private vehicle sector should logically consider the environmental health implications of that sector, but often do not. Natural resource scholars concerned about the impact of mining on resource-dependent communities and Native American tribes should logically examine the health effects of copper smelters, uranium tailings, and mercury from coal-fueled power plants, but often do not. Some notable exceptions can be found in the work of environmental sociologists who examine the health-related impacts of pesticides and other industrial chemicals (Harrison, 2011; Little, 2014; Saxton, 2015), coal (Bell, 2016), uranium (Malin, 2015), and unconventional oil and gas production (Wylie, 2018; Ladd, 2018).

While this chapter will not explicitly engage with these aspects of "undone environmental health sociology," we hope our work stimulates others to think of the health aspects of their environmental sociology research and practice. Indeed, one of the major points we wish to make is that environmental sociology should view health as central to most, if not all, of its work—much as environmental sociology asks sociology overall to consider the centrality of environmental concerns.

One of the most notable aspects of the field of environmental health is researchers' engagement with communities impacted by environmental contamination. Since laypeople have often been the primary source of hazard recognition and action, environmental health researchers typically build ongoing relationships with affected communities, either by providing research and advocacy services for them or by working with them in joint research/practice partnerships. Increasingly, work in these areas is taking the form of transdisciplinary social science-environmental health collaborations, which typically involve researchers from multiple disciplines in addition to the community partner.

As we cannot cover all of the sources and consequences of the environmental health hazards discussed above in this chapter, we focus mainly on a subset of environmental health considerations related to chemical exposures. This is primarily because chemical exposures are often less visible to the general public than the health hazards associated with environmental pollution generated by the transportation, agricultural, and extractive sectors. Exposure to toxics affects both individuals and collectivities. Individual-level experience includes personal health concerns, psychological awareness of toxic trespass, assigning of responsibility, and decisions about personal levels of change such as avoiding harmful products. Community-level experience includes collective action in the form of public protest, litigation, pressure on government, and pressure on those parties held responsible for contamination. Not only do people experiencing toxic exposures have to discover the existence of contaminated sites and deal with the effects of their exposure, they frequently also must struggle to prove that diseases or conditions they are suffering from are related to that contamination (Brown, 2007; Brown & Mikkelsen, 1997; Edelstein, 1988; Hoover, 2017).

We begin by providing a brief history of environmental illness and its political-economic context. We then turn to the matter of regulatory neglect in order to better understand how government and industrial science have failed to protect human and environmental health, relying primarily on the work done by impacted community members and environmental health advocates in bringing these issues to the attention of academics and the public. Next, we consider studies of contaminated communities, which formed the

basis of early environmental sociology, followed by health social movements and other challenges to the dominant epidemiological paradigm, as well as more recent developments in exposure experience and contested illness. Finally, we discuss new research methods and sensibilities and end with some concluding thoughts on environmental health and justice activism in the current era.

## A Brief History of Environmental Illness

It is clear why we should all pay more attention to environmental health. In 2015, pollution was responsible for more deaths worldwide than tobacco smoke, nearly three times as many as AIDS, malaria, and tuberculosis combined, and more than *20 times* as many as war and murder (Landrigan et al., 2017). Air pollution alone was responsible for 4.2 million early deaths that year, with the majority occurring in rapidly industrializing areas of the developing world (WHO, 2016). Cancer is a leading cause of mortality, with one in five people—one in three in industrialized nations—expected to develop the disease in their lifetimes (WHO, 2016). Around 20% of cancers are directly attributable to environmental factors (WHO, 2016). In the United States, asthma rates have been steadily increasing for decades, from 3.1% of the population in 1980 to 8.4% in 2010 (CDC, 2012). From 2001 through 2009, asthma rates rose the most among black children, who experienced a 50% increase in the disease (CDC, 2011). From 2014 to 2016, asthma rates among black children rose from 13.4% to 15.7% (CDC, 2018a). Communities of color remain disproportionately impacted by pollution, toxicity, and environmental hazards (as reviewed in Chap. 3).

Meanwhile, of the 80,000 chemicals currently registered for use in the United States, it is estimated that fewer than 2% have been assessed for toxicity, and only five have ever been banned (Steingraber, 2010:103). Other chemical removals have stemmed from voluntary agreements between EPA and chemical companies, such as in the examples perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), though replacement chemicals have many structural and toxicological similarities. State bans have been a more productive mechanism, as seen with bisphenol-A (BPA), flame retardants, and some polyfluoroaskyl chemicals (PFAS). Many of these chemicals have been linked to cancer, high blood pressure and heart disease, diabetes, obesity, asthma, neurological, and reproductive problems. Yet these chemicals are ubiquitous in our environment—they are in the air that we breathe, the foods that we eat, the materials found in our homes, workplaces, schools and hospitals, and the products we put on our bodies.

Chemicals have not only become part of our lives—they have quite literally become part of us. Centers for Disease Control and Prevention (CDC) biomonitoring studies routinely show that that nearly all Americans have detectable levels of harmful substances such as perchlorate, mercury, BPA, perfluorinated chemicals, and flame-retardants in their blood (CDC, 2018b). While the CDC study focused on adults, an Environmental Working Group study found more 232 industrial compounds and pollutants in the cord blood of American infants (EWG, 2009). Activists have termed this kind of chemical contamination *toxic trespass*—because without our consent and often without our knowledge, the chemicals in consumer and personal care products, home and office furnishings, and building materials have now passed into our bodies.

## The Chemical Revolution

Along with modern conveniences like electricity and locomotives, the Industrial Revolution also brought new environmental and health hazards to the American public. Coal miners were routinely killed when mines collapsed or exploded; others developed respiratory ailments like silicosis and pneumoconiosis—also known as black lung disease (Bell, 2013, 2016; Bell & York, 2012). Clouds of smoke and soot hung over cities like toxic clouds and lingered in ill-ventilated homes

near the manufacturing districts. Burning coal discharged harmful pollutants into the air including mercury, lead, cadmium, carbon monoxide, and arsenic. The consequences of these exposures included severe asthma, chronic respiratory infections, and premature death. Meanwhile, the chemical industry was being born, as chemists learned that the distillates of coal tar could be used to create synthetic dyes (Travis, 1993).

The hazardous health effects of synthetic chemicals used in the manufacturing process have long been known to industrial science, although this knowledge was rarely shared with workers or the general public. By 1895, it was clear that German dye factory workers were experiencing convulsions, bloody urine, and skin discolorations (Fagin, 2013). By 1906, thirty-eight workers at a dye factory in Frankfurt had been diagnosed with bladder cancer; yet this knowledge did little to slow the growth of the industry (Fagin, 2013). After World War I, new factories were opened in the U.S., where workers were not told about the known dangers of the chemicals they were handling. In 1932, twenty-three bladder cancer cases were discovered at a DuPont dye factory. Despite being told about the other instances of bladder cancer among workers in similar factories, the company claimed that it could not spare any money to research the health impacts of the chemicals used in dye manufacture (Fagin, 2013). In 1958, when yet another cancer cluster was discovered at Cincinnati Chemical Works and confirmed by the Ohio State Health Department, the plant was closed and production simply moved to New Jersey, where new employees began work with no knowledge of what had happened in the Cincinnati plant (Fagin, 2013).

## Early Struggles for Recognition

The rapid growth of petrochemical-based industries meant that the public was being exposed to increasing volumes and concentrations of pollution and toxicity with little regulatory oversight. By the end of the nineteenth century, activists in the settlement house movement were already leading struggles for worker protection and public health in rapidly industrializing urban spaces. Chicago's Hull House, founded by Jane Addams in 1888, quickly became a center for social justice and progressive reform that often centered on growing pollution and toxicity being produced by industry (Dowie, 1996; Gottlieb, 1993). Resident activists made the connection between issues of degradation of the urban environment, disease, and workplace hazards. For example, Alice Hamilton, a professor of pathology at the Women's Medical School of Northwestern University, pioneered systematic analyses of workplace hazards and foreshadowed later environmental health concerns associated with heavy metals and petroleum-based chemicals. Florence Kelly, another leader of Hull House, made the connection between community and workplace hazards in her research, noting that the working and living conditions were "ruinous to the health of [industrial] employees" and their families (Gottlieb, 1993: 63).

In 1962, Rachel Carson's *Silent Spring* called public attention to the environmental and health effects of DDT and other toxic chemicals, asserting that "[f]or the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals, from the moment of conception until death. In the less than two decades of their use, the synthetic pesticides have been so thoroughly distributed throughout the animate and inanimate world that they occur virtually everywhere" (Carson, 1962: 15). A marine biologist by training, Carson synthesized and presented an enormous amount of data to demonstrate the harm that chemical pesticides pose to ecosystems and human communities. She described how DDT accumulates in the fatty tissues of animals that eat pesticide-laden vegetation—an effect that is magnified at each successive level of the food chain, so that the species at the top of the food chain carry the highest concentrations of DDT in their bodies. For Carson, the danger for most people was not a single large scale or catastrophic exposure, but the "innumerable small-scale exposures to which we are subjected day by

day, year after year" (1962: 173). She was among the first to link synthetic chemicals like DDT to breast cancer, and to foreshadow the role of endocrine disrupting compounds (EDCs) on human health. Carson was subjected to a relentless campaign of personal and professional attacks led by the pesticide industry, which questioned her scientific credentials and even her sanity. President Kennedy tasked the President's Science Advisory Committee with reviewing Carson's evidence, which was fully substantiated by the Committee's report (PSAC, 1963). Public outcry led to the creation of the Environmental Protection Agency (EPA) in 1970, and one of its first acts was to ban DDT.

## Community-Based Campaigns for Environmental Health and Justice

During the late 1970s and early 1980s, grassroots movements for environmental health and justice arose in response to toxic chemical contamination in poor communities and communities of color. Love Canal, for example, was a working-class residential neighborhood of Niagara Falls that was built above a toxic waste site without residents' knowledge. Residents had complained of odors and substances surfacing in their yards for decades, and in 1976 the city finally hired a consulting firm to investigate. The investigation revealed toxic chemical residues in the air, buried drums of toxic waste, and high levels of PCBs in the storm sewer system (CHEJ, 2018). The city did not follow the recommended mitigation strategies, having conducted a cost-benefit analysis of cleaning up the contamination and deciding that the $20 million that it would cost exceeded the monetary value of the working-class residents' lives (Gibbs & Livesey, 2003). Community residents, led by Lois Gibbs, conducted a community health survey documenting an unusually high number of miscarriages and children with born with birth defects and various intellectual disabilities. When their data was dismissed by the New York State Department of Health, the community took their fight to the EPA. After two-year battle that included taking EPA representatives hostage (Gibbs & Levine, 1982), the community was finally bought out and relocated. The Love Canal episode ultimately led to the creation of EPA's Superfund program in 1980—a federal program designed to finance cleanup of toxic waste sites. Lois Gibbs would go on to found the Citizens Clearinghouse for Hazardous Waste, now the Center for Health, Environment and Justice (CHEJ), a national organization that has assisted thousands of grassroots groups fighting toxic contamination in their communities.

Although communities of color had been protesting the siting of hazardous waste for decades, in 1982 a proposal to build a landfill for PCB-contaminated soil in a small, predominantly African American community in Warren County, North Carolina led to a massive protest staged by the NAACP (Bullard, 1990). The protest received mainstream media coverage as well as the attention of the Congressional Black Caucus. The Warren County protests inspired other groups in poor minority communities to fight the discriminatory decision-making processes that resulted in a disproportionate share of environmental burdens and hazards being located within them (Bullard, 1990)—and sparked a sub-field of related scholarship among environmental sociologists and others (reviewed in Chap. 3).

Robert Bullard's (1990) *Dumping in Dixie: Race, Class, and Environmental Quality* was the first major academic work in the rapidly growing field of environmental justice, emphasizing how systematic and institutionalized environmental racism leads to higher levels of environmental exposure, health inequalities, and exclusion from environmental decision-making for people of color in the United States. Many key community organizing efforts that formed the basis for the environmental health and justice movement began in rural, largely African-American areas of Louisiana's industrial chemical corridor between New Orleans and Baton Rouge, often referred to as Cancer Alley (Lerner, 2006; Roberts & Toffolon-Weiss, 2001). Later on, Cancer Alley activists would be among the first to employ lay community monitoring (now called civic science) via the Louisiana Bucket Brigade, whose

inexpensive community monitoring devices demonstrated widespread petroleum-based contamination that was otherwise not being monitored or reported on by official sources (Allen, 2003).

The community organizing that employed popular epidemiology and civic science (Brown & Mikkelsen, 1997; Ottinger, 2010; Wylie, 2018) has led some environmental sociologists to focus on the intersection of toxic contamination, community response, and the failure of environmental governance (Dillon et al., 2018). At the same time, it has made environmental sociology a major contributor to public sociology, in particular by combining support of environmental organizing, frequent participation in that organizing, and critiques of existing government and scientific policy and practice.

## Regulatory Neglect

The Toxic Substances Control Act (TSCA) of 1976 gave EPA the authority to require industry reporting of chemicals as well as health and safety testing, and to enforce restrictions on chemicals deemed to present an "unreasonable risk of injury to health or the environment." However, it exempted the 62,000 chemicals already in production from many testing and reporting requirements. New chemicals could enter the market unless the EPA could prove that they posed an "unreasonable risk." Yet the agency had only 90 days to make that determination and rarely had the time, staff or funding to test new chemicals thoroughly. As a result, nearly all new chemicals have been allowed to go on the market with little to no health or toxicity data.

In 2010, Senator Frank Lautenberg (D-NJ) and Representatives Henry Waxman (D-CA) and Bobby Rush (D-IL) introduced Congressional bills intended to address some of the shortcomings of TSCA. The chemical industry spent more than $125 million on lobbying Congress during the debate over TSCA reform (Cordner, 2016). The revised law, referred to as the Frank R. Lautenberg Chemical Safety for the twenty-first Century Act (LCSA), was passed in 2016 and represents a significant but still partial victory for human and environmental health. While the new law requires EPA to prioritize and evaluate chemicals based on the risks they pose to human and environmental health rather than on the costs and benefits of regulating them, only a handful of chemicals are scheduled to be evaluated each year. The final version of LSCA also prevents states from enacting their own restrictions on the chemicals under EPA review, even though these reviews are likely to take years, and bars future regulatory action on any chemicals that have undergone an EPA review. Finally, the single-chemical approach to assessment (i.e. in contrast to evaluating together chemicals belonging to the same class, like BPA and BPS) leaves the door open for regrettable substitutions. The result is that in the United States, chemicals are still "innocent until proven guilty." Once chemicals are in use, the burden is on consumers, community residents, and the victims of chemical contamination to prove harm.

Yet consumers and community members have no affordable, systematic way to monitor or document their exposure to toxic chemicals (Wylie, 2018). Moreover, conclusively proving harm is almost an impossible task (Langston, 2010; Murphy, 2006; Nash, 2006; Oreskes & Conway, 2010). Contaminated communities' personal experiences have historically not been seen as sufficient or "legitimate" evidence of contamination (Gibbs, 2002), but "scientific" proof of chemical-induced illness in humans is nearly impossible to come by because the type of controlled experiments on human populations required to generate conclusive evidence of harm would be impractical and unethical. Furthermore, the effects of chemical exposure may not become evident for many years (Colborn et al., 1997; Murphy, 2006) and waiting decades for epidemiological studies to demonstrate harm is not a feasible solution for contaminated communities. Finally, even when epidemiological studies document unusually high rates of illness, this does not necessarily prompt government or regulatory action because these studies cannot "prove" that the sufferings of community members were caused by the hazard in

their community (Gibbs, 2002). Contaminated communities thus often find themselves in an impossible bind, with their concerns remaining unacknowledged and unaddressed by regulatory agencies.

## Community Concerns Ignored by Regulatory Agencies

The pattern of community health concerns being ignored by regulatory agencies is, unfortunately, a longstanding one. In 1979, mothers in Woburn, Massachusetts discovered a cluster of leukemia cases among neighborhood children whose drinking water had all come from the same well. They demanded an investigation. However:

> health authorities from the state and federal agencies concluded that there was no connection between the drinking water and the clustering of disease. The Woburn parents persevered, making maps that showed the clustering of leukemia cases along pipelines from a particular contaminated drinking-water well. Local parents took these maps to health officials, politicians, and journalists who they thought would help them. It was not until years later that the Massachusetts Department of Health confirmed the connection of disease to the water supply and closed the drinking-water well. (Gibbs, 2002: 103).

Other cases in San Jose, CA, Brownsville, TX, Tucson, AZ, and Elmira, NY, illustrate instances in which parents brought environmental health issues to the attention of the proper authorities only to be dismissed. In each case, the parents' suspicions about environmental contamination were later confirmed (Gibbs, 2002). Various sociological studies documenting this pattern of community discovery of contamination and the difficulty of proving adverse health outcomes (e.g., Brown & Mikkelsen, 1997; Edelstein, 1988; Erikson, 1994; Levine, 1982) soon followed. These scholars found widespread distrust of government and industry among community members for failing to prevent the original contamination and then failing to take responsibility and remediate the problem once community groups detected it. That problem has led contaminated communities to do their own fact-finding and research that residents either lead or collaborate on.

In recent years, environmental health concerns associated with unconventional oil and gas extraction have grown as hydraulic fracturing (also known as "fracking") operations have expanded dramatically across the United States (Willow & Wylie, 2014). Environmental sociologists have begun to study the impacts of fracking on ecosystems and human communities as well as the regulatory failures that are associated with it. The health risks posed by the chemicals and volatile organic compounds used in fracking are well-documented (Colborn et al., 2011). Moreover, oil and gas extraction "emits pollutants that are associated with cardiovascular disease, the leading cause of mortality in the United States" (McKenzie et al., 2019). Threats to the health and safety of oil and gas workers abound—and these threats are extended and amplified for families who have had wells drilled on or near their property are exposed toxic emissions twenty-four hours per day. Yet even when air samples for hazardous pollutants are found to be many hundreds of times above regulatory thresholds, regulatory agencies often fail to issue any violations (Global Community Monitor, 2011; Opsal & O'Connor, 2014; Wylie, 2018).

The reason for this can be traced back to the early 2000s, when the Bush administration exempted oil and gas operations from numerous federal environmental protection statutes, leaving the responsibility for environmental health and safety monitoring primarily up to the states (Colborn et al., 2011). As Colborn et al. note, although some states have oil and gas commissions that are ostensibly responsible for monitoring natural gas production activity, the "primary mission of these agencies has been to facilitate natural gas extraction and increase revenues for the states" (2011: 1040). In addition, even if they wanted to monitor, state agencies are chronically under-resourced and under-funded (Malin et al., 2017; Sumi, 2012).

Some environmental sociologists have chosen to collaborate with environmental health scientists, since affected communities often require scientific evidence of contamination and

its health effects, and sociologists are increasingly able to work together with like-minded environmental health scientists to do so (Adams et al., 2011; Altman et al., 2008; Hoover et al., 2015). This has broadened environmental sociology's contributions to public sociology, since much of the research of this type is used to advance public policy, legislation, and regulation.

## The Politics of Measurement

The way in which risk is defined, assessed, and measured further shapes the response that communities will receive from regulators. For many hazardous chemicals, regulatory agencies rely on threshold limit values (TLVs) that are established by moving from high doses of a specific chemical to progressively lower levels in order to find the threshold at which there is no discernible effect. These values then determine the level at which a particular chemical is deemed to be safe or dangerous, and allowable limits are set below that level (Murphy, 2004, 2006). However, TLVs are designed to prevent acute harms such as knock-down and death, not to control the effects of aggregate lower dose exposures over longer periods of time. Furthermore, toxicologists find that they cannot "fingerprint" the contribution of specific sources when exposure to chemicals is ubiquitous (Altman et al., 2008). Chemical exposure studies test for causation of illness via single exposure routes and consider in isolation experiences that are actually composite and interactive (Nash, 2004; Wylie, 2011). A lack of evidence of significant exposure via the single route tested for is then used to "used to dismiss the possibility of harm even when harms are readily apparent" (Wylie, 2011: 354).

An ironic illustration of this is described by Michelle Murphy. When new carpets were installed in their Washington building, EPA scientists began to complain of "tearing eyes, irritated throats, burning lungs, shortness of breath, crippling headaches, and dizziness" (Murphy, 2004: 277). Yet toxicological tests were unable to detect an acute dose of any specific chemical, and the official determination was that there was no threat to human health (Murphy, 2004). These EPA scientists, even with their resources, prestige, and scientific training, struggled unsuccessfully to have their health concerns acknowledged and were unable to 'prove' harmful exposure. When toxicological tools failed to detect "significant" contamination, and so EPA staff was told that their contamination was not meaningful.

As environmental epidemiologist Devra Davis summarizes: "when we can't marshal definitive statistical proof of a toxin's specific harmful effect . . . it has become standard to say that we simply don't know whether the toxin is harmful or not. The absence of evidence of harm—even when no effort has been made to gather such evidence—becomes grounds for inaction" (2002: xviii). Environmental sociologist Alissa Cordner (2015) (and author of Chap. 9 on Risk) describes environmental hazards and risks as "contested topics" whose definitions often vary across institutional contexts and disciplines. This is important, she suggests, because the way in which risk is defined will influence the ways in which regulatory and other types of institutions assess and manage risk. When TLVs become the way of 'knowing' whether a chemical is harmful or not, embodied knowledge about what makes humans sick is ignored. In other words, the privileging of remote, lab-based science over the embodied experiences of people on the ground means that if a person is experiencing symptoms associated with chemical exposure, but the levels they have been exposed to have been determined to be "safe," it is the human experience rather than the number generated in the lab that is dismissed.

Although a majority of social scientific studies on fracking employ quantitative analysis (Willow & Wylie, 2014), an emerging body of qualitative ethnographic research has begun to examine the embodied experiences of people living in communities impacted by fracking (c.f. Hudgins & Poole, 2014; Simonelli, 2014; Willow, 2014; Wylie & Albright, 2014). This is critically important given the fact that local residents' embodied experience is often very different from "official evaluations of risk" (Checker, 2007: 113). In

addition, as Willow and Wylie note, since residents of fracking zones "are often discredited as irrational within the wider public discourse" it is not sufficient to only "collect samples and compile statistics; we need to tell real stories that speak to real people's experiences, to give voice to views that may otherwise remain unheard" (2014: 226).

## Personal Care and Consumer Products

Though many of us think of outdoor sources (e.g., factories, refineries, power plants, landfills, contaminated disposal areas) as the primary source of toxicity and pollution, our indoor environments also contain hundreds of chemicals that are known to be toxic. From the chemicals in cleaning and personal care products to pesticide residue on food to non-stick coatings on cookware to flame retardants in our furniture, clothing, and electronics, consumer products are a central component of our environment—and an area in which poor regulations and lack of information can have negative implications for our health.

The average American uses anywhere from 4 to 25 products each day, with women using an average of 12 and men using an average of 6 (EWG, 2018a). One in five of the 29,000 personal care products in the Environmental Working Group's public database have been found to contain chemicals linked to cancer (EWG, 2018b). Synthetic estrogens and other endocrine disrupting compounds (EDCs) are now common in modern industrial and consumer environments. These compounds mimic natural estrogen or interfere with the production of other hormones, which is a particular concern for women's health and reproductive systems. Bisphenol-A (BPA) is one well-known example; other EDCs include certain flame retardants (used in furniture, clothing, and electronics), polychlorinated biphenyls or PCBs (banned by the EPA in 1979 but still found in insulation, electrical equipment, caulking, and oil-based paint), phthalates and phenols (used in cosmetics, food and beverage containers and plastic wraps), and pesticides and herbicides that are widely sold and used in the United States. Over 900 synthetic compounds in industrial and commercial products have been identified as EDCs, including many that have been shown to make human breast cancer cells grow in a laboratory (Silent Spring Institute, 2018). Breast cancer rates have increased by more than 40 percent since 1973, with the result that one out of every eight women in the United States today is diagnosed with the disease (Gray et al., 2017).

Building on the work of environmental health nonprofits and advocacy organizations like Environmental Working Group and Breast Cancer Prevention Partners (formerly Breast Cancer Fund), a few environmental sociologists have recognized the consequences of these exposures for women's health. Lubitow and Davis examine the corporate response to rising breast cancer incidence, which has included the practice of *pinkwashing,* which they define as the "co-optation of breast cancer symbolism by corporate actors who stand to profit from the use of breast cancer awareness imagery, including pink ribbons" (2011: 139). They suggest that pinkwashing allows corporations which may be producers of toxic products to profit from growing sales of these products (now adorned with pink ribbons) and simultaneously control the public narrative and women's experience of the disease in a way that obscures the contributions of environmental exposures to rising cancer rates (Lubitow & Davis, 2011).

## Alternative Approaches to Regulation and Research

In 2006, the European Union (EU) passed a far more comprehensive and precautionary approach to chemical manufacture and use than the U.S. The EU's Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) legislation employs a "no data, no market" rule that requires manufacturers to provide health and safety data for both new and existing chemicals that are manufactured in or sold within Europe. This is an application of the *precautionary principle*—the idea that in the absence of evidence, we should err on the side

of caution and not take any chances with human health.

The U.S. federal government has shown little inclination to follow the EU's example or to challenge the chemical industry's preferences for the regulatory status quo. While the EU has banned over 1000 chemicals from use in cosmetic and body care products under REACH, the U.S. Food and Drug Administration (FDA) restricts just nine. As a result, personal care products that are sold in the U.S. and in Europe can have different formulations: one with toxic chemicals, and one without. For example, in 2011 the Campaign for Safe Cosmetics reported that two chemicals linked to cancer (formaldehyde and 1,4 dioxane) had been found in dozens of baby shampoos and bath products being sold in the U.S., even though Johnson & Johnson was selling formaldehyde-free versions of these products in Europe (Malkan 2016). This is because, in contrast to European law, U.S. cosmetic makers may use almost any material in their products with little regulatory oversight or restriction. In a recent and historic case, Johnson & Johnson was ordered to pay nearly $5 billion in damages to women who had developed ovarian cancer as a result of using the company's baby powder and other talc products (Hsu, 2018). Investigations by The New York Times and Reuters revealed that Johnson & Johnson knew about the risk that asbestos in its talc products posed for decades but concealed the information from consumers and the general public (Hsu, 2018). Finally, in response to growing public awareness and concern over BPA in the U.S., a number of manufacturers chose to remove BPA from their products and adopted a "BPA-free" label. However, in the absence of regulatory standards, many manufacturers quietly replace BPA with BPS, which is nearly chemically identical and has similar estrogenic properties. Variations on this story—lengthy EPA assessments, resistance to regulatory action from industry and government, and regrettable substitutions that do nothing to address the underlying concerns about toxicity, as previously discussed—have been repeated again and again for other major contaminants.

Environmental sociologists have been active in promoting a perspective that links together concerns about environmental health effects, legislation, regulation, requisite scientific evidence, and community engagement. Environmental sociologists examine such concerns through the lens of corporate secrecy combined with regulatory capture of agencies such as EPA (Dillon et al., 2018; Frickel et al., 2010). In this perspective, the seemingly simple action of replacing one chemical with another is viewed as a complex process involving corporate, government, and scientific actors who insist on a single-chemical approach that serves to obscure the larger social context (Cordner et al., 2016).

Research in the field of science and technology studies (STS) has shown that regulatory decisions in the U.S. are based not on purely on scientific calculations, but are instead shaped by a myriad of social, political, and economic factors (Cordner et al., 2016, 2019; Frickel & Moore, 2006; Krimsky, 2003). This includes the strategic production and dissemination of industry-friendly research that is often intended to plant seeds of doubt regarding the state of the science (Michaels, 2008; Oreskes & Conway, 2010). These strategies have been highly effective. However, social scientists have also examined the ways in which scientific data has been used to advance social movement efforts that are more protective of human health (Brown, 2007; Brown et al., 2011; Frickel, 2004; Lubitow, 2013; McCormick, 2007). For example, Lubitow (2013) shows how collaborative efforts between activists and scientists working on bisphenol-A (BPA) resulted in a set of frames that resonated with the public and established the need for action on BPA.

## Contaminated Communities and Environmental Sociology

There are two general forms of environmental contamination. *Episodic* cases have a specific geographical location with a human-caused or human-exacerbated disaster like oil or chemical spills, pesticide drift, large-scale toxic emissions,

nuclear meltdowns, or the discovery of a disease cluster. In the early years of environmental sociology, these were typical research subjects. *Ongoing* exposure to contamination may be low-level and chronic rather than acute and dramatic. This does not mean that episodic contamination is not part of a pattern of ongoing contamination, but rather that this second form is not discovered as a result of a visible crisis. This second form, for instance, includes the persistent presence of contaminants such as BPA, parabens, phthalates, or flame retardants in personal and consumer goods, and is the subject of the later section on "exposure experience."

In all of the above situations, disease sufferers and exposed populations face many obstacles. In addition to ethnographic studies that analyze community-wide and individual responses to contamination, and policy analyses that examine state and federal failures at detection, remediation, and regulation, as we noted earlier, environmental sociologists have also engaged in collaborative work with environmental health scientists on biomonitoring and household exposure studies.

## Contested Environmental Illness

Government oversight of industrial activities and disasters is often very poor, and moreover, government response often serves to minimize the problem. Corporations that are responsible for contamination fight hard to disprove claims of illegal or immoral activities, buy off complainants, and fund researchers who will side with the companies. Scientists are often unavailable to provide the research that would document the contamination since affected people and communities lack resources to hire them—and scientists may have a disincentive to perform this type of research since it is often not well-received in academic settings. Even affected people may oppose investigation because of ideological identification with the company or industry, personal connections with the polluters, fear that their area will be stigmatized and/or that companies will leave, and that property values will decrease and the tax base will erode once the contamination is revealed. This has been shown in nuclear war production (Kaplan, 2000), industrial toxics dumping (Fagin, 2013; Judge et al., 2016), and natural resource extraction (Cable, 1993).

The totality of these obstacles makes for a "dominant epidemiological paradigm" in which many institutions and professions do not recognize environmental causation of disease. Players in the dominant epidemiological paradigm include established institutions entrusted with the diagnosis, treatment, and care of disease sufferers, as well as academic professional associations, journals, media, universities, medical philanthropies, and government officials. Overturning this paradigm requires not just scientific innovation and progress, but often social movement activity by affected people and groups (Brown, 1992). As a result, we are faced with "contested environmental illnesses," i.e. diseases and conditions that engender major scientific disputes and extensive public debates over environmental causes. These include well-established diseases like breast cancer, where the debate focuses on the role of environmental factors, as well as less-established diseases like Gulf War Illness, where there is debate about its very existence (Brown, 2007).

The earliest environmental ethnographies were rooted in narrative tales of the experiences of residents moving from discovery to action, as noted in the earlier section on "Regulatory Neglect." This tradition began with Erikson's analysis of the 1972 flood at Buffalo Creek, Kentucky, where a poorly constructed and inadequately maintained dam broke, causing a massive amount of coal mining slurry to sweep down the hollow, where it destroyed hundreds of homes, killed 125 people, wounded many others, and left enduring psychological scars on surviving community members. Attorneys for the survivors asked sociologist Kai Erikson to study the situation, and his report became the first book-length community study of a human-caused environmental disaster (Erikson, 1976). Erikson placed human-made disaster into the cultural, social, and historical context of the community;

addressed the individual mental health and physical health outcomes of affected individuals within the cumulative community-level effects; and demonstrated that social science can work to help affected people. Like Erikson, psychologist Michael Edelstein (1988) emphasized the joint physical and mental health effects of environmental disaster, and developed the widely used term "contaminated communities." His notion of the "inversion of home" showed how, in these communities, the safe haven of one's home is transformed into a constant source of danger and fear.

Many contamination episodes are "chronic technological disasters" that unfold over a long period of time—for example, hazardous waste dumping or other forms of ongoing pollution—as opposed to singular, often more dramatic occurrences such as a chemical factory explosion or a refinery fire (Kroll-Smith & Couch, 1990). On top of that, contaminated sites usually take a very long time to deal with, from the process of contamination discovery, public agency investigations, scientific research into the contamination and possible remediation, corporate delay tactics and attempts to contest responsibility, and, frequently, litigation. Combined, the contamination discovery and its resolution can take many decades (e.g., Brown & Mikkelsen, 1997; Fagin, 2013).

Discoveries of toxic contamination alone are not enough to compel action or remediation. Polluting facilities and industries often seek to create obstacles for contaminated communities, while local and state governments may fail to act appropriately because they fear revenue loss and may also have political and personal ties to polluting companies. At the federal level, regulatory action is often weak because of anti-regulatory norms—and, as victims of chemical exposure have learned— the supposedly neutral science of risk is very politically involved, usually unlikely to confirm public health hazards, and often not beneficial to affected communities. This was illustrated by Clarke's (1989) examination of the Binghamton, New York state office building fire that released high levels of PCBs. In this case, although the county health commissioner pressed for comprehensive biomonitoring of potentially exposed people, the state health department refused, having determined that the likely PCB exposures were an "acceptable risk."

Sadly, people suffering from environmental illness often cannot get adequate help from health professionals either, mainly due to health professionals' lack of education around issues of environmental hazards. Environmental health has been inadequately studied both by epidemiology and by medicine (Clapp & Ozonoff, 2004). Significantly, the work of environmental sociologists in collaboration with environmental health scientists has both called out this problem and offered practical solutions to dealing with it through litigation, corporate and governmental provision of alternative water sources, health surveys, health effects studies, and regulation. In their studies of activist responses to contaminated sites, sociologists have reported how hard it is for epidemiologists to gain federal and private grant support for environmental research (Clapp & Ozonoff, 2004). The National Institute of Environmental Health Sciences is one of the smallest institutes within NIH, and other institutes fund very little research on environmental factors. In medical training, occupational and environmental medicine have been relegated to a minor position, and the environmental dimension typically gets less attention than the occupational (Castorina & Rosenstock, 1990). Extensive evidence from clinician surveys and case reports of environmental health trainings show that health professionals are not sufficiently literate in environmental health (Brown et al., 2018; Trasande et al., 2010). These shortcomings are not surprising, since the larger society is generally unaware of environmental factors in disease causation. The "environmental health literacy" approach seeks to educate all sectors of society to not only understand environmental factors in disease, but to act on them (Finn and O'Fallon 2018).

Ultimately, health social movements are necessary to press the case for environmental causation of illness. These movements operate in various manifestations and combinations of demands for recognition of environmental health causation, better health access, more equity in

health care, support for lay epistemologies of disease, and lay involvement in scientific research and medical practice. Health social movements arose in many non-environmental areas, such as health care access, women's health, occupational health, AIDS, mental patients' rights, and disability rights (Brown et al., 2004). These movements can be seen as falling into the following categories: *health access movements,* which seek equitable access to healthcare and improved provision of healthcare services; c*onstituency-based health movements*, such as the women's health movement and gay and lesbian health movement, which focus on health inequalities rooted in race, ethnicity, gender, class and/or sexuality; and *embodied health movements*, which address disease, disability, or the experience of illness by challenging accepted scientific and medical perspectives on etiology, diagnosis, treatment, and prevention. Embodied health movements often mobilize around "contested illnesses" that are unexplained or unacknowledged by current medical science or whose purported environmental cause is disputed (Brown, 2007), and it is clear that much of what we have written above centers on this embodied experience. The contested illnesses that we wrote about above are especially in need of such a manifold health social movement approach because of their struggles against the many components of the dominant epidemiological paradigm.

## Exposure Experience

Exposure experience is the process by which people identify, understand, and respond to chemical embodiment (Altman et al., 2008). It stems from the medical sociology concept of "illness experience," which examines how people understand and live with disease, how it impacts their work and home lives, how it may lead them to challenge diagnostic definitions and treatment approaches, and how all the above are impacted by race, class, gender, and other elements of social structure (Bell, 2008; Lawton, 2003). Exposure experience developed as a concept later than the earlier experiences of social discovery and mobilization in contaminated communities. The earliest sociological research on contamination response involves people seeing visible contamination in forms such as chemical spills, explosions, soot deposition, seeping materials, and clouds of pesticide spray. The presence of such external contamination does not, however, show if it entered people's homes and bodies. Household exposure offers the possibility of seeing what toxicants entered living and working spaces, and biomonitoring show how contaminants enter the internal human environment (Brody et al., 2007). Since contamination does not rely on proximity to a polluting facility, bodily exposure to contaminants makes people more aware of the ubiquity of those substances in the world around them and of the near-impossibility of avoiding exposure by moving elsewhere.

People's experiences of household exposure and biomonitoring are shaped by place-based awareness of external contamination, as well as by the embodied experience resulting from testing of their homes and bodies. For example, low-income and largely people of color residents bordering a refinery in Richmond, CA were unsurprised at high levels of contaminants coming from the nearby facility, but *were* surprised to learn about contaminants coming from consumer products. Residents of a wealthier comparison area, Bolinas, who assumed their environments were very pristine and had tried to shop for healthy products, were even more surprised to learn about endocrine disruptors in their household air and dust (Adams et al., 2011). Participants in a household exposure report-back study in Cape Cod, MA interpreted their individual results through a shared history of living in an area that is considered to be a contaminated place, and had to rethink conceptions of pollution as they learned about contaminants in their homes coming from consumer products rather than a nearby military base (Altman et al., 2008).

When there is a direct economic connection to the polluter, exposure experience may combine criticism and litigation with support of the company's importance to the region, and political mobilization may manifest later than in other

cases. This was the situation in the Mid-Ohio Valley area affected by massive PFOA contamination from a DuPont Chemical factory which played a major role in the local economy (Judge et al., 2016). In Appalachia, Cable (1993) argues while individual forms of resistance are common, they may not always coalesce into collective resistance because people feel too constrained by the economic, and social power of companies that are often the major—if not sole—employer, and who exert a great deal of control over local politics. Cable's study of chemical contamination of Yellow Creek, Kentucky found that people made complaints and attempted to work through institutional channels for many years, only mobilizing when the growth of the environmental movement made collective action seem more possible. But the economic and political power of local industry does not always lead to quiescence or to minimal levels of resistance. Indeed, the environmental justice movement had an especially firm origin in Louisiana towns and unincorporated areas that were overwhelmingly dominated by petrochemical firms (Allen, 2003).

Given the ongoing challenges in obtaining an adequate response from government and regulatory science, it has become increasingly clear that consumers, communities, and sympathetic scientists will need to develop and deploy alternate research approaches. We have touched on these earlier in discussion the importance of lay knowledge and research involvement and the growing trend of collaboration between environmental sociologists and environmental health scientists. In the next section, we discuss community-based approaches to studying and documenting toxic contamination in our environments and in our bodies.

## New Research Methods and Sensibilities

### Community-Based Participatory Research

Because mainstream science and government were often unable or unwilling to conduct the research needed to show contamination and its effects, victims of toxic contamination were among the first laypeople to develop research collaborations with scientists. Such partnerships offer the potential for both individual and community empowerment in terms of achieving recognition of the problem, obtaining remediation, taking legal action, conducting research, and advocating for chemical regulation (Brown & Mikkelsen, 1997). There has been a long trajectory of community-based participatory research (CBPR) approaches (Wallerstein et al., 2017), coupled with resident-identified contamination through "popular epidemiology" (Brown & Mikkelsen, 1997) and "street science" (Corburn, 2005), yielding various ways to deal with community contamination. Due to advances in exposure sampling and analytical chemistry and the rise of CBPR models that employ household exposure and biomonitoring, more communities are able to access these techniques in order to study chemical body burdens (Morello-Frosch et al., 2009). Community-based exposure and biomonitoring projects help level information disparities between polluting industries and surrounding communities, creating access to otherwise inaccessible exposure data. Such research allows communities greater agency as they develop understandings, assert meanings, and respond to their exposure (Brody et al., 2007, 2014; MacKendrick, 2010; Washburn, 2014).

Community-based participatory research (CBPR) involves close, collaborative planning, conduct, and translation of research between participants and researchers. Research participants—often residents of impacted communities or community groups–are involved in the research at every step. This public involvement ensures that research questions are relevant and useful; increases the quality, quantity, and utility of collected data; and increases the potential for dissemination of research findings and their translation into policy interventions (Israel et al., 1998; O'Fallon and Dearry 2002; Wallerstein et al., 2017). We extend CBPR to include a deliberative, reflexive process to explore our engagement in such projects. This framework of *reflexive research ethics* involves self-conscious, interactive, and iterative reflection upon researchers' commitment to serving activist

needs, examining relationships with research participants and communities, and engaging with principles of professional and scientific conduct (Cordner et al., 2012; Panikkar et al., 2012). One demonstration of this concept is found in the practice of advocacy biomonitoring.

## Advocacy Biomonitoring

Prompted by the development of the Center for Disease Control and Prevention's National Health and Nutrition Examination Survey (NHANES) biomonitoring project, environmental activists quickly understood the value of showing people what contaminants were in their bodies. Advocacy biomonitoring involves laypeople, working through activist organizations to produce important environmental health science. These projects are often initiated by non-scientists, usually NGOs, who contract outside laboratories to conduct the chemical analyses. Some NGOs have scientists on staff, but they are not typically academic scientists who would have the ability to conduct the biomonitoring research on their own. Sample sizes are small, typically ranging from three to 30 people, so results are not intended to be analyzed statistically but rather to illustrate the number and type of chemicals in ordinary people. Many of these projects involve individuals publicly sharing their exposure data, along with photographs and biographies. These studies thereby become contamination narratives and calls for social change, as well as personal approaches to exposure reduction. Projects typically target chemicals that are less-studied and poorly regulated, and for which health implications and exposure sources often uncertain. These studies emphasize the importance of going beyond individual solutions to press for regulatory and corporate reform in order to reduce exposures (MacKendrick, 2018; Morello-Frosch and Brown 2014; Washburn, 2014). A new variant, conducted by Silent Spring Institute, uses crowd-sourced biomonitoring using the DetoxMe Action Kit, in which people pay to participate in urine biomonitoring for 10 emerging contaminants, as part of a national collaborative of participants.

## CBPR Approaches to Biomonitoring and Household Exposure

The integration of social science in biomonitoring and household exposure studies has facilitated the development of new theories such as the "research right-to-know" (Morello-Frosch et al., 2009), "exposure experience" (Altman et al., 2008), and "politicized collective illness identity" (Brown, 2007) that have redefined and restructured exposure studies as a whole, while also increasing public understanding, environmental health literacy, community empowerment, and mutual trust and respect between researchers and study communities. Transdisciplinary environmental health research has increased public awareness of the effects of exposure, but has also moved beyond the physical and health consequences of environmental disaster and contamination to include community empowerment, ethical practices of sharing data, and policy implications (Brown, 2007; Brown et al., 2011). An example is the Household Exposure Study (HES), a CBPR project to evaluate exposures to pollutants from legacy contaminants, consumer products, and local emissions (Brody et al., 2009). Silent Spring Institute, an independent research center started through the efforts of the Massachusetts Breast Cancer Coalition, collaborated with academics in examining environmental exposures on Cape Cod. Later, in partnership with the environmental justice organization Communities for a Better Environment, Silent Spring expanded the HES to collect data in two Northern California communities. Community members were engaged at every level, as participants rather than subjects, in shaping their report-backs and the type of information that they would provide, as well as in pressing for governmental policy action (Adams et al., 2011; Brown et al., 2010).

## Civic Science

Civic science (also called citizen science) has been a growing mechanism for affected communities to gather badly needed data about the chemicals and hazards they are being exposed to in their daily lives. While civic participation in scientific data collection has a long history (e.g., public ornithology), civic partnerships in scientific knowledge production (beyond residents merely serving as an instrument of data collection) are more recent—and have been key contributions of social science in this area. One significant example of such work can be seen in the efforts of the Louisiana Bucket Brigade to collect air quality samples in fenceline communities (Ottinger, 2010). Another community used a drift catcher to track drift from pesticide applications (Harrison, 2011). The Public Lab for Open Technology and Science pioneered developing tools for public monitoring of environmental quality, with a range of techniques such as using helium balloons equipped with digital cameras to detect oil spill effects from the BP oil spill, hydrogen sulfide detectors using photographic paper to visualize the toxic hazards associated with oil and gas development, and thermal bobs to detect water temperature increases from thermal pollution. These tools and other similar approaches enable communities to report toxic releases that are often unknown to or overlooked by regulatory agencies (Wylie, 2018). In this manner, they are providing broad social context for seemingly isolated instances of contamination, mobilizing affected residents, aiding social movements, challenging the dominant epidemiological paradigm, and developing alternative research approaches. That combination is indeed a deeply sociological approach to environmental health.

## Developing a Transdisciplinary Approach

Transdisciplinary collaborations, such as the ones discussed here, replace the solo researcher or lab team with actively engaged community-based participant research teams though a series of negotiations and recursive interactions between disciplinary practices that bring together social scientists, environmental health scientists, and community groups and residents. This reflexive and iterative research process moves beyond multidisciplinarity, in which researchers maintain their respective disciplinary methods and perspectives, to a truly interdisciplinary form that fully integrates and engages with the overlaps and intersections between disciplines to ensure all facets are investigated (Russell et al., 2008). Furthermore, these projects give communities data to fully comprehend their exposure experience, to pressure the government to respond and remediate environmental harm, and to bring about policy change that is proactive and precautionary to prevent other communities from experiencing similar problems.

## Public Sociology for Environmental Health

Putting all the above elements of research methods and sensibilities together, we arrive at a public sociology for environmental health. In the tradition of "public sociology" (Burawoy, 2004), this type of research seeks to inform debates and discussions outside of academia. In one example, the Contested Illnesses Research Group at Brown University worked with students in an undergraduate class and a community group, ENACT (Environmental Neighborhood Awareness Committee of Tiverton) to press the polluter and the state agencies for a cleanup agreement. They also succeeded in securing a major increase in polluter fines for companies failing to obey the state environmental agency's orders, and in crafting a home equity loan program, the Environmentally Compromised Home Ownership (ECHO) Loan Program, that would provide loans from the state for residents living on or near contaminated sites (Senier et al., 2008).

In another example, researchers first at Brown University's Contested Illnesses Research Group

and later Northeastern University's Social Science Environmental Health Research Institute undertook a strong public policy approach in studying the political, economic, scientific, and public discovery and action on emerging contaminants. For one class of those contaminants, flame retardants, researchers were part of a national coalition that contributed to the reduction in use and thus population exposure to flame retardants, as well as impacting regulatory reform in California that spread to other states and cities. The researchers contributed to the efforts of community groups working on local bans of flame retardants, and worked directly with manufacturers, fire marshals, firefighters, and scientists to reduce flame retardant use and to adopt safer flammability standards. For another class of chemicals—per- and polyfluorinated compounds (PFAS), researchers assisted affected communities in gaining scientific expertise, pressing state and federal agencies for cleanup and research, and mobilizing themselves into a national coalition of community-based organizations (Cordner et al., 2018). The range of methods and sensibilities we discuss here show the path for a highly engaged approach to environmental concerns, one in which the needs of affected people and communities are placed in the primary position of importance.

## Toward Environmental Health and Justice for all

### The Importance of Federal Funding

The political climate in the 1990s paved the way for rising support for government funding of environmental issues, especially after the first national People of Color Environmental Leadership Summit and the development of the Principles of Environmental Justice (Bullard, 1993). Additionally, National Institute of Environmental Health Sciences (NIEHS) director Kenneth Olden, a supporter of environmental justice and of community involvement in research, was appointed in 1991. By 1995, NIEHS had become the first of the National Institutes of Health (NIH) to create a CBPR grant initiative. New programs focused on environmental justice and the ethical, legal, and social implications of scientific research offered the infrastructure needed for social scientists and community groups to enter the NIEHS sphere. Annual meetings brought together grantees, creating a network in which environmental health and social science researchers learned from one another and developed additional collaborations. Eventually, social science research became a requirement for some NIEHS programs and projects, an essential step for promoting interdisciplinary environmental health research (Baron et al., 2009).

However, NIEHS represents only around 1.98 percent of the NIH budget (HHS, 2019), and there is relatively little environmental health research taking place throughout the rest of NIH. The EPA had some CBPR and environmental justice programs at one time, including the very successful Community Action for a Renewed Environment (CARE) program that provided grants that enabled communities to conduct environmental health assessments (Phase 1) and then proceed to amelioration and intervention approaches (Phase 2). But this successful program was always underfunded; in 2009, only 9 grants out of 235 proposals were awarded, representing less than a 4% funding rate (NEJAC, 2010). CARE was abruptly ended during President Obama's administration in 2012. There are now relatively few opportunities for communities to access this type of funding through EPA. Similarly, the very successful Science to Achieve Results (STAR) program, which supported graduate students in various fields working on environmental problems and solutions was ended in 2015 without explanation.

### The Regulatory Climate

The present regulatory climate is particularly unfriendly to the principles of environmental health and justice. The EPA has placed restrictions on oil and gas research throughout its portfolio, largely due to Congressional pressure. The Trump administration's initial pick to

head the EPA, Scott Pruitt, spent much of his previous career as Oklahoma attorney general suing the EPA over environmental regulations, and made it clear that his intention was to dismantle the agency (Davenport & Lipton, 2017). The EPA under Scott Pruitt reversed many progressive gains in environmental policy and regulation, and has removed many restrictions on industrial production, mining, and fossil fuel development. Andrew Wheeler, the head of EPA from 2018 to 2021, is a former coal industry lobbyist. Opposition to EPA's recent actions has come from not only existing environmental and environmental health groups, but also from general science organizations like the Union of Concerned Scientists. New groups have sprung up specifically to deal with the Trump-era EPA's anti-environmental approach. One such group, the Rapid Response Network, mobilizes people to comment on EPA rule changes during open comment sessions, and publicizes criticism of EPA actions. Another, the Environmental Data and Governance Initiative (EDGI), archives federal environmental data, monitors federal environmental websites for changes and deletions, and interviews past and present EPA staff to learn the history and current situation of EPA actions (Dillon et al., 2017, 2018). EDGI has been extensively cited in major media outlets and on the floor of the U.S. Congress, and represents a form of "data resistance" (Vera et al., 2018).

EPA policy and practice in the Trump era resembled that of the Reagan era, but even under Democratic leadership, the EPA has often been a revolving door with industry (Carpenter & Moss, 2014). The initial limitations on TSCA mentioned earlier were the result of direct corporate influence that has extended since the 1976 passage of that act (Richter et al., 2018). Environmental health and justice activists have a long history of struggles with EPA going back to Love Canal (Gibbs, 2002).

## Manufacturers and Consumers

Although federal action on hazardous chemicals seems unlikely in the immediate future, industrial and consumer product manufacturers don't need to wait for government mandates—they could choose to phase-out harmful chemicals and switch to safer alternatives, require chemical safety screenings, and make product ingredients and safety information publicly available. In practice, this usually requires significant pressure from activists and consumer groups. Activist and consumer-initiated pressure has already led many corporations to remove flame retardants and some PFAS from their products (Brown et al., 2020). Safer Chemicals Healthy Families—a coalition of 450 organizations and businesses representing more than 11 million individuals—successfully pressured leading home improvement retailers to remove the toxic chemicals methylene chloride and N-methylpyrrolidone (NMP) chemicals from their products by the end of 2018, after EPA's proposed ban was shelved following Scott Pruitt's confirmation as EPA Administrator.

Consumers are also using databases like Environmental Working Group's *Skin Deep* database to search for nontoxic alternatives to conventional household and personal care products as well as Silent Spring Institute's *Detox Me Action Kit* to better understand and reduce their exposure to common household chemicals. However, it is important to note that even if some of us are able to reduce our exposure to toxics within our own homes by investing the time and money required to research and purchase nontoxic products and foods, there is a limit to how much we can accomplish as individual consumers. We cannot, for example, control the chemicals used by our neighbors, let alone those by factories, power plants, or incinerators in our regions. Biomonitoring studies have found pollutants such as pesticides, lead, mercury and PCBs in the blood of people who were making deliberate efforts to reduce their exposure; some of the most careful shoppers, those who regularly purchase organic or natural products, had some of the highest levels of industrial chemicals in their bodies (Commonweal, 2007). People living in remote regions of the Arctic, thousands of miles from factories, also have chemicals flame retardants and PFASs in their blood, because they are

found in the water, air, and animals that migrate north. Moreover, MacKendrick (2010) shows that as mainstream media outlets have increasingly focused on green consumption and individual acts of self-protection (rather than state action to prevent toxic exposures), the responsibility for this costly and time intensive "precautionary consumption" falls disproportionately on women and mothers—and does little to actually mitigate the risk of exposure to toxic hazards (MacKendrick, 2018). As sociologist Andrew Szasz (2007) concludes, we cannot, as individuals, "shop our way to safety." Instead, the scale of the problem requires a collective political response. History tells us that no significant change is likely without broad-based social movements demanding that human and environmental health be prioritized over corporate profits.

## Back to the Grassroots

Grassroots groups have been fighting for progressive change at the local level for decades, and that has helped shape the impressive new national focus on climate activism and mobilization around the Green New Deal. More recently, regional and national coalitions like the Alliance for a Healthy Tomorrow and Coming Clean have become important sites for collaboration, networking, and coordination between grassroots groups and other organizations. Increasingly these coalitions recognize that for genuine large-scale transformation, movements for environmental health and justice must ultimately be linked with larger struggles for social, economic, and racial justice. In February 2019, progressive Congressional representatives led by Rep. Alexandria Ocasio-Cortez (D-NY) and Senator Edward Markey (D-MA) introduced legislation to enact a Green New Deal— a policy approach that would transition the U.S. economy away from fossil fuels and address historical inequities in job access, housing, and transportation. Alternative frameworks for chemical regulation could conceivably fall within a Green New Deal umbrella.

Yet even in a future administration and with an EPA more in line with its original mission to protect human health and the environment, the effects of industry power, regulatory capture, and scientific conservatism on the policymaking apparatus will remain. Thus, the work of the many organizations that have made environmental health and justice their mission since the days of Alice Hamilton, Jane Addams, and Florence Kelly will continue. It is our hope that an ever-growing number of people will join the movement in demanding safer products, regulatory oversight based on the Precautionary Principle, an end to toxic exposures, remediation of existing hazardous sites, and restorative justice for communities that have suffered disproportionate harm. It is also our hope that environmental sociologists will continue to expand their practical work to further environmental justice, to engage in academic-community research partnerships to serve the needs of contaminated communities, to advance transdisciplinary work with environmental health scientists, and carry out advocacy along with their research. Together, we can create a world that is healthier, safer, and more just for us all.

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# Food Insecurity

13

Dorceta E. Taylor

## Introduction

Food insecurity is a global concern. In 2018, an estimated 700 million people faced severe food insecurity (FAO, 2019). Such people consume less than 2100 calories per day. Though the rates of global food insecurity are expected to fall from 21.1% in 2018 to 10.4% in 2028, food insecurity will continue to affect a substantial portion of the world's population (ibid). The highest rates of food in-security are found in Sub-Saharan Africa, Latin America, and the Caribbean (Thome et al., 2018).

Despite its wealth and immense levels of food production, food insecurity has reached troubling levels in the U.S. According to the U.S. Department of Agriculture (USDA), food security exists when all people have access to enough food to maintain an active, healthy life all the time. On the flip side, food insecurity is defined as a household-level social and economic condition that is characterized by limited or uncertain access to adequate food (see Fig. 13.1). A related concept, hunger, is described as an individual-level physiological state that may be an outcome of food insecurity (Coleman-Jensen et al., 2018a, b).

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In the U.S., roughly 40 million people or 12.5% of the population live in households that are food insecure (Galvin, 2019). This includes 24.8 million youths under the age of 18 years who are food insecure (Coleman-Jensen et al., 2018a, b). Several demographic characteristics are related to food insecurity. That is, African American and Hispanic households experience greater food insecurity than White or Asian American households. Families living below the poverty level are more food insecure than those above it and single-parent households with children are more prone to food insecurity than two-parent households. While 10.1% of male-headed households are food insecure, 18.5% of female-headed households are; neither of these types of households have spouses. In addition, residents of central cities have higher rates of food insecurity than those in the suburbs or rural areas (Coleman-Jensen et al., 2016, 2018a, b; Thompson, 2005).

## The Food Desert and Food Swamp Frames

There are many reasons why food insecurity is prevalent and persistent among particular groups of people. As Fig. 13.2 shows, food insecurity can arise from a lack of access to land, high food prices, a dearth of places to purchase foods, cli-mate events, over-exploitation of resources, and resource degradation, to name a few.



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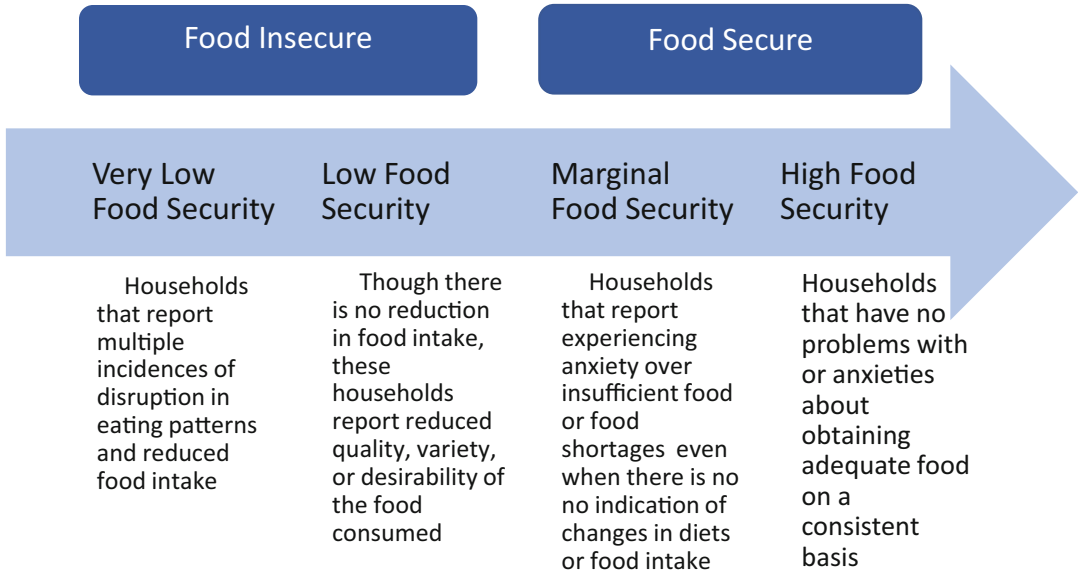


**Fig. 13.1** Definition and Range of Food Insecurity. (Compiled from Coleman-Jensen et al., 2018a, b)

The persistence of food insecurity in the U.S. has led to a large number of studies on the topic. However, the studies tend to focus on only a limited number of the causes identified herein. That is, many of these studies focus on institutional deficits in the food environment. Hence, studies tend to examine how race, gender, and class are related to access to food stores and restaurants. These studies tend to focus on urban areas; this leaves us with a limited understanding of rural food insecurity.

A variety of ecological terms are used to describe low-income, urban food environments. One of the most frequently used and contentious is the term "food desert." The term was popularized in the United Kingdom in the 1990s when researchers used it to characterize suburban housing developments that lacked shops, churches, community centers, and so forth (Cummins and Macintyre, 2002; Smith et al., 2010). As time passed, the concept evolved to focus on food retailers and this is, in part, why the term food desert is now commonly used to describe neighborhoods in which residents lack access to fresh, healthy, and affordable foods.

Food desert studies have been conducted in countries such as the U.S., Canada, the United Kingdom, Australia, and New Zealand. In most instances, poor urban communities are described as food deserts (Beaulac et al., 2009; Cummins and Macintyre, 1999; Luan et al., 2015; Mason et al., 2013; Pearce et al., 2006; Smoyer-Tomic et al., 2006; Sushil et al., 2017; White et al., 2003). Residents of such communities often live more than a mile from supermarkets or large grocery stores, or lack transportation to get to distant food outlets (Beaulac et al., 2009; Cummins and Macintyre, 2002; Pearce et al., 2006, 2007; Smith et al., 2010; USDA, 2013).

In the American context, the USDA has been influential in defining food deserts. According to the agency, food deserts are rural and urban communities that lack ready access to healthy, fresh, and affordable food. While other communities may have access to grocery stores and supermarkets, food deserts are communities with either no food access or that are served by convenience stores and fast food restaurants that offer very few healthy options (USDA, 2013). In this definition, the agency identifies the sources of healthy and unhealthy foods; it also makes direct connections between access to supermarkets and full-line grocery stores, poor diet, and health outcomes.

1. Lack of land on which to grow food
   a. Lack of ownership
   b. Disputed ownership
   c. Arable land not available
   d. Land grabs
2. Conflicts
   a. War, fighting
   b. Population displacement
3. Drought, famine
4. High and fluctuating food prices
   a. Inability to afford food
5. Disasters
   a. Events such as floods, hurricanes, monsoons, typhoons
   b. Rising temperatures, climate change
6. Lack of places to purchase food
7. Poor food quality
   a. Wilted, spoiled food
   b. High calorie, low nutritional value
8. Physical inaccessibility
   a. Mobility limitations
   b. Lack of transportation
   c. Transportation costs to high
   d. Distance to obtain food too great
9. Resource depletion, eg., overfishing
10. Resource degradation
11. Privatization of communal/public resources
12. Curtailment or banning of hunting, fishing, gathering, and other subsistence activities
13. Corporate consolidation of market shares in the food sector
14. Closing of food outlets
15. Inability of small stores to compete with mega food stores
16. Limitations of growing food and conducting agricultural activities in urban areas
17. Lack of funding
    a. Operate food outlets
    b. Food production
    c. Small farming operations
18. Lack of culturally desirable food
19. Lack of knowledge about finding and preparing certain foods.

**Fig. 13.2** Common Causes of Food Insecurity

The USDA operationalizes its definition of food desert by correlating the location of supermarkets and full-line grocery stores in census tracts with the poverty levels of tracts. Hence, a census tract is designated as a food desert tract if it has a poverty rate of 20% or more or a median income that is at or below 80% of the median family income for the area. In addition, the tract must also have at least 500 residents living in it and at least 33% of the tract's population must live more than a mile from a supermarket or large grocery store (10 miles in non-metropolitan areas) for it to qualify as a food desert tract (USDA, 2013). The agency's definition is reflected in the approaches many scholars take when they study food access.

A related concept, "food swamp" has arisen in recent years to describe low-income, urban communities that have an overabundance of fast food restaurants, convenience stores, mini marts, gas stations, and liquor stores selling food. This idea is also embedded in the USDA's definition. According to D.J. Rose et al. (2009), food swamp is a more useful concept to describe neighborhoods where fast food and junk food far outweigh healthier alternatives. They argue that the large amounts of energy-dense foods sold in venues in such neighborhoods crowd out the relatively few healthy food choices residents have. The researchers suggest that the term food swamp be used in lieu of the food desert concept. Researchers at the USDA have promoted the food swamp concept (USDA, 2009; Ver Ploeg, 2010a, b), and researchers in Canada (Luan et al., 2015) and New Zealand (Sushil et al., 2017) have also conducted food swamp studies.

The influence of these conceptualizations can be seen in research on food access in the U.S. The food desert frame has emerged as a dominant narrative in food security studies. In this genre of research, identifying the spaces to be labeled deserts, the race/ethnicity and social class of the inhabitants of such spaces, the quantity and location of food sources, quality of food, the behavior of residents, and the health of inhabitants in the food deserts are the main preoccupations of environmental sociologists and researchers in other allied disciplines and fields.

Common approaches to studying food environments that adopt the food desert frame place emphasis on distance to supermarkets, density of food stores, analysis of food content within stores, the pricing of food, efforts to bring more grocery stores to cities, attempts to sell healthier foods in corner and convenience stores, food acquisition strategies, and changes in prices and availability of food after new grocery stores are built in underserved locales. Food desert research is often focused on identifying community deficits and deficiencies.

As Table 13.1 shows, research that examines adaptive strategies or analyses that enhance our understanding of community agency, assets, and strengths are less common. Hence studies of where people obtain food outside of commonly examined food outlets are atypical. Even less prevalent are studies that explore how food insecure people obtain food and how they perceive and understand their consumption behavior.

Moreover, these studies are focused on a small segment of food outlets. They tend to examine full-line or full-service supermarkets and grocery stores, corner stores, mini marts, gas stations, and full-service as well as fast food restaurants. As Taylor and Ard (2015) found, there is a much richer variety of places selling food in cities. Table 13.2 shows the types of food outlets and other places where people obtained food when Detroit was studied from a food systems perspective. It should be noted that missing from the list are institutions such as schools, hospitals, nursing homes, prisons, and so forth.

## The Food Oasis and Food Grassland Frames

Researchers who have recognized gaps and framing challenges in the food desert literature are raising questions about the definition of food deserts and the depiction of communities described as such. Though the occurrence of food deserts has been widely reported in the media and extensively studied, are poor inner-city neighborhoods as devoid of healthy food outlets as some researchers and the media have

**Table 13.1** Approaches to Studying Food Insecurity and Food Access

| Framework of Study | Methodological Approach | Location Studied | Authors | Year | Publication Outlet |
|---|---|---|---|---|---|
| Food Desert | Distance to supermarkets | Detroit | Zenk, et al. | 2005 | American journal of public health |
| | Distance to supermarkets | Detroit | Zenk, et al. | 2006 | Ethnicity & Disease |
| | Distance to supermarkets | Detroit | Zenk, et al. | 2009 | Am. Journal of health promotion |
| | Distance to groceries/corner stores/restaurants | Detroit | Zenk, et al. | 2013 | Appetite |
| | Distance to food stores and fast food outlets | Hidalgo County, TX | Sharkey, et al. | 2009 | Intnl. Jnl. Of health Geographics |
| | Distance to food stores | U.S. national study | Powell, et al. | 2007 | Preventative medicine |
| | Distance to and density of food stores and liquor stores | Forsyth County, NC; Baltimore/Baltimore County, MD; Manhattan & Bronx, NY | Moore & Diez Roux | 2006 | American journal of public health |
| | Distance to food stores | Mississippi, North Carolina, Maryland, & Minnesota | Morland, et al. | 2002 | American journal of preventative medicine |
| | Distance to food stores | California | Ghirardelli, Quinn & Foerster | 2010 | American journal of public health |
| | Density of food stores | Washington, D.C. metro | Leslie, Frankenfeld, & Makara | 2012 | Applied geography |
| | Density of food stores | Rural Maine | Hubley | 2011 | Applied geography |
| | Density of fast food restaurants | New Orleans | Block, Scribner & DeSalvo | 2004 | American Jnl of prevent. Medicine |
| | Accessibility of stores selling fresh foods | Toledo | Eckert & Shetty | 2011 | Applied geography |
| | Analysis of food content in grocery stores | New Orleans | Miller, Bodor & Rose | 2012 | Jnl. Of environ. & public health |
| | Analysis of food content in grocery stores | Vermont, Arkansas | Krukowski, et al. | 2010 | Journal of community health |
| | Analysis of food content in grocery stores | S. Louisiana, Los Angeles County | Farley, et al. | 2009 | Journal of urban health |
| | Analysis of food content in grocery stores | New Haven | Andreyeva, et al. | 2008 | Health affairs |
| | Analysis of food content in grocery stores | Detroit | Zenk, et al. | 2006 | Ethnicity & Disease |
| | Analysis of food content in local businesses | Bronx | Lucan, et al. | 2018 | American journal of prevent. Medicine |

(continued)

**Table 13.1** (continued)

| Framework of Study | Methodological Approach | Location Studied | Authors | Year | Publication Outlet |
|---|---|---|---|---|---|
| | Food pricing | New Haven | Andreyeva, et al. | 2008 | Health affairs |
| | Food pricing | Flint | Sadler, Gilliland & Arku | 2012 | Journal of Urban Affairs |
| | Food purchasing decisions | Southwest Baltimore | Zachary, et al. | 2013 | Qualitative Health Research |
| | Food purchasing decisions | Central Texas | Evans, et al. | 2015 | International Jnl of behavioral nutrition and physical activity |
| | Food purchasing decisions | North Carolina | MacNell, et al. | 2017 | Jnl of Hunger & Environ. Nutrition |
| | Shopping and food purchasing decisions | Detroit | Budzynska, et al. | 2013 | Public health nutrition |
| | Store characteristics and individual mobility | Minneapolis | Shannon | 2016 | Annals Amer. Assoc. geographers |
| Food swamp | Density of junk food stores and fast food outlets | New Orleans | Rose, et al. | 2009 | U. Mich. National poverty center |
| | Comparing food swamps and food deserts | National Study | Cooksey-Stowers, et al. | 2017 | Intnl. Jnl. Env. Res. Public health |
| | Comparing food swamps and food deserts | Baltimore | Hager, et al. | 2017 | Public health nutrition |
| Food oasis | Density of supermarkets/ groceries/corner stores | National Study | Howlett, Davis & Burton | 2016 | Journal of business ethics |
| | Density of small full-service food retailers | San Francisco Bay Area | Short, Guthman & Raskin | 2007 | Jnl planning education & research |
| Food grassland | Density of full-service supermarkets | Detroit | Devries & Linn | 2011 | Data driven Detroit |
| | Density of full-service supermarkets | Detroit | Linn | 2011 | Data driven Detroit |
| Shopping patterns | Choice of where to shop and travel distance | Detroit | LeDoux & Vojnovic | 2013 | Health & place |
| | Choice of where to shop and travel distance | Detroit | Rose | 2011 | Qualitative Health Research |
| | Choice of where to shop and travel distance | Detroit | Devries & Linn | 2011 | Data driven Detroit |
| | Choice of where to shop and travel distance | Pittsburgh | Kumar, et al. | 2011 | Health & Place |

(continued)

**Table 13.1** (continued)

| Framework of Study | Methodological Approach | Location Studied | Authors | Year | Publication Outlet |
|---|---|---|---|---|---|
| Diet and health | Nutritional intake and supermarket distance | Detroit | Zenk, et al. | 2009 | American Jnl of health promotion |
| | Distance to supermarkets and ill-health | Mississippi, North Carolina, Maryland, & Minnesota | Morland, et al. | 2006 | American journal of preventative medicine |
| | Dietary intake and obesity | Vermont & Arkansas | Krukowski, et al. | 2010 | Journal of community health |
| | Dietary intake and obesity | National Study | Cooksey-Stowers, et al. | 2017 | Intnl. Jnl. Env. Res. Public health |
| | Dietary intake and obesity | Detroit | Budzynska, et al. | 2013 | Public health nutrition |
| | Dietary intake and obesity | New Orleans | Rose, et al. | 2009 | U. Mich. National poverty center |
| | Dietary intake and stress | Detroit | Zenk, et al. | 2013 | Appetite |
| Adaptive strategies | Strategies for securing food | Detroit | Rose | 2011 | Qualitative Health Research |
| | Strategies for securing food | Chicago | Zenk, et al. | 2011 | Health Education & Behavior |
| | Strategies for securing food | North Philadelphia | Hillier, et al. | 2011 | Urban geography |
| | Strategies for securing food | Oakland & Chicago | Alkon, et al. | 2013 | Geoforum |
| | Bringing more healthy food stores to cities | Detroit | Pothukuchi | 2005 | Economic development quarterly |
| | Bringing more healthy food stores to cities | East Baltimore | Hee-Jung, et al. | 2011 | Health promotion practice |
| | Bringing more healthy food stores to cities | Hidalgo County, TX | Sharkey, et al. | 2009 | Intnl Jnl of health Geographics |
| | Bringing more healthy food stores to cities | New Haven | Andreyeva, et al. | 2008 | Health affairs |
| | Bringing more healthy food stores to cities | Baltimore | Antin & Hora | 2005 | Practicing anthropology |
| | Immigrants operating healthy food stores | Buffalo | Khojasteh & Raja | 2017 | Jnl of Hunger & Environ. Nutrition |
| | Selling healthier foods in corner stores | New Orleans | O'Malley, et al. | 2013 | Journal of community health |
| | Selling healthier foods in corner stores | New York City | Dannefer, et al. | 2012 | American journal of public health |
| | Selling healthier foods in corner stores | Hartford | Martin, et al. | 2012 | Public health nutrition |

(continued)

**Table 13.1** (continued)

| Framework of Study | Methodological Approach | Location Studied | Authors | Year | Publication Outlet |
|---|---|---|---|---|---|
| | Selling healthier foods in corner stores | East Baltimore | Hee-Jung, et al. | 2011 | Health promotion practice |
| | Selling healthier foods in corner stores | Baltimore | Hee-Jung, et al. | 2009 | Public health nutrition |
| Changing access | Changing food access when new stores are built | Flint | Sadler, Gilliland & Arku | 2012 | Journal of Urban Affairs |
| | Changing food access when new stores are built | California | Wang, et al. | 2007 | Jnl of hunger and Env. Nutrition |
| | Changing food access when new stores are built | Bronx | Elbel, et al. | 2015 | Public health nutrition |
| | Changing food access when new stores are built | Pittsburgh | Richardson, et al. | 2017 | Annals of epidemiology |
| Food justice | Food insecurity and environmental injustice | Detroit | Taylor & Ard | 2015 | Environmental practice |
| | Food insecurity and environmental injustice | Toledo | Burdine & Taylor | 2018 | Local environment |
| | Food insecurity and environmental injustice | Oakland & new Orleans | Clendenning, Dressler & Richards | 2016 | Agriculture and human values |
| | Food insecurity and environmental injustice | New Orleans | Passidomo | 2014 | Agriculture and human values |
| | Food insecurity and environmental injustice | Lafayette, California | Longo | 2016 | Agriculture & agricultural science |
| | Food insecurity and environmental injustice | California | Alkon & Norgaard | 2009 | Sociological inquiry |
| | Food insecurity and environmental injustice | New York City | DePasquaqle, Sarang & Vena | 2018 | Fordham urban Law journal |
| Food sovereignty | Food insecurity, production & self-determination | Detroit | White | 2010 | Race/ethnicity |
| | Food insecurity, production & self-determination | Detroit | White | 2011a | Environmental practice |
| | Food insecurity, production & self-determination | Detroit | White | 2011b | Race/ethnicity |
| | Food insecurity, production & self-determination | Detroit | Taylor & Ard | 2015 | Environmental practice |

(continued)

**Table 13.1** (continued)

| Framework of Study | Methodological Approach | Location Studied | Authors | Year | Publication Outlet |
|---|---|---|---|---|---|
| | Food insecurity, production & self-determination | Toledo | Burdine & Taylor | 2018 | Local environment |
| | Food insecurity, production & self-determination | Chicago | Block, et al. | 2012 | Agriculture and human values |
| | Food insecurity and environmental injustice | Oakland & new Orleans | Clendenning, Dressler & Richards | 2016 | Agriculture and human values |

portrayed? Raja et al. (2008) question the idea of food deserts and argue that the notion of an urban food desert can be misleading. Not only does the concept conjure up images of environments bereft of places to purchase healthy foods, studies that focus on identifying only full-service supermarkets and grocery stores miss a variety of small food outlets that carry healthy foods that urban consumers may desire.

Other critics also argue that the focus on supermarkets and full-line grocery stores as the sole or primary indicator of good food access distorts our understanding of local food environments (Alkon et al., 2013; Hubley, 2011; McKinnon et al., 2009; Taylor & Ard, 2015). Some suggest that it might also underestimate the availability of food (Alkon et al., 2013; Burdine & Taylor, 2018; Sharkey et al., 2009). The emphasis on supermarkets and full-line grocery stores often ignores the important roles that independent grocers and small ethnic grocery stores play in urban food systems (Khojasteh & Raja, 2017). For instance, a study of three San Francisco Bay area neighborhoods found what researchers termed "food oases" with full-service food retailers offering affordable, culturally desired food in ethnic minority neighborhoods. The study found ethnic food stores—overlooked in most food insecurity studies—provide foods neighborhood residents want (Short et al., 2007). Studies have also found that these smaller stores have a positive influence on the consumption of fruits and vegetables (Bodor et al., 2007).

Though all agree that parts of some cities are underserved by food retailers that sell healthy and affordable foods, the portrayal of entire cities as food deserts does not hold up under scrutiny. Ergo, some community activists (Yakini, 2010) and researchers question the food desert narrative as it pertains to their cities (Devries & Linn, 2011; White, 2010, 2011a, b). Consequently, researchers from Data Driven Detroit analyzed National Establishment Time Series data from 2010 and reported that they found 115 grocery stores in Detroit. Arguing that it is a myth to describe the entire city as a food desert, the researchers asserted that it is more accurate to describe the city as a "food grassland" that has small pockets lacking easy access to grocery stores (Devries & Linn, 2011). Further research revealed that only about 10% of the city could be classified as a food desert if the USDA definition is used and about 90,000 people live in such areas (Linn, 2011).

## Food Consumption, Health, and Place

Scholars studying food access have linked food availability and consumption patterns to health and place (Budzynska et al., 2013). For instance, researchers associate the consumption of high-calorie, unhealthy food with obesity, diabetes, hypertension, and other illnesses (Rose et al., 2009). Budzynska et al. (2013) found, that obesity is prevalent in Detroit. However, once demographic factors were accounted for, there was no correlation between body mass index and the presence of supermarkets.

**Table 13.2** Defining Detroit's Food Sources. (Adapted from Taylor & Ard, 2015)

| Food Outlet Type | Definition | Definition Source | Example |
|---|---|---|---|
| Traditional supermarket | Offers full line of groceries, meat, produce<br>At least $two million in annual sales<br>Chain supermarkets or grocery stores | Food marketing institute | Kroger, A&P, Spartan |
| Fresh format supermarket | Emphasis on perishables<br>Natural and organic foods | Food marketing institute | Whole foods |
| Superstore | At least 30,000 square feet<br>Annual sales of $12 million or more<br>Extensive selection of non-food items | Food marketing institute | Metro foods |
| Super warehouse | High-volume hybrid of traditional supermarket and warehouse store<br>No frills, limited service<br>Reduced prices<br>Bulk food items and perishables<br>Full range of service departments | Food marketing institute | Cub foods,<br>Food 4 less |
| Supercenter | Hybrid of traditional supermarket and mass merchandiser<br>Wide range of food and non-food items<br>Average 170,000 square feet | Food marketing institute | Meijer, Walmart supercenters |
| Mass merchandiser | Large store selling primarily clothing, electronics, and sporting goods<br>Sells groceries too | Food marketing institute | Kmart, target |
| Limited- assortment store | Limited assortment of center-store and perishable items<br>Reduced price point | Food marketing institute | Aldi's<br>Trader joes |
| Small groceries, convenience or corner stores | Small and medium-sized grocery stores and convenience stores<br>Limited selection of staples and other goods<br>Under $two million in annual sales | Food marketing institute / Taylor and Ard (2015) | Motown market |
| Dollar stores and variety stores | Small stores selling staples and knickknacks<br>Foods and consumable items<br>Low prices | Food marketing institute | Dollar general, Dollar tree |
| Pharmacy or drug store | Prescription-based drug store<br>General merchandise and seasonal items<br>Limited selection of food items | Food marketing institute | Walgreens, CVS |
| Gas stations | Gas stations with attached mini marts or convenience stores that sell food | Taylor and Ard (2015) | Mobil mini Mart |
| Liquor and party store | Stores selling alcohol<br>Limited selection of food items | Taylor and Ard (2015) | Liquor Castle |
| Full-service restaurant | Have wait staff and sit-down service<br>Payment collected after meals are served and tips expected | Block et al. (2004) | Olive garden, red lobster |
| Fast food restaurant | No wait staff and sit-down service<br>Payment collected before meals are served and no tips expected<br>Drive-through service | | Burger king, McDonalds |
| Health foods | Health foods and nutrition supplements | Taylor and Ard (2015) | Nature's remedy |
| Bakery | Sells baked goods | Taylor and Ard (2015) | National Bakery |
| Caterer | Prepares food by order | Taylor and Ard (2015) | Golden spice |
| Coffee, tea, and juice shops | Serves primarily coffee, tea, or beverages<br>Limited amount of baked goods or cooked food | Taylor and Ard (2015) | Starbucks |

(continued)

**Table 13.2** (continued)

| Food Outlet Type | Definition | Definition Source | Example |
|---|---|---|---|
| Confectionaries | Stores selling primarily candy and other sweets | Taylor and Ard (2015) | The candy shop |
| Bars & clubs | Bars or clubs serving meals also | Taylor and Ard (2015) | Varsity lounge |
| Banquet halls/ hotels | Banquet halls that serve meals and hotel restaurants | Taylor and Ard (2015) | St. Regis hotel |
| Community supported agriculture | Cooperative—Customers pay for produce<br>Has a weekly basket of produce prepared for delivery or pick up | Taylor and Ard (2015) | Plantscapers choice |
| Food cooperative | Group of people buying food and/or produce collectively<br>Purchasing can be done at a store or through a club | Taylor and Ard (2015) | Detroit Black community food security network food buying club |
| Farmers' markets, produce markets | Local farmers sell fresh produce<br>Other consumables sold | Taylor and Ard (2015) | Eastern market |
| Urban farms and community gardens | Food-producing urban farms<br>Produce sold at farm/garden or other venues<br>Produce may also be donated<br>Includes mobile food vans | Taylor and Ard (2015) | Earthworks urban farm |
| School garden | Food-producing school farm or garden<br>Produce sold at farm/garden or other venues<br>Produce consumed by students and staff at school | Taylor and Ard (2015) | Drew transition center |
| Dairy | Storage, processing, and distribution of milk and milk products | Taylor and Ard (2015) | Star dairy |
| Ice cream parlor | Sells primarily ice cream and dairy products<br>Limited food items on menu | Taylor and Ard (2015) | Dairy queen |
| Meat markets and deli | Fresh meat and seafood<br>Delicatessen | Taylor and Ard (2015) | Prime gourmet meats |
| Wholesaler | Sells bulk items<br>Sells at wholesale prices | Taylor and Ard (2015) | Atlas wholesale food company |
| Manufacturer, processor | Commercial food manufacturer or processor | Taylor and Ard (2015) | Michigan packing co. |
| Distributor | Commercial distribution hub for food items | Taylor and Ard (2015) | Hispanic food distributor |
| Food pantries or soup kitchens | Food pantries, soup kitchens, faith-based programs, etc. serving or distributing food to individuals | Taylor and Ard (2015) | Loaves and fishes |
| Food banks | Large warehouses storing food for distribution to smaller organizations serving those needing food<br>Does not give out food directly to individuals | Taylor and Ard (2015) | Gleaners |
| Food hub | Centrally located, permanent facility<br>Has a business management structure<br>Aggregates, stores, processes, and distributes food<br>Focus on locally or regionally grown/ produced food<br>May provide wholesale or retail vending space<br>May offer social services | USDA Agricultural Marketing Service | Eastern market |

Though many factors affect consumption patterns, scholars argue that food choices are affected by food availability (Morland et al., 2006). Studies also linked food availability in grocery stores to the diets of nearby residents. That is, the presence of stores selling fresh produce is associated with the increased consumption of fruits and vegetables of neighborhood residents (Zenk et al., 2009). Conversely, the presence of fast food outlets is said to increase the consumption of such foods by area residents.

However, some researchers question an important assumption in this line of research. They argue that the assertion that a person's neighborhood food environment has a direct effect on his or her dietary behavior and health rests on the supposition that people buy all or most of their food in their immediate neighborhood (Alkon et al., 2013; Kumar et al., 2011; LeDoux & Vojnovic, 2013).

Wang et al. (2007) found that the opening of a full-line grocery store did not alter the consumption behavior of nearby residents. Other researchers have found that consumption patterns were unrelated to increased access to supermarkets (Budzynska et al., 2013; Lee, 2012). Cummins and Macintyre (2006) argue outright that researchers have not provided the requisite data to demonstrate that there is a causal link between food access and health outcomes.

Researchers have argued that in analyzing local food environments, one should not assume that people shop for food only at the stores closest to them or in their immediate neighborhood (Cummins, 2007; Mason et al., 2013). Since people often shop for food outside of their immediate neighborhoods or municipalities, the type of stores in a particular neighborhood does not always completely define what kinds of foods people have access to and consume. With this in mind, some food access researchers have been studying the leakage rate, or the number of residents purchasing food outside of their neighborhoods, in low-income communities in Detroit. LeDoux and Vojnovic (2013), for example, found that the racially and ethnically diverse residents of Detroit's Lower East Side bypassed their neighborhood food stores to shop at independent, discount, and regional supermarkets in other parts of the city or in the nearby suburbs.

Rose (2011) studied the food purchasing habits of low-income Detroit residents and found that they shopped for food outside their neighborhoods but also coordinated their trips so they could share rides to get to distant grocery stores. Only 11% of the participants in Rose's study relied exclusively on the food outlets in their neighborhoods to obtain food. So, not only do low-income residents show agency in determining where they shop, they also found ways of maximizing their funds by shopping where the food was cheapest, where there were sales, and where they could get the most goods for their money. Gallagher (2007) found that Detroit residents traveled twice as far to reach a "mainstream" grocery store as they would to reach a fringe food establishment.

Devries and Linn (2011) used State of Michigan Department of Human Services data on expenditures on Electronic Benefit Transfer (EBT) cards. They found that many Detroit EBT recipients eschewed neighborhood stores and purchased their food outside of the city. About one-third, or 31%, of the Detroit EBT household grocery bills were transacted outside of the city. The Social Compact (2010) study of Detroit found that when the whole population was considered, there was a 30% leakage rate for money that Detroiters spent on groceries outside the city.

Similarly, a survey of Philadelphia residents found that only a third of low-income individuals purchased groceries within a mile of their home (Young et al., 2011). Kumar et al. (2011) report that Blacks in Pittsburgh were reliant on jitneys and taxis to transport them to food stores outside of their neighborhoods. Alkon et al. (2013) also found that low-income urban dwellers in Oakland and Chicago utilized a variety of strategies to obtain food; many of these are understudied in the food access literature.

One important dimension of food access is the economic ability to purchase healthy food options such as fruits and vegetables. This is important to consider since the USDA reports that food prices have been rising steadily since 1980 (USDA Economic Research Service, 2016). Higher food

prices are related to the overall reduced consumption of food; this is especially true of the consumption of healthy foods (Andreyeva et al., 2008, 2010).

## Food Justice and Food Sovereignty

Food justice and food sovereignty are two additional frames that researchers are using to study food insecurity and access. The concept of food sovereignty emerged out of a 1996 gathering of farmers' organizations from across the globe (Timmermann et al., 2018). The concept, proposed by La Via Campesina (a movement comprised of roughly 200 million poor families from 79 countries), is an attempt to provide an alternative frame to terms like food insecurity and develop transnational critiques of the impacts of corporate food regimes on those who are impoverished or disenfranchised (García-Sempere et al., 2018).

Simply put, food sovereignty asserts the rights of people to think about and engage in actions to make their own decisions about the food system. This involves defining and organizing local agricultural initiatives to satisfy their needs and that of their communities (Grey & Patel, 2015; Portman, 2018). Hence, food sovereignty discourses and movements involve challenges related to ownership and control of land and activism aimed at redistributing land (Borras Jr. et al., 2015). Furthermore, as Norgaard and Fenelon argue (see Chap. 23 in this volume), food sovereignty movements in Indigenous communities have been alive and well for years and they focus on the challenge of colonialism and the need for reordering relationships between people and species, which much of the non-Indigenous food sovereignty movement often ignores.

Environmental injustice identifies and articulates racist and discriminatory acts that result in racial inequities in the environmental realm. Proponents of the environmental injustice thesis assert that people of color are subject to racist and discriminatory acts, policies, practices, and decision-making that result in racial inequities. Hence, environmental justice seeks redress for perceived unfair acts (Taylor, 2000, 2014). It is appropriate to analyze the food access experiences of people of color through the lens of environmental justice as there is extensive documentation of the links between agriculture, food production, and the emergence and perpetuation of environmental inequalities in communities of color (e.g., see Taylor, 2014).

The food justice movement seeks to enhance access to healthy, affordable, and culturally desired foods. These goals are guided by a critique of racism, discrimination, and institutional policies that affect people's ability to obtain adequate, high-quality food (Alkon & Agyeman, 2011; Alkon & Norgaard, 2009; Agyeman & McEntee, 2014). Hence, food justice seeks to remediate food insecurity and other inequities (such as access to arable land) through the food system (DePasquale et al., 2018). Food justice activists focus on challenging and overturning structured inequalities (Deric, 2014; Sbicca, 2018). They do this through engaging in the policymaking process and by challenging anti-democratic forms of control (Levkoe, 2006).

Food justice and food sovereignty are narrative frames that occupy critical spaces in the discourses about food production and sustainability in the U.S. Food justice and food sovereignty discourses combine interest in sustainability and consumption of healthy foods with concerns about social justice, equitable access to healthy foods, and control over the production of said food. Minority-led food justice and food sovereignty movements are often rooted in environmental justice principles. Hence, they address inequalities in the food system by blending demands for human rights and sovereignty with the quest for social justice. Food sovereignty advocates believe that control of the means of food production, distribution, and consumption are critical elements to the empowerment and survival of disadvantaged groups (Taylor, 2000, 2014; Taylor & Ard, 2015; White, 2010, 2011a; Yakini, 2010, 2013).

Still, subsistence activities such as farming, gardening, fishing, hunting, and gathering are often overlooked in food insecurity studies.

Consequently, analyses of the role of urban farming and gardening, community organizing to increase access to food, and the role of community-based food assistance programs in providing food are barely studied or are completely overlooked in food insecurity research. Food justice and food sovereignty activists are working to bring these activities into the food insecurity discourse.

## Urban Farming and Gardening as a Food Acquisition Strategy

Despite the growth in research on food access, studies of where people obtain food outside of commonly examined food outlets are still relatively few. For instance, subsistence activities such as farming and gardening are often ignored. Consequently, analyses of the roles of urban farming and gardening in increasing access to food are not widely studied (Burdine & Taylor, 2018; Taylor & Ard, 2015; White, 2010, 2011a, b).

But, as individuals in urban environments experience higher levels of food insecurity, urban gardens can be important sources of locally-grown, healthy foods (Taylor & Ard, 2015). In recent decades, urban gardens have been used to increase the green infrastructure of cities while providing increased educational, entrepreneurial, social, and recreational spaces for residents (Saldivar-Tanaka & Krasny, 2004). As a result of deindustrialization, depopulation, and foreclosures, many rustbelt cities have ample vacant land that can be used for urban agricultural initiatives (Burdine & Taylor, 2018; Goldstein, 2009; Taylor & Ard, 2015). Detroit, for instance, has 66,832 vacant parcels (Detroit Land Bank Authority, 2016). Cleveland has about 3300 acres of vacant land within its confines (Goldstein, 2009). Toledo, too, has many vacant lots, and a 2015 land survey found 14,614 vacant lots in the city (Lucas County Land Bank, 2015).

Today, post-industrial cities across the country are transforming their urban landscapes by including urban agriculture and gardening into city planning. Toledo, for instance, encourages the development of urban gardens as a strategy to increase the number of food sources residents have access to. The Lucas County Land Bank also supports urban gardening initiatives by encouraging residents to purchase vacant lots for a hundred dollars (Lucas County Land Bank, 2015).

The benefits or urban gardens are well documented. They can enhance individual, household, and community food security by improving access to fresh produce, which, in turn, increases the consumption of healthy foods (Alaimo et al., 2010; Allen et al., 2008; Ghose & Pettygrove, 2014). Community gardens can also be an important source of culturally-desired ethnic foods (Saldivar-Tanaka & Krasny, 2004). Glover et al. (2005) found that participation in community gardens facilitated civic engagement and political citizenship.

In Toledo, not only do urban gardeners grow a large variety of crops on small plots of land, they donate food grown in the gardens to neighbors and gift and share food with family and friends. Neighborhood residents participate in the decisions about what foods are grown in the gardens; this process increases access to culturally desired food and can help build community solidarity (Burdine & Taylor, 2018).

## Conclusion

Given the urgency of the problem, it is imperative for researchers to continue examining topics related to food insecurity. However, as the above discussion makes clear, it is also important that researchers broaden their understanding of food insecurity and what causal factors contribute to the phenomenon. To date, researchers have focused their attention on only a small segment of potential food insecurity research. There is room for scholars to use new theoretical and methodological approaches in their research to help us understand food insecurity more fully. Through broadening our frameworks for understanding and researching the problem, this can also help to identify new strategies that advance a vision of food justice and food sovereignty.

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# Part III

## Culture, the State, and Institutions

# Animals in Environmental Sociology

14

Linda Kalof and Cameron T. Whitley

## Introduction

It is well established that nonhuman animals have substantial social significance in human society (Arluke & Sanders, 1996; Irvine, 2008; Nibert, 2013). However, some aspects of sociological investigation have not fully engaged with the question of how animals are embedded in human social systems. Wilkie (2015) calls for a reimagining of C. Wright Mills' sociological imagination into an "animalizing of the sociological imagination" to recognize that animals are an integral part of human social systems and how we treat and engage with animals impacts human social life. It is curious that animals often are invisible in environmental sociology, a subdiscipline constructed in opposition to human exceptionalism (Tovey, 2003). When animals do appear, they are considered primarily as part of ecological systems or "wild nature," with the billions who exist as food, domestic or service animals largely ignored (Tovey, 2003). Yet, it is clear that humans and other animals live in co-constituted, collaborative worlds (Despret, 2013; Haraway, 2008; Porcher, 2017). Indeed, animals are so embedded into the social fabric that society cannot be fully understood without including them, and we are challenged to "think from the animal" and ask "what matters for them?" (Despret, cited in Carter & Charles, 2018). To "think from the animal" involves a recognition that our engagement and use of animals alters natural and social systems in often profound ways. Engaging with environmental sociology from a sociology of animal studies perspective, this chapter begins a conversation on "thinking from the animal" by asking what matters for animals in environmental sociology?

To answer the question "what matters for animals?" we take a realist-materialist approach. This approach follows the York and Longo (2017) strategy of bridging the gap between environmental sociology and sociology animal studies scholars. A realist-materialist approach to studying animals is a perspective that "focuses on actual animals" with a concern for their material reality, not how they are socially constructed in human minds (York & Longo, 2017:35). The realist-materialist approach acknowledges the continuous interaction between human and nonhuman landscapes, provides ontological standing to nonhuman animals and the potential for epistemological access to their worlds (York & Longo, 2017: 38). In this chapter, we attempt to understand the shared experiences of animals that are imposed by social processes in "recognition that we are not alone in the world, that other animal species also exist (and) have similar

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environmental experiences to our own" (Tovey, 2003: 210). This recognition corresponds well with Pellow's (2014) theory of socioecological inequality that examines "the ways in which humans, nonhumans, and ecosystems intersect to produce hierarchies—privileges and disadvantages—within and across species and space that ultimately place each at great risk" (p. 245). Pellow notes that while socioecological inequality draws on the New Ecological Paradigm, deep ecology, social ecology, ecofeminism, environmental justice, and political economy, it does not identify a single origin of our ecological crises, but instead focuses on intersectionality because of the "varied and multiple forms of inequality and hierarchy driving our socioecological crises" (pp. 7–8).

In this chapter we provide an overview of the current state of scholarship on the material reality of animals in environmental sociology as their lives are intertwined, or intersect, with human activities and ecosystems. We structure the chapter around three animal categories: Domestic Animals, Liminal Animals, and Wilderness Animals.[1] It is the reality of an animal's living situation (her environment) rather than her species identity that determines membership in one of the three categories. In light of Tovey's lament that domestic animals are rendered invisible in environmental sociology, we begin our overview with a lengthy description of the material reality of *Domestic Animals* (those who are kept in captivity by humans), divided into four subcategories: companions, agricultural animals, working animals and animals on display. We also consider animals in natural disasters as an increasing area of concern of the reality of domestic animals. Next, we cover the environmental issues faced by the untold numbers of *Liminal Animals* who are neither domestic nor wild, but who depend on the human environment for living space and food. Finally, we describe the reality of the lives of *Wilderness Animals*, those truly wild animals who live in specific ecological niches or territories.

[1] These three categories are taken from Donaldson and Kymlicka (2011).

## Domestic Animals

Domestic animals are "kept in captivity by a human community that maintains total control over their breeding, organization of territory, and food supply" (Clutton-Brock, 2012: 3). As Donaldson and Kymlicka (2011) note, as a subordinated class intended to serve humans, domestic animals have been made dependent on human care, coerced into social participation, and exploited for food and labor. In this section, we address the material reality of how animal lives are impacted by domestication and how the process of domestication has impacted the environment. We divide domestic animals into the following categories: companions, agricultural animals, working animals and animals on display. We also address animals in disasters as an important domestic category because of the impact environmental catastrophic events such as hurricanes, flash flooding, tsunamis and earthquakes have on this population and the reality that the intensity of these events is likely to increase with climate change.

## Companions

Companion animals are those with whom we share our homes and lives, and it is estimated that 68 percent of households in the US have animal companions (American Pet Products Association, 2018). Although having animal companions benefits both humans and animals, it also has environmental consequences, specifically in terms of generating greenhouse gas emissions, a key issue for environmental sociologists. Keeping cats and dogs in the US accounts for the release of 64 million tons of nitrous oxide and methane, which equates to the US having about 12 million more cars being driven each year with feed production and animal waste accounting for most of these emissions (Okin, 2017). Dogs and cats ingest about 25 percent of all animal derived calories consumed in the US (see Fig. 14.1) and account for 13.5

**Fig. 14.1** Ben with his meal of species-appropriate raw food. Author photograph

percent of the total 39.0 million tons of wild caught forage fish (De Silva & Turchini, 2008).

Similar to humans, companion animals produce an enormous amount of feces and urine, but there is not a public service system to accommodate and treat animal waste. Okin (2017) notes that, "if all the feces from US dogs and cats…were disposed as garbage, their feces would be equivalent to the total garbage produced by 6.63 million Americans, or approximately the population of Massachusetts" (p. 8). Viruses, bacteria and parasites can exist in dog waste, which is especially problematic in high density areas where water and air can easily become compromised. For instance, in the Chattahoochee River National Recreation Area near Atlanta bacteria levels often exceed safe guidelines prompting the city to send out warnings. Similarly, in 2000, the surf in San Diego was closed to swimmers 125 times due to water contamination, in part because of unmanaged dog waste. Social scientists and particularly environmental sociologists are important in assessing how to address animal waste through normative changes and behavior interventions. In this instance, an educational plan and additional trash cans were provided. However, scholars continue to monitor beaches along the California coast noting the importance of continuing animal waste education and mitigation efforts (Oates et al., 2017). Unmanaged companion animal droppings are not only a health concern but can also damage urban greenery. In the city of Boulder, CO, nitrogen has been shown to kill native grasses in city parks. Much of the education plan for this area went to convincing residents that dog waste is not natural fertilizer (Blenderman et al., 2018). The impact of fecal matter on air quality is another concern, although it has not been extensively studied. Bowers et al. (2011) show that beyond predicted sources of airborne bacteria (soil, leaves, etc.), animal fecal material (particularly dog waste) is an unexpected contributor.

Because companion animal waste can be a major issue in urban environments, social scientists have become particularly interested in social and psychological behavior of dog walkers when dealing (or not dealing) with waste. Studies suggest that although the physical environment plays a role in promoting waste pickup, individual values and beliefs about the importance of picking up waste can increase or decrease the action regardless of environmental factors such as location of waste bins (Lowe et al., 2014). Since 2004, researchers in Montreal have been implementing dog waste composting programs and assessing their social and environmental impacts. They find that not only are people supportive and enthusiastic with the program, but implementation at just one run in an urban area diverts nearly one ton of dog waste and at least 7000 plastic bags from landfill sites while also producing 1700 pounds of compost in just one year (Nemiroff & Patterson, 2007). Similar dog waste anaerobic digester experiments have been conducted in the US. Although composting is one option, many cities have responded by implementing tickets and fines (as illustrated in Fig. 14.2), but nevertheless only around 59–74


**Fig. 14.2** Animal waste pick-up sign. Author photograph

percent of people clean up after their dogs (Blenderman et al. 2018). It is argued that when considering a companion animal, individuals should consider the animal's ecological footprint and how to mitigate her environmental impacts (Okin, 2017).

## Agricultural Animals

Agricultural animals are bred for the production of animal products. They are domesticated, but they are not usually companions who live in the home. Billions of agricultural animals are produced each year in the US alone, and animal protein production contributes to a large portion of food system climate impacts. Environmental sociologists are rarely focused on the impacts of agricultural animal production on animal wellbeing and the shared impacts on both humans and animals. In 2015, 9.2 billion farm animals were slaughtered in the US, primarily for food (USDA, 2015). As environmental sociologist and animal studies scholar Ryan Gunderson (2011, 2012, 2013) suggests, the environmental health consequences of livestock agribusiness are

substantial. In 2006, the Food and Agriculture Organization (FAO) of the United Nations warned that livestock production was a major factor in biodiversity loss, a leading source of greenhouse gas (GHG) emissions, and a key contributor to water pollution (Steinfeld et al., 2006). Studies show that the livestock sector is a leading contributor to climate change (Herrero et al., 2011), with direct emissions estimated to be approximately 14.5 percent, a substantial impact for a single sector (Sakadevan & Nguyen, 2017). Cattle have the greatest impact, accounting for roughly 77 percent of livestock GHG emissions (Herrero et al., 2013). It is not just the production of land livestock that contributes to GHG emissions. Freshwater fish farming, once thought to be relatively environmentally friendly, has an impact as well. Methane is produced in these environments when excreta and unconsumed feed gets deposited at the bottom of ponds where little oxygen exists (Poore & Nemecek, 2018). Beyond increases in GHGs, intensive animal feeding operations have clear instantaneous and direct impacts on air and water quality. Wing and Wolf (2000) report that when compared to those not living near intensive animal livestock operations, people living near intensive swine production operations in North Carolina report increases in headaches, runny noses, sore throats, excessive coughing and burning eyes.

Water quality is at great risk from concentrated animal feeding operations, much of which is connected to norms about acceptable management practices. Burkholder et al. (2007) argue that "generally accepted livestock waste management practices do not adequately or effectively protect water resources from contamination with excessive nutrients, microbial pathogens, and pharmaceuticals present in waste" (p. 308). Antibiotics used in industrialized livestock production have been known to enter the water system through feces contamination, which has likely contributed to the reduction in effectiveness of several classes of antibiotics (Gilchrist et al., 2006; He et al., 2016), and this is a particularly pernicious problem in developing countries (Schriewer et al., 2015).

Beyond water and air pollution, livestock production accounts for about 26 percent of global land use (Sakadevan & Nguyen, 2017). Forests are continuously cleared to increase production. Seventy percent of the global land used for animal production engages direct grazing and indirect feed crop cultivation (Steinfeld et al., 2006). In many cases, these areas are monocrop systems that cannot support biodiversity so the land used for animal production often suffers from degradation, soil erosion, nutrient depletion and ecosystem collapse (Sakadevan & Nguyen, 2017).

While the environmental consequences of concentrated animal feeding operations (CAFOs) are substantial, so also are the consequences of living in confined conditions for billions of animals. Failure to address the environmental impacts on all living beings situates environmental sociology in a human exceptionalism paradigm, the very perspective it evolved to push against. While human health concerns of CAFOs are important, so also is the recognition that living in such conditions is detrimental to the health and welfare of untold numbers of animals whose suffering in confinement is well documented (see Fig. 14.3). For example, without a stimulating environment, confined animals are significantly more likely to have abnormal or damaging social behavior (Moinard et al., 2003). Confined pigs (and chickens) develop joint and skeletal problems including the loss of the ability to walk due to rapid growth and weight gain (Prunier et al., 2010; Temple et al., 2012), and pigs have high levels of stress (Sutherland et al., 2010) that result in immunological defects which are passed on to their offspring (Pakpour et al., 2012).

With the current world population at 7.7 billion and continued growth expected, there is a critical need to develop a global strategy for food security and sustainability (Godfray et al., 2010). Regulations, new technologies and dietary changes are important factors in reducing the environmental impact of agricultural animal production, and dietary changes are likely to have the greatest influence. Poore and Nemecek (2018) estimate that "moving from current diets to a

**Fig. 14.3** Veterinarian examining pigs at a swine confinement animal farming operation, Getty Images

diet that excludes animal products . . . has transformative potential, reducing food's land use by 3.1 (2.8 to 3.3) billion ha (a 76% reduction), including a 19% reduction in arable land; food's GHG emissions by 6.6 (5.5 to 7.4) billion metric tons of $CO_2$eq (a 49% reduction); acidification by 50% (45 to 54%) . . . for a 2010 reference year" (p. 991). Sociologists have explored how social and social psychological factors contribute to support for plant-based diets (Whitley et al., 2018), suggesting that how food animals and meat eating is constructed in relation to individual value orientations contributes heavily to support. So, for those who are more heavily guided by altruism, framing plant-based diets in terms of animal welfare becomes important, however, for those guided more heavily by egoism, framing in terms of economic or personal benefit elicits a greater support response. Additionally, sociologists have explored identity-based factors in the normalization of veganism among different populations (Greenebaum, 2012; Twine, 2018), and the maintenance of vegan social movements (Cherry, 2015).

## Working Animals

While a growing body of work engages the idea of energy justice, even including conversations about enslaved humans (see Lennon, 2017; Sovacool & Dworkin, 2015), nonhuman animals remain excluded from these dialogues. Working animals are the foundation of energy systems, and they remain an essential part of labor and energy harvesting in developing countries (see Fig. 14.4). The environmental sociological work on energy is substantive but lacks an acknowledgement of the past and present place of animals in these processes or their use as intentional and unintentional sentinels (see Whitley, 2017, 2018, 2019). Animals such as donkeys, mules, camels, cattle, buffalo, yaks, horses, llamas, reindeer, goats, elephants, and dogs have been used for

**Fig. 14.4** Working elephant, Getty Images

energy in transporting goods, crop cultivation, logging and land excavation, leveling, mining, milling and water-raising.[2] As an example, animal power continues to be used in domestic and international logging operations. Studies suggest that animal power in logging, the use of draft horses in particular, is more climate friendly (Engel et al., 2012). Animal powered logging inflicts less harm on topsoil, can target specific trees to effectively promote forest regeneration, uses less fossil fuel, can engage challenging terrain, and is more economical when needing to work in heavy snow (Malatinszky & Ficsor, 2016). However, animal power produces less output, animals must be trained, humans must be trained to work with animals, and animals may suffer from poor working conditions (Malatinszky & Ficsor, 2016). Working animals have a critical social role regardless of the environmental harm that comes with the work activity. It is argued that the human-animal working relationship is the foundation of the human-animal bond, that animals are actors in the work they perform, that they have a need to be recognized for doing effective work, and that they complete tasks for payment, such as for affection and food (Despret, 2016; Porcher, 2017).

Using an ethnographic approach to understand the human-elephant working relationship in wildlife management and conservation in India, Münster (2016), asserts that relations between human and captive elephant workers are often co-constructed through interaction and trust development. It is argued that because of the handlers' concern for the environment and eagerness to promote conservation they may be more attuned to working animal welfare compared to those using animal power for non-conservation purposes such as in human interaction exhibits and elephant riding. Research

[2] There is a connection between the material reality of the lives of working animals and human slavery since the tools, structures and ideologies that make the enslavement and oppression of other species possible are similarly employed in the enslavement of humans (Spiegel, 1997).

shows that working elephants, particularly those forced to interact with humans in non-conservation environments do experience increases in stress (Millspaugh et al., 2007). Working donkeys also have compromised health issues (Fsahaye et al., 2018), and once a working animal has no labor value, he is deemed expendable (Wilkie, 2010).

Animal strength is an important feature in working animals, but it is not the only characteristic needed when utilizing animals for landscape transformation or to obtain natural resources. For example, in addition to mules and horses used for bringing coal to the surface of eighteenth-century mines, canaries were used as sentinels to detect toxic chemicals and potential health risks to humans. Whitley (2017, 2018, 2019) argues that in the context of animal sentinels we should think of use intentionality. For example, sentinels were historically used intentionally in energy development practices such as mining, but as mechanization took hold, animals were replaced by technology. Today, animals often serve as unintentional sentinels, bearing the brunt of environmental problems and showcasing this distress to humans. We see this in energy development when wildlife, domestic, agricultural, or liminal animals are exposed to toxic chemicals or distressed environments, become sick and serve as warnings (albeit unintentional sentinels) of potential risk to humans (Mattes & Whitley, 2021; Whitley, 2019).

## Display Animals

Animals are displayed in a variety of visual cultural venues, such as zoos, television and the ubiquitous internet. The animal conservation and species survival missions of zoos is most salient to the entanglement among humans, animals and the environment. While artificial ecological environments such as zoos and aquariums allow humans to view and engage diverse animal species in the age of the Anthropocene (Grazian, 2015:16), species survival plans are designed to manage populations of specific species who are threatened or endangered. Indeed, some animals have skirted extinction because of zoo breeding programs, including the Arabian Oryx, Przewalski's Horse, California Condor, Corroboree Frog, Bongo and Regent Honeyeater (Taronga Conservation Society Australia, 2017; World Association of Zoos and Aquariums, 2018). Thus, conservation is an important mission of zoos. The International Union for the Conservation of Nature reports that there were 33 extinct wild animal species as of 2016. One of the most noted extinctions in recent history was that of the West African Black Rhino (pictured in Fig. 14.5), who was last sighted in the wild in 2006, declared extinct in 2011, and there are none known to be currently in captivity.

The conservation mission of zoos is criticized by a number of scholars (see Braverman, 2012; Keulartz, 2015; Malamud, 1998), and one major criticism is that zoos dispose of animals who do not match their conservation needs. For example, the genetically redundant animal "takes up valuable zoo space without contributing to the diversity of the population (and) certain zoo animals . . . are 'bred for extinction' or purposefully not bred," or euthanized, such as the litter of tiger cubs who were sired by a tiger with an undesirable "generic" lineage (Braverman, 2012: 185). Undermining the mission of conservation, unwanted animals are either sold to animal dealers or culled such as Marius, a healthy young male giraffe at the Copenhagen Zoo, who was put to death in 2014, publicly dissected and fed to the zoo's carnivores (Keulartz, 2017).

Zoos and aquariums can be challenging environments for the captive animal's mental and physical health. Animals who live in inappropriate environments often display stereotypies (repetitive movements and behaviors) including rocking, pacing, moving in circles, excessive sleeping, and self-destruction/mutilation. Most zoos have incorporated enrichment programs to reduce stereotypies (Wagman et al., 2018). Enrichment programs stimulate animals' natural behaviors with activities such as using puzzle feeders that challenge animals to work for their food.

In summary, Malamud (2012) argues that animals who are displayed in visual cultural

**Fig. 14.5** West African Black Rhino, Author: Jerzy Strzelecki, Wikimedia Commons

frames such as zoos are always displaced from their natural contexts resulting in a sense of human entitlement and control and degraded outcomes for other animals. Zoos are criticized for undermining their mission of conservation by disposing of surplus animals and those who do not contribute to genetic diversity. While some zoos provide enrichment programs for animals to improve their quality of life, a realist-materialist perspective considers captivity to be an inappropriate environment for the mental and physical health of most animals.[3]

## Animals in Disasters

There are large numbers of animals who are vulnerable to natural disasters, but the coordinated efforts to assist them are limited. As sociologist Leslie Irvine (2009) notes "there is no Red Cross for animals. . .When declared national disasters involve animals, the response typically involves a patchwork of organizations and individuals" (p. 14). For example, on August 29, 2005, Hurricane Katrina made landfall in the Gulf Coast of the US. People were instructed to evacuate and leave pets behind. Many refused to leave their companion animals and did not evacuate, and those who did were met at shelters by officials who refused to accept them with their animals.[4] Without a proper disaster plan, many animals were released into the streets or executed. Irvine (2009) describes one of the horrific examples of companion animal treatment during the events of Hurricane Katrina. In St. Bernard Parish many people were instructed to evacuate and take their

[3] The Detroit Zoo was the first US animal facility to end a long-standing tradition (81 years) of keeping elephants in captivity. Winky and Wanda were sent to an elephant sanctuary in California in 2015.

[4] A 2006 poll found that 44 percent of people who did not evacuate during Hurricane Katrina did so because they did not want to abandon their animal family members (Fritz Institute, 2006).

animals to local schools. Once there, they were ordered to leave the schools without their animals, and "(r)ather than transporting the animals to safety, Parish deputies shot and killed the dogs and cats left in their care…Once the deputies had killed the animals in the schools, they went into the street to kill strays" (Irvine, 2009: 25). Evacuees described deputies assuring them that their animals would be cared for, and some evacuees even returned to schools to look for their companions, but instead found remnants of a massacre. At Beauregard Middle School, "(p)hysical and forensic evidence reveals that the animals were not killed humanely, with a shot to the head, but were shot in body cavities and left to bleed to death" (Irvine, 2009: 26).[5] It is estimated that more than 100,000 pets were left behind and 70,000 died because of inadequate evacuation polices (Louisiana SPCA, 2018). In 2006, Congress passed legislation requiring local and state governments that receive federal emergency grants to include companion animals in disaster plans and authorized the use of federal funds to support pet-friendly evacuation shelters (Irvine, 2009).

More recently on September 14, 2018, Hurricane Florence made landfall in North Carolina. With legislation in place, shelters opened to welcome both humans and their animals. Fortunately, various organizations and private citizens worked to rescue animals who were left behind or confined in flooded houses. For example, Hurricane Florence animal rescue organizations included the American Humane Rescue, an organization that for over a century has deployed people to disaster zones to rescue and care for animals (American Humane Rescue, 2018) and Code 3 Associates, a nonprofit dedicated to providing professional animal disaster response teams and resources (Code 3 Associates, 2018) (see Fig. 14.6).

The material reality of the lives of animals in disasters is that agricultural animals are the most vulnerable to disaster events, particularly those in confined feeding operations (CAFOs). Confinement structures are not built to withstand extreme conditions such as high winds and flash flooding. In addition, there are no comprehensive systems to support the evacuation or relocation of livestock during disasters. Sociologists Ladd and Edward (2002) note that Hurricane Floyd's landfall on North Carolina in 1999 dropped 20 inches of rain, killing more than two million chickens and turkeys, 30,000 hogs and hundreds of cattle. And in 2018, Hurricane Florence struck North Carolina again killing over 5500 confined pigs and 3.4 million confined birds who drowned during the flooding (Pierre-Louis, 2018).[6] Livestock vulnerability is not the only concern when disaster strikes. Animal confinement facilities produce large quantities of waste that, with flooding and high winds, can spread throughout surrounding communities, leading to air and water contamination.[7] Hurricane Floyd flooded approximately 250 CAFOs, creating "a veritable witches brew of sewage, bacteria, petroleum, pesticides, and farm/industrial chemicals that spread through the region" endangering "every species in its path" (Ladd & Edward, 2002: 36). Beyond human health concerns, untreated waste entering rivers can create algal bloom outbreaks and kill off native fish, which can lead to ecosystem collapse.

## Liminal Animals

Liminal animals are non-domesticated species who live among humans but are neither full members of the human community nor fully external to it and includes animals such as rodents, raccoons, squirrels, birds, and coyotes. Also known as commensal (together at table) species, liminal animals use the modified or constructed human environment for living space and food, with the habitat "providing the majority

[5] These cases largely remain unprosecuted or charges have been dropped (Irvine, 2009).

[6] North Carolina is the second largest producer of swine, home to 9.7 million pigs in production and a major producer of poultry (Pierre-Louis, 2018).

[7] Swine grown in North Carolina produce 10 billion gallons of manure annually, most from intensive farming operations (Pierre-Louis, 2018).

**Fig. 14.6** Amber Batteiger (American Humane Rescue) and Mike Mather (Code 3 Associates) rescue dogs stranded in homes after Hurricane Florence in North Carolina, September 2018. Photographer Kenn Bell

of living space and subsistence or provide those resources at a critical point in the animals' lives, without which their populations would not be viable" (O'Connor, 2013: 7). The pigeon is a good example of a familiar liminal animal in urban areas. A non-native, feral bird "whose niche is one designed to be the exclusive habitat of humans" the pigeon has access to abundant food in discarded garbage and from the hands of people who enjoy feeding them (Jerolmack, 2013: 11), as illustrated in Fig. 14.7.

Access to anthropogenic food sources drives most liminal animals into the human community, resulting in modifications in both physical and behavioral animal characteristics. For example, changes in skull size in badger and red fox populations in Denmark are attributed to changes in human-provided food sources (Yom-Tov et al., 2003). In Russia, urban common hamsters now demonstrate features not seen in nonurban populations, such as genetic modifications (Feoktistova et al., 2013), and in Canada, poor health in urban coyotes (see Fig. 14.8) is associated with the use of low quality but easily accessible anthropogenic food resources such as compost waste (Murray et al., 2015, 2016).[8]

Finally, in a meta-analysis of the effect of food provisioning on wildlife (through such resources as supplemental feeding by tourists, accidental agriculture and intentional management) Becker et al. (2015) found food provisioning results in both high infection outcomes and behavioral and immune mechanisms through which human-

[8] Sarcoptic mange is a pernicious disease that compromises the health of red foxes and coyotes, and some communities are attempting to treat the condition in foxes by injecting Ivermectin into meat baits at daily feeding stations of dry dog food over a 4–5 week period. See http://www.foxwoodwildliferescue.org/2017/01/05/treating-sarcoptic-mange-in-red-foxes/

**Fig. 14.7** Pigeons accept handfuls of food from youngsters in front of the Hotel de Ville in Paris. Source: Photographer Locke, Justin/National Geographic Creative, Image 1,122,633

provided resources alter host exposure and tolerance to pathogens.

Charismatic megafauna who scavenge for anthropogenic food sources are a particular problem of human-animal conflict made worse as wildlife habitats are destroyed. For example, sociologists Kalof et al. (2017) have described the problem Churchill, Manitoba has with the local polar bears who, because of global warming, are stuck on the mainland until the Hudson Bay freezes over when they are able to migrate onto the frozen ice to hunt ringed seals. As a way of keeping the bears out of trouble during October and November, a polar bear jail was erected in a former aircraft storage hangar. Problem bears are tranquilized for incarceration until the bay freezes over and they are removed by helicopter back into the wild. Bears who are

**Fig. 14.8** Coyote with mange. Photographer Franco Folini, Wikimedia Commons

outside the town perimeter and thus not "jailed" scavenge the town dump for food. Biologists use dye to identify chronically aggressive bears, with as many as five repeat offenders destroyed every year. The devastating consequences of the bears' habituated behavior is illustrated in Fig. 14.9 that shows a dirty, soot-covered polar bear rummaging in a fiery garbage dump with the number 13 painted on his side.

Unfortunately, liminal animals are widely persecuted as pests and invaders of human spaces and many species are vulnerable to ruthless extermination (Donaldson & Kymlicka, 2011).[9] Attitudes toward liminal animals are culture-specific, locally contingent and often dependent on animal body size, with coyotes at the upper end of the adaptable size range, which accounts for increased coyote-human conflicts (O'Connor 2013: 78). Antagonism toward coyotes and other meso-carnivores who are labelled pests sustains contemporary wildlife killing contests. Thousands of animals, including coyotes, foxes, bobcats, prairie dogs, rabbits, and squirrels, are killed in organized events in which participants compete for prizes for killing the most or the largest animals in a specified time period.[10]

While it is common to think of liminal animals as pests, many species are uniquely beneficial to both the environment and human well-being. For example, urban scavengers such as gulls, crows, and foxes remove roadkill from urban areas within hours, providing an important ecosystem service. Schwartz et al. (2018) set camera traps baited with chicken heads as simulated "roadkill corpses" in 12 sites in the city of Cardiff, UK. Seven species were observed removing the roadkill: crow, magpie, gull, domestic dog, red fox, and domestic cat, with corvids the most common scavengers. The researchers make two important points: 1) the estimates of the impact of roads on wildlife are underestimated due to the removal of roadkill by scavengers, and 2) in spite of the ecosystem service that scavengers perform, including benefits to both the environment and human health, all of the wild species observed scavenging are treated as pests in the local area and can be culled, under specific circumstances (Schwartz et al., 2018: 3, 5). It is also reported

[9] We humans have long history of destroying liminal animals such as rats, mice, squirrels, sparrows, raccoons, coyotes, and foxes. The ritual public slaughter of agricultural pest animals was common in rural communities around ancient Rome (Futrell, 1997), and bothersome animals such as flies, grasshoppers, locusts and sparrows were excommunicated and exorcised during the animal trials of the Middle Ages (Kalof, 2007: 63).

[10] See HSUS Fact Sheet on Wildlife Killing Contests, https://www.humanesociety.org/sites/default/files/docs/HSUS_Wildlife-Killing-Contests-Toolkit.pdf (Accessed July 6, 2021).


**Fig. 14.9** Habituated bear searching for food in a garbage dump. Source: Photographer David Hiser/National Geographic Creative, Image 278,049

that leopards in Mumbai, India, prey on stray dogs thus reducing the number of dog-bites and the risk of rabies transmission and increasing the number of wildlife species preyed on by stray dogs (Braczkowski et al., 2018).

How dogs contribute to and take away from ecosystems is a rarely studied but important question.[11] In a review of the ecological role of dogs as predators, Ritchie et al. (2014) found that in both urban and wild environments, dogs affect biodiversity by acting as predators or competitors in specific communities, thus contributing to the decline of rare and threatened species (and some common species). But through their predation on other predators such as invasive species and herbivores, dogs maintain the resilience of ecosystems by protecting and promoting biodiversity (Ritchie et al., 2014: 63–64). In addition, because of the density of dogs in some areas, other species in the animal community respond to dogs as a predatory risk, suggesting that community structure may be altered by dogs even when they have no direct predatory effect (Ritchie et al., 2014: 64–65). Sociologist Arluke and Atema (2017) argue that changing the perception of stray dogs as pests or as "clutter" on the streets (see Fig. 14.10) could strengthen humans' ability to develop connections to the dogs and bring them into the human community.

Finally, in an international review article on the benefit of predators and scavengers on human well-being, O'Bryan et al. (2018) also note the value of liminal species in spite of their far-reaching assistance in waste-disposal and the

[11] The question depends largely on the definition of "dog." Vanak and Gompper (2009) categorize dogs into six groups: owned dogs, urban free-ranging dogs, rural free-ranging dogs, village dogs, feral dogs and wild dogs (dingoes, feral dogs and their hybrids). However, Ritchie et al. (2014) note that dingoes could fit into each of these groups which illustrates the difficulty of defining "dog," and they argue for a definition based on spatial and temporal contexts of the study site.

**Fig. 14.10** Stray dogs in Darjeeling. Photographer Arne Hückelheim, Wikimedia Commons

regulation of zoonotic diseases.[12] They argue for a conservation solution that will allow a variety of species to exist in landscapes shared with humans; making visible the benefits provided by "so-called problem animals is an important step for establishing tolerance in these shared spaces" (O'Bryan et al., 2018: 229).

## Wilderness Animals

Wilderness or truly wild animals live in specific ecological niches or territories and try to avoid human contact (Donaldson & Kymlicka, 2011), as well they should. The harm humans have wrought on wilderness animals is vast and from a realist-materialist perspective the impact on their lives is profound: they are hunted, captured, and subjected to wildlife management schemes; their territory and resources are invaded, colonized, displaced, and destroyed (Donaldson & Kymlicka, 2011) (see Fig. 14.11).

Hunting by humans has had a particularly devastating effect on wildlife populations and ecosystems. Overhunting, wasteful hunting and trophy hunting have driven many megafauna species extinct. By the end of the last Ice Age, hunting (and environmental changes) had wiped out the giant wombats, large ground sloths, the mammoth, the mastodon, the cave bear and rhinoceros in Europe, the horse in the Americas, the pigmy elephant and hippopotamus in the Mediterranean islands and the marsupial lion in Australia (Clutton-Brock, 1999; Kalof, 2007; Mithen, 1999). But the slaughter of wildlife during the Paleolithic "pales in comparison with the process by which today's humans consume ecosystems . . . hunting not only directly affects harvested wildlife but also reshapes entire ecosystems and, in some cases, human societies" (Brashares & Gaynor, 2017: 136). The demand for wild meat and other incentives for hunting (such as its cultural importance) are linked to

[12] Foxes may reduce Lyme disease risk in humans by controlling mice populations (O'Bryan et al., 2018: 230).

**Fig. 14.11** Hippo Trophy, Zambia, Author Lord Mountbatten, Wikimedia Commons

economic factors, sociopolitical circumstances, and both local and global market dynamics (Brashares & Gaynor, 2017). In a meta-analysis of the impact of hunting in the tropics, Benítez-López et al. (2017) found that mammal populations were 83 percent smaller and bird populations 58 percent smaller in areas where hunting occurred.

The disappearance of apex predators such as the wolf (Fig. 14.12) from ecosystems through hunting and habitat loss has cascading effects. Indeed, Estes et al. (2011) argue that the loss of large animal consumers may be the most pervasive influence that humans have had on the natural world, and they give many examples of trophic cascades that have changed animals, ecosystems, and human wellbeing. For example, the reduction of lions and leopards in Africa has led to behavior change and population outbreaks of olive baboons, driving them to anthropogenic food sources and increased contact with humans that has resulted in higher rates of intestinal parasites in both the baboons and their human neighbors (Estes et al., 2011: 304). The authors conclude that "many of the ecological surprises that have confronted society over past centuries—pandemics, population collapses of species we value and eruptions of those we do not, major shifts in ecosystem states, and losses of diverse ecosystem services—were caused or facilitated by altered top-down forcing regimes associated with the loss of native apex consumers or the introduction of exotics" (Estes et al., 2011: 306).

Restoring an apex predator is beneficial not only to the ecosystem, but also to neighboring human communities. For example, in a study of the restoration of dingoes, an apex predator in Australia's terrestrial ecosystem (who is shown in Fig. 14.13), Prowse et al. (2015) used computer simulations to illustrate that dingoes are effective predators of native herbivores with substantial ecological and financial benefits for cattle rangelands.

Human-driven environmental changes have also impacted wild animal populations. In an essay focused on the direct impacts of climate

**Fig. 14.12** Timber Wolf in West Virginia, Photographer Forest Wanderer, Wikimedia Commons

**Fig. 14.13** Dingo, Northern Territory, Australia, Wikimedia Commons

change on wild animals, Palmer (2016) notes that changing temperatures will cause some animal species to expand their ranges, while others will shift their range by moving towards the poles or upwards in elevation. For example, the red fox in Canada has been advancing north, while the Arctic fox has been retreating; some species cannot move at all due to physical barriers to migration or the presence of prey food species, such as the polar bear who has had a range contraction (Palmer, 2016: 134). Recent research on the role of learning in the migrations of North American ungulate species found that reintroduced populations of bighorn sheep and moose did not migrate as did historical populations—only nine percent of the translocated sheep migrated compared to between 65 and 100 percent of the sheep in longstanding herds (Jesmer et al., 2018). The authors came to a conclusion that is of great importance to the material-reality of ungulate species: ungulate migration is established and maintained by social learning and the cultural transmission of the animals' traditional knowledge[13]—knowledge that has been disrupted in bighorn sheep populations by market hunting and their vulnerability to disease from domestic sheep (Jesmer et al., 2018: 1023).

Climate change has substantial effects on wildlife, including: (1) the timing of animal seasonal activities (with spring activities occurring earlier, autumnal events later and reproductive seasons ending earlier), (2) ocean temperatures with warm water species expanding (such as the common dolphin) and cold water species contracting (such as the white-beaked dolphin), and (3) the Arctic sea ice that has caused low ovulation rates in female ringed seals, reduced body size and adult survivorship in Beaufort Sea polar bears, and an expansion of bowhead whales into northern areas that are now ice-fee (Palmer, 2016: 135). The rise in sea level is also turning freshwater wetlands saline, as in Kakadu National Park in Australia that has experienced a displacement of freshwater-dependent species such as magpie geese, barramundi and turtles (Palmer, 2016: 135–136).

Expanding human populations and modified environments have also destroyed wild animal habitat. In a study of the impact of fragmentation and forest edges on forest vertebrate animals, Pfeifer et al. (2017) used data collected in 22 landscapes distributed across seven major biogeographic regions to examine species' responses to edges. They found that the abundances of 85 percent of animal species are affected by fragmentation and that forest edges restructure ecological communities (p. 187). Species who are negatively affected by edges include threatened forest-core species of immediate conservation concern, such as the Sunda pangolin, the Bahia tapaculo, the long-billed black cockatoo, and Baird's tapir. Species who are positively affected by edges include invasive species, such as the green iguana (Fig. 14.14) and the common boa constrictor (Pfeifer et al., 2017: 188). They conclude that "less than 50 percent of Earth's remaining forests can be considered free from edge effects, but even those forests are under threat from the chaotic expansion of road networks, selective logging, wildfires, widespread hunting and other human encroachment into the last intact forest frontiers" (Pfeifer et al., 2017: 191).

In a study of the ecological condition and plight of the silvery gibbon who lives in West Java forest fragments, Malone et al. (2014) used a political ecology approach to understand the politicization of the forest that undermines the ecological health of the region and its animal and human communities. They argue that understanding sociocultural realities of the region such as the deep connection between gibbons and humans and acknowledging the cultural significance of the species foster healthier ecosystems and potential recovery of an endangered species. Clausen and York (2008) also examined the influence of social structural factors on biodiversity and found that increases in both economic growth and population size increased the number of threatened fish species in nations.

[13] Social learning and the cultural transmission of learned behavior is common among other animal species (see for example, Bekoff, 2007; Marino, 2017; Van Schaik et al., 2003).

**Fig. 14.14** Green Iguana, Brazil, Photographer Charles J. Sharp, Wikimedia Commons

Finally, we draw attention to the problem of invasive animal species, nonnative species who modify and disrupt colonized ecosystems and who are often introduced through human activities such as global commerce and the pet trade (Rafferty, 2018). Invasive species, especially mammals, are a global threat to biodiversity. In a meta-analysis, Doherty et al. (2016) found that invasive mammalian predators (mostly cats, rodents, dogs, and pigs) "are implicated in 87 bird, 45 mammal, and 10 reptile species extinctions—58 percent of these groups' contemporary extinctions worldwide … (and) further endanger 596 species at risk of extinction" (p. 11261).

Indeed, free-ranging cats in the US kill 1.3–4.0 billion birds and 6.3–22.3 billion mammals annually (Loss et al., 2013). Finally, invasive feral pigs (Fig. 14.15) are becoming increasingly problematic in many communities worldwide. For example, introduced into the California Channel Islands in the mid-nineteenth century, feral pigs have provided a food source for a large population of golden eagles (a transient visiting predator) who in turn have fed (to near extinction) on the island foxes who have lived on the islands for 20,000 years. The realist-materialist approach emphasizes concern for the lives of the introduced pigs, the golden eagles and the foxes since their material reality stems from human-induced changes to the island, the mainland and the surrounding marine environment (Roemer et al., 2001).

## Conclusion

Our overview of the material reality of contemporary domestic, liminal and wilderness animals establishes the critical importance of assessing the entanglement among humans, animals and the natural world. This is especially important for environmental sociologists who seek to better understand how society impacts the natural environment and how the natural environment impacts society. Animals serve as part of both

**Fig. 14.15** Feral pig, Australia, CSIRO, Wikimedia Commons

society and the natural environment and are interwoven in environmental sociology by proximity. How we define, use, support and create policies for animals influences human and non-human health and wellbeing and also exacerbates or mitigates local environmental issues such as community water quality and global issues such as climate change. These observations follow directly from the realist-materialist approach to human-animal interactions (York & Longo, 2017) that undergirds this chapter.

Thus, the material reality of the lives of most domestic, liminal and wild animals—as they intersect with humans and ecosystems—is dire. Domestic animals are exploited by the billions for food and fiber, and their confinement contributes to pollution and vulnerability in natural disasters. In addition, the ecological footprint of keeping companion animals needs further examination. It is important for environmental sociologists to explore how people consider the environmental impact of companion animal ownership and if they would be willing to make tradeoffs in other areas of their lives to offset that impact. Indeed, the increase in the keeping of, and affinity for, companion animals might increase public sentiment for campaigns against industrial animal agriculture (Fitzgerald, 2019). For example, social pressure has contributed to legislation for increased animal protections for agricultural animals with bans on gestation crates and battery cages. With increased awareness, it could be possible to push more agricultural animal producers and animal food corporations to consider their environmental impacts and make associated changes in production.

Liminal animals, in spite of their contribution to ecosystems, are persecuted as pests and suffer physical and behavioral changes from anthropogenic food sources, particularly in urban areas.

Geographers argue that the challenge of the future is to imagine "lively and inclusive cities" that encourage the development of ways to effectively share power with the nonhuman world (Owens & Wolch, 2017, see also Donaldson & Kymlicka, 2011). For example, the increasing "living-with-animals" campaigns enhance public awareness and education on the need to share space with a variety of animals who are increasingly a part of urban areas, such as coexisting with coyotes (coyotewatchcanada.com), black bears, wolves (westernwildlife.org), and mountain lions (www.mountainlion.org).

Wild animals are being devastated by hunting, poaching and human encroachment into their habitats. Some positive interventions into the disappearance of wildlife and their habitat include animal sanctuaries and the protection of ecological zones and corridors for wild animals, strategies that "point us toward the kinds of practices that are required for human, animal, and non-animal life to flourish jointly" (Calarco, 2015: 68). Poaching is particularly problematic with links to the spread of zoonotic disease, the extinction of endangered species and connections to other crimes such as smuggling drugs and weapons (Hill, 2015). Interventions into poaching range from a holistic approach with computer simulation (Hill, 2015) to the use of remotely piloted aircraft systems (Mulero-Pázmány et al., 2014). Finally, environmental sociologists can be mediators in supporting research that enhances understanding between conservationists, animals and the general public. For example, Cherry (2019) has found that concern for the environmental impacts on avian species inspires bird watchers to participate in citizen science and wildlife conservation. Indeed, environmental sociologists have established that public values have a distinct "concern for animals" dimension that is separate from biospheric altruism (Dietz et al., 2017).

We agree with those who propose an earth-centered world with global justice for animals, humans and ecosystems, and those propositions swirl around the concept of "liberation." For example, Pellow (2014) argues for a "total liberation perspective" to challenge socioecological inequality and the linked oppressions of humans, nonhumans and ecosystems. This view of liberation is similar in many ways to the goal of critical animal studies that promotes global justice for animals, humans, and the earth, noting that the pursuit of animal liberation and human liberation are one and the same (Gigliotti, 2017). The elimination of animal exploitation through domestication (those animals whom humans use as food, labor, and companions) is considered by some to be a critical component in the search for "more liberatory possibilities" among humans and other animals (Calarco, 2015: 68; Nibert, 2013). Finally, it is important to acknowledge that animals are active agents who have always struggled against and resisted their domination by humans (Hribal, 2011). Colling (2020) argues that we must listen to the voices of other animals and read their actions to give them space in a world overrun by human civilization because their struggles are at "the center of their liberation movement." Others argue that the acknowledgement of animals as active agents is essential to collaborative, respectful human-animal relationships (Despret, 2016; Haraway, 2008; Porcher, 2017), and we must focus on asking the critical question, "What matters for them?" We end with an appeal for altruistic coexistence for all beings in earth's ecosystem. As Clark (2017) argues, an awakening to the real presence of others is the process of rejecting the anthropocentric world in favor of a world where all beings are revered.

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# Religion and the Environment

15

Lynn Hempel

## Introduction

> If ecological dynamics are "entangled with human ways of being in the world," they are also entangled with all the ways religion haunts, animates, influences, and interprets those ways of being (Jenkins, 2016: 23).

Religion remains a prominent feature of contemporary life. More than four out of five people on the Earth identify with a religious group and although there are substantial geographical variations, the religiously affiliated are, on average, younger and have more children than the non-affiliated, suggesting that the world is becoming more religious, not less (Pew, 2017). Within the United States, religious affiliation is declining, but religiosity endures. Most Americans believe in God or a higher power (89%), talk to God (75%), believe God or a higher power has protected them (77%) and will judge people based on their deeds (61%) and nearly half (48%) believe God determines what happens in their lives "all" or "most" of the time (Pew, 2018).

Religion also remains a powerful force shaping policies and institutions that affect the lives of believers and non-believers alike. Indeed, it would be difficult to understand contemporary politics, transnational migration, globalization, or international conflict without reference to religion. Understanding the complex influences of religion is fundamental to comprehending the complexities of our world. Yet religion is often relegated to the margins of environmental studies due perhaps to the perception that environmental conditions are unaffected by religious culture or institutions, that religion and science are incompatible, that secularization and modernity go hand-in-hand, or that secularization in some parts of the world signal a waning influence of religion more generally. There is a strange irony in this neglect, particularly in the context of extensive anthropogenic change, as all human social action is shaped by culture and all cultures, whether overtly religious or not, are shaped by religion (Buckser, 1996; Geertz, 1973; White, 1967). Religion is not exterior to the forms of social organization, governance, and patterns of action that affect the environment; it is deeply entwined with them. The study of religion and the environment addresses how.

Researchers working within this area study a range of topics relating to the intersection of religion and the environment including: the links between religious thought and environmental practice and perspectives; how religious meanings, behaviors, and institutions affect environmental actions and policies; and how environmental events intersect with the religious resources people draw on as they navigate environmental risks and their relationship to the natural world. Throughout, the research shows that

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religion matters for environment studies not simply because it influences human understanding, but because religion profoundly shapes human actions that impact the Earth.

## Defining Religion

Religion is a complex phenomenon that belies easy definition. The origins of the term itself are disputed and the breadth of definitions expands from there. Nevertheless, there are dominant notes in how religion is practiced. More than two-thirds of the world's population identifies as either Christian (31.2%), Muslim (24.1%) or Hindu (15.1%). The remainder identify as Buddhist (6.9%), Jewish (0.2%), or as practicing "folk" or other religion (6.5%), or do not identify with a religion (16%) (Pew, 2017). Yet given the diversity and breadth of spiritual practice even within major traditions, there may be no simple encompassing way to define religion. Moreover, there are pitfalls to creating fixed definitions that, intentionally or not, exclude other faiths and spiritual practices, especially since this exclusion can make it difficult to see where and how religion is changing and adapting to contemporary environmental conditions (Taylor, 2016).

It is with this in mind that I focus on "lived religion" and the diversity and complexity of religion as it relates to people's lives (Ammerman, 2006, 2014; Hall, 1997; McGuire, 2008; Orsi, 1997, 2003). The study of lived religion examines religion as a form of cultural work and its expression as a form of language that "comes into being in an ongoing, dynamic relationship with the realities of everyday life" (Orsi, 1997: 7). Scholars working within this tradition are not seeking a singular definition of religion that describes what religion is and is not, but instead focus on religion as practiced by people in the contexts they are living. Religious doctrines and official institutions play an important part in this, but their interpretation and application are recognizably varied, structured and situated in shared practices and cultural histories, and enacted and canalized within social contexts in diverse ways. The study of lived religion does not ignore the more formal aspects of religion, but instead "directs attention to institutions *and* persons, texts *and* rituals, practice *and* theology, things *and* ideas—all as media of making and unmaking worlds" (Orsi, 2010: xxxvii). As such, it is not religious text, truth, or essence that is the ultimate focus of attention. Instead, the focus is on seeing how people cultivate religious consciousness and practices as they weave "a layer of spirituality" into the fabric of their lives and their interactions in the world (Ammerman, 2014: 196).

Applied to the environment, the study of lived religion attends to the ways in which people are shaped by, and draw on, religious resources in their understandings of, and interactions with, the environment. Three areas of focus exist (cf. Edgell, 2012; Orsi, 2003):

1. Religion as meaning systems and the "worldviews" it creates.
2. Religion as practice intertwined with the practices of everyday life.
3. The study of religious ecology including the circumstances, material and otherwise, in which specific religious expressions emerge, and the conditions to which they respond.

Below, I review research as it relates to each area and suggest directions for future study. There are two dominant strands in the literature on religion and the environment which reflect disciplinary differences in the study of religion more broadly. The first, from divinity and theological studies, provides rich accounts of how different religions and/or spiritualties conceptualize nature and human/nature interactions and how these beliefs shape practices and possibilities relating to the environment. The second is more social-scientific in that it seeks to explain patterns in, and identify predictors of, environmental attitudes and behaviors in relation to specific religious traditions. This latter strand is more limited in its scope relative to the first as research in this area focuses largely on Western Christian traditions but provides important insights into the mechanisms through which religion shapes environmentalism and variations in these effects. I will not be able to review all the literature that

elucidates either strand but offer some illustrative examples from each below.

## Religious Worldviews

> What people do about their ecology depends on what they think about themselves in relation to things around them. Human ecology is deeply conditioned by beliefs about our nature and destiny—that is, by religion (White, 1967: 1205).

White's quote reflects a broadly held view that people hold different beliefs about reality and human existence which shape environmental perspectives and practices. All people understand the world and act in accordance with certain foundational assumptions which guide how we define and understand environmental issues. But while worldviews and religious worldviews overlap in many respects, religious worldviews diverge insofar as they tend to define an ultimate reality and provide a comprehensive cosmology describing origination, change, and the afterlife (Silberman, 2005). In many cases, this cosmology is rooted in beliefs about superhuman forces, such as a divine god or gods, that create and sustain the Earth and can alter or ignore physical forces. This orientation can have important implications for environmental studies. Because causal forces affecting our existence are not limited to the physical world, they cannot be known, understood, or acted on in the same way as other phenomenon. As such, religious understandings of environmental issues often diverge from more secular or scientific ones.

One of the most central ways in which religious worldviews are thought to affect environmental interactions is by defining nature and human relations to it. For example, in many eastern traditions (e.g., Taoism and Confucianism) the concept of *Qi*—a spiritual energy matter that flows through and connects and unites everything—is fundamental. Buddhism teaches the importance of living in harmony with nature and of cultivating acceptance and awareness for which nature serves as a teacher. And Hindu traditions teach that everything is interdependent and related; the entire world is divine (Jenkins, 2016).

These holistic accounts can be contrasted with more dualistic or atomistic worldviews in which biophysical systems are seen to be distinct from human ones, and in which environmental resources often are viewed as gifts from God intended for human benefit. Indeed, this is part of the argument forwarded by Lynn White (1967) in what has become a canonic piece in environmental studies. White's thesis is that Judeo Christian systems, and particularly western Christianity, promote an anthropocentric view of nature by teaching people to view themselves as separate from nature. This deeply rooted dualism along with the belief that God gave humans dominion over nature made it possible for adherents "to exploit nature in a mood of indifference." This, White argues, is the "root cause of the contemporary ecological crisis" (White, 1967: 1205, 1207).

White's work highlighted the important implications religious worldviews have for contemporary environmental problems. It also bought greater awareness of, and inquiry into, how religious cosmologies and culture, more generally, shape ecology (Tucker & Grim, 2001). Indeed, it would be difficult to understand the trajectory research on religion and the environment takes without reference to White's work. Yet many dispute White's assertions on theological and empirical grounds. The breadth of religion alone belies the simple thesis that there is a Judeo-Christian worldview or that this worldview uniformly affects people's environmentalism. Within western Christianity there are important socio-historical and cultural differences across different traditions, regions, and populations. Yet even if we adopt a narrower focus on conservative Protestantism in the US, numerous studies suggest a more nuanced account than White's is still needed.

For example, using data from the US General Social Survey, Sherkat and Ellison (2007) find that conservative Protestants are no less likely than followers of other religious traditions to view environmental degradation as a serious

problem or to undertake individual actions related to environmental stewardship such as recycling, once political ideology is controlled for. However, they are significantly less likely to indicate they would make sacrifices for the environment or engage in collective forms of environmental activism, particularly when they believed in the inerrancy of the Bible. The authors conclude that religious beliefs and their relation to the environment are "diverse and multiplex" as are the religious resources people draw on, resulting in divergent patterns of environmental concern and activism among Protestants in the US.

Guth et al. (1993, 1995) find similarly divergent patterns based on their analyses of data from four national surveys. They analyze a range of religious variables (religious affiliation, beliefs, involvement, and commitment), sociodemographic characteristics, and political views in relation to attitudes toward environmental protection. They find that while other religious variables have some influence, religious beliefs about the Bible and eschatological views concerning the afterlife are the strongest predictors of environmental attitudes. They notably conclude that evangelical Protestants are conservative on environmental issues because of these beliefs.

More recently, Smith et al. (2018) use data from two nationally representative surveys to compare the effects of different approaches to measuring an 'evangelical' effect on 14 different environmental outcomes. Of the four measures of evangelical Protestantism tested, biblical literalism was found to have the most consistent negative effect across the environmental outcomes examined. Moreover, they find that conservative Protestants do not differ from other religious groups or the non-affiliated in their concerns about current environment problems (e.g., water pollution) but diverged when questions concerned *future* outcomes. Specifically, evangelicals adopting a literalist view of the Bible are significantly less likely to express concerns about the future effects of climate change or about exhausting the Earth's natural resources.

These and other studies direct attention to specific beliefs within a theologically conservative worldview. Namely, beliefs about the inerrancy or literalness of the Bible and related eschatological views are thought to be pivotal. Kilburn (2014) provides two explanations for this. First, biblical literalist beliefs are more closely related to the Genesis story of creation, which is interpreted by many to place humankind at the center of the world and to give humans dominion over nature (Djupe & Hunt, 2009). Second, biblical literalism relates to an eschatological view based on dispensationalism and characterized by a belief in the imminence of 'End Times'. This other-worldly outlook is argued to create a certain "quiescence" and passivity about the future of the Earth and the need for this-worldly reform (Guth et al., 1995). Rather than being a focal concern, the Earth is seen as "more as a backdrop" for God's actions in saving humans (Curry, 2008: 158). Findings from several studies add empirical support to these observations (Smith et al., 2018; Barker & Bearce, 2013; Evans & Feng, 2013; Guth et al., 1995).

Related research demonstrates that while religion is an important source of a person's worldview, it does not operate in isolation from other identities. In 2015, for example, Pew (2015) released a study on religion's impact on attitudes toward climate change and other environmental issues in the US. They found that 77% of Hispanic Catholics and 56% of Black Protestants believed that climate change is mostly due to human activity; while only 8% and 20%, respectively, indicated there was no evidence that the Earth is getting warmer. By comparison, 37% of white evangelical Protestants and 34% of white Catholics said there was no evidence that climate change is occurring. Such divergent patterns are difficult to explain if Christian affiliation alone is assumed to be coterminous with a person's worldview and environmentalism. Similarly, most Black Protestants (60%) adopt an optimistic view that new solutions will emerge to address the strains on natural resources caused by a growing world population. The unaffiliated (76%), followed by white Catholics (67%) and white mainline Protestants (63%), were more likely to see population growth as leading to a major problem. These and related studies (Arbuckle, 2017;

Hempel & Smith, 2019; Peifer et al., 2014) demonstrate that worldviews are not constituted by religion alone. Religious cultures and identities intersect with other social locations and cultural influences and create divergent, and even opposing, understandings of environmental risk and action. As such, religious cosmology does not produce one vision or modality of environmentalism, but hybrid modalities as religious perspectives intersect with different lifeworlds.

Worldviews play an important role in explaining the physical and social world by giving both meaning and moral value (Geertz, 1973), but more work is needed to identify how and when they affect people's environmentalism. Empirical support for White's thesis remains mixed likely not because worldviews have no effect, but because worldviews shape people's environmentalism in diverse ways, and we're only beginning to understand and identify how. Recent findings thus provide several directives for future research.

First, they underscore the importance of thinking carefully about how worldviews are being conceptualized and measured. If the goal is to better clarify when and how religious worldviews influences environmental interactions, it is necessary to identify what belief or combination of beliefs may be generating the observed effect, particularly since religion can mean many things. Woodberry et al. (2012), for example, distinguish three broad meanings in the use of the term 'evangelical' in the literature: (1) an affiliation, (2) a series of doctrinal markers, and/or (3) a religious movement identification. Depending on the criteria used, the proportion of population defined as evangelical ranges from less than 10% to almost one-half of US adults (Hackett & Lindsay, 2008).

Second, recent findings demonstrate that worldviews are not interchangeable with religious denomination or tradition. Simply knowing a person's denominational affiliation, or which religious tradition they follow, is insufficient for understanding their environmentalism. This is especially the case considering individual variation in the content and intensity of religious beliefs and interpretation of religious doctrine within and across religious populations. Further, other identities and cultural resources, including those relating to race, class, and gender, intersect with religious ones. Religion does not operate independent of these and other social locations but interweaves with them. Yet when studies collapse religious understanding into a singular categorical membership or preconstructed attribute that exclusively drives action, they oversimplify important variations in religious self-understandings and their environmental consequences.

Lastly, there is a need for more granular analyses to identify *what* aspects of environmentalism are affected by religious perspectives and why. While religious worldviews may inform environmental concern and behaviors they do not do so uniformly. For example, a religious worldview may have a strong effect on certain components of person's environmentalism (e.g., attitudes about the future effects of climate change) but little effect on others (e.g., recycling). That is because environmental events and conditions have what Sewell (1992) calls a polysemic character, i.e. they have multiple meanings and relevancies. Compounding this issue is the tendency to treat environmentalism as a unitary construct despite substantial arguments for, and evidence of, its multidimensionality. We should be cautious of treating worldviews as fixed lenses that determine how people see the world and everything in it including all aspects of the environment. It may be more useful to conceptualize worldviews as cognitive schema that, while often shared, also get altered and revised as people navigate and respond to environmentally-related issues. In so doing, we gain greater insight not only into how people's religious perspectives shape aspects of their environmentalism, but also how religious beliefs may be drawn on and adapted as people respond to changing conditions.

In sum, the concept of 'worldview' can be too static and imprecise an explanation when worldviews are reduced to or assumed based on religious affiliation, when intersections with other identities are ignored, and/or when a given worldview is assumed to shape environmentalism in a

fixed and uniform way. Much more work, particularly comparative work, is needed to understand when and how religion is infused into a worldview, its impact on how people understand and respond to environmental issues, and how religious worldviews are used and adapted as people navigate changing environmental conditions. To this end, The Forum on Religion and Ecology at Yale and the *Religions of the World and Ecology* series edited by Tucker and Grim provide expansive resources and insight into the diverse and nuanced ways in which religious worldviews shape people's ecology. Two other anthologies provide added insight: Richard Foltz's (2003) *Worldviews, Religion and the Environment: An Anthology* and Richard Bohannon's (2014) *Religions and Environments: A Reader in Religion, Nature and Ecology*.

## Religious Practice

> Religions are action systems as much—if not more than—they are thought systems (Albanese, 1991: 200).

The meanings worldviews generate do not just exist in people's heads. They also relate to what people do. Religion is not simply pondered; it is also embodied and enacted since all religions are sustained through human activity (Albanese, 1991; McGuire, 2016; Morgan, 2009).

Religious practice relates to human environmental interactions in both direct and indirect ways. It does so in part by reinforcing religious beliefs that shape a person's environmentalism. Daily rituals, religious attendance, meditation, and prayer help to clarify core beliefs and promote greater internalization of religious commitments. For instance, the movement of prayer beads used by members of various religious traditions including Hinduism, Catholicism, and Islam aids in meditation and connection with spirituality, *Q*i is cultivated through bodily movement of *t'ai chi*; and aspects of Hindu spirituality encourage physicality through yoga.

Religious prescriptions and prohibitions have additional implications for the environment. Excessive consumption, waste, and greed are considered immoral across most religious traditions and many religions encourage conservation, dietary restrictions, and other behaviors with potentially positive environmental effects. For example, Islamic legal code encourages protection of water resources and rangelands. Jainism teaches Ahimsa or non-violence in all parts of life including kindness to animals, vegetarianism, and self-restraint with the avoidance of waste. Jewish traditions see the Sabbath as serving an "essential constraint on our destructive tendencies" (Fink, 1998: 3). And Hinduism teaches the importance of living a simple life: "...people are meant to learn to enjoy spiritual happiness, so that to derive a sense of satisfaction and fulfilment, they need not run after material pleasures and disturb nature's checks and balances" (Finlay & Palmer, 2003: 91; Grim & Tucker, 2014).

Another and, I believe, more critical way in which religious practices shape environmental interaction is through the development of collective meaning. Fundamental to the study of lived religion is that religion *is* intersubjective and "fundamentally social" (McGuire, 2008: 13; Orsi, 2003). Participation in religious congregations builds a sense of community among members and fosters what Peter Berger (1967) calls plausibility structure, that is, a sociocultural context in which religious beliefs and meanings gain authority and facticity. For religious beliefs to be plausible, people must participate in interactive networks with others who support and confirm these beliefs. Ammerman (2014: 200) similarly argues:

> [T]he more deeply embedded people are in these organized sites of spiritually infused conversation, the more likely they are to carry strands of that conversation with them. It's not that they have learned a set of doctrines or subscribed to a set of behavioral prescriptions... It is that they have learned to "speak religion" as one of their dialects.

This emphasis on social interaction has implications for how religion and the environment intersect since learning to 'speak religion'

also entails learning how to speak about the Earth and the place of humans in relation to it. Djupe and Hunt (2009), for example, maintain that understandings and opinions about the environment are shaped through religious interactions in two key ways: (1) individuals gather information from clergy, doctrine, and fellow members; (2) members observe and better match the behavioral and attitudinal cues of their peers. More regular interaction results in members' views becoming more aligned with the average view of the congregation. Using a two-stage survey design, they find that social communication occurring within a congregation is more critical than individual religiosity in shaping their environmental attitudes. They conclude that religious organizations act as an important social nexus in which religious norms and values are established and interpreted in relation to the environment. Reasoning about the implications of religious beliefs for environmentalism occurs within this nexus.

Related research underscores this social nexus effect. Mangunjaya and McKay (2012) studied the effects of integrating pro-environmental/conservationist messaging into Islamic sermons after Indonesia's Islamic Council of Scholars announced a series of fatwas concerning the environment. The fatwas highlighted the Islamic beliefs and texts that relate to conservation and safeguarding biodiversity and were stressed by religious leaders. Based on results of a two-stage survey design, they found that exposure to leaders' sermons significantly increased concerns and awareness about environmental issues among participants.

Of course, exposure to environmental messaging alone does not determine attitudes or behaviors. In a study of the effects of Pope Francis's 2015 encyclical, *Laudato Si*, on environmental concern Li et al. (2016) found its release had little impact on attitudes towards climate change among US Catholics and may have even backfired among conservative Catholics. Related research finds that Catholic bishops in the US were hesitant to take action on climate change following the encyclical's release because of the political costs doing so could entail (Veldman et al., 2014). These studies accentuate the point that religious-based messaging about environmental issues is not univocal, but instead interacts with individual and contextual factors, particularly political ones. Participation in faith-based communities exposes, and potentially reinforces, reasoning and understanding about the environment, but does not determine it. Nevertheless, religious understandings are socially embedded; religious congregations are key sites in which adherents gather and interact with one another; and, social interactions among members help to generate collective understandings of who 'we' are, what is going on, and what needs to change (Lichterman, 2012). These collective understandings can and do play a substantial role in how communities define, and respond to, environmental issues.

The study of practice within an interactional context provides added insight into environmental activism. Religious participation remains a robust predictor of civic engagement, including rates of charitable giving, volunteering, voting, and political activism (Putnam & Campbell, 2012). Furthermore, religious congregations provide critical resources for motivating and sustaining activist identities and collective mobilization including civic skills and leadership experience, symbolism, emotional support, material and human resources (e.g., money, space, congregants), and dense social networks with important social, organization, and geographical ties (Immergut & Kearns, 2012). Indeed, Putnam (2000: 66) contends that the faith communities in which people worship together "are arguably the single most important repository of social capital in America," where social capital is defined as the social networks, norms of obligation and reciprocity, and trust which sustain collective action. Religious communities provide fertile ground and critical resources for activism, particularly community-based activism, yet, to date, the record on environmental activism among religious groups is mixed, in part, because some narratives define the environment as a non-issue and environmentalism as a moral threat (MacIlroy & Hempel, 2019).

The study of religious practice thus opens several avenues for future research in environmental sociology. The most obvious of these is the exploration of religious practices which, in the aggregate, can have direct positive or negative consequences on environmental conditions and environmental health outcomes. This includes the study of 'nature religions' (Albanese, 1991) in which nature is seen to have sacred significance and transformative power, and forms of traditional ecological knowledge in which adaptive practices and potential lessons for ecosystem sustainability exist and may have important implications for physical and emotional wellbeing. These and other forms of "nature-related religiosity" tend to be overlooked when there is a more singular focus on religious worldviews (Jenkins, 2009: 289; Taylor, 2005: 1375).

The study of practice further relates to the interactional spaces in which religious understandings and normative standards are produced. This becomes particularly salient given that cultural worldviews are found to have considerable effects on the composition of a person's social network (Vaisey & Lizardo, 2010). A closer focus on interactional contexts can illuminate how interactions within these spaces shape environmentalism, affect worldviews, and make community organizing possible and powerful (Lichterman, 2012). It helps us see how communities respond to changing environmental conditions and collectively develop and evaluate their moral responses to them. And it helps us understand how religious *qua* environmental commitments are fostered and maintained. Since these spaces of religious production are not limited to official places of worship, but are woven into a myriad of settings, future research should explore how religious understandings of environmental issues are constituted, primed, and infused into other settings including government, work, education, leisure, public debate, and everyday conversations.

A focus on religious practice shifts attention away from cognition to people's actions with the understanding that religious culture is not simply shared beliefs and values, but also a repertoire or 'toolkit' of habits, customs, skills, and styles that orient and guide behavior (Swidler, 1986). Religion is about more than ideas and membership, in other words, it's also about what people do (Ammerman, 2006). And what people do as they interact with the environment is often entwined with religion as a source of habits, customs, styles and skills. While the dominant trend within the study of religion and the environment remains largely focused on more cognitive aspects of religion, religious practice is as important—if not more so—in shaping religion/environment interactions. After all, it is through religious-based action that religion manifests its effects in and on the Earth.

## Religious Ecology

> [A] core task for the sociological study of religion is analyzing the empirical variation in practices oriented to sacralization, the institutions (religious and other) that facilitate such practices, and the resulting religious experiences and moral orders that emerge in specific times and places (Edgell, 2012: 255).

Above, I addressed the relevance of religious belief and practice in the everyday world. This leads to the question: how does the everyday world impact religious expressions and their relation to the environment? The last body of literature reviewed here addresses this question by widening the scope of analyses beyond individuals and collectives to examine the broader context and contextual effects shaping the relationship between religion and the environment. Studies adopting this approach examine the conditions in which religion operates and the circumstances, material and otherwise, in which specific expressions of religion emerge and to which they respond. While diverse, these accounts emphasize the interplay of secular and religious forces and the importance of viewing religion as a dynamic, interactional force rather than as a static "transhistorical and transcultural" essence (Asad, 1993: 116). In brief, they highlight how what happens outside a religious institution is as important as what happens within it

and that just as religious expressions morph and change in relation to broader contextual conditions, so too do the ways in which they interrelates with the environment. I group this literature under the heading of "religious ecology" because each study addresses the relation of religion to its broader surrounding but acknowledge the risks of applying a narrow label to such a wide range of thinking.

One of the more prominent debates within the sociology of religion concerns secularization and, in particular, growth in parts of the world of the 'nones' category—that is people who self-identify as atheists or agnostics or who indicate that they have no particular religious affiliation. Some see this as an indicator of the declining relevance of religion in contemporary society, but most scholars see this trend as a product of increasing religious pluralization and, thus, to reflect a change in religion's relationship to institutions rather than a decline in the significance of religion in people's lives.

Religious pluralism occurs as religion becomes less a matter of inheritance and more a matter of choice. In response, religious expressions become more eclectic and syncretic as people draw from a range of religious and spiritual resources to find solace under what Smith and Emerson (1998: 106) call a sacred canopy of small umbrellas. The influence of religious traditions still resonates, but in diverse and more idiosyncratic ways. These expressions of religious self-formation make different kinds of religious activity visible to us, Bender (2012) argues, and challenge our more conventional notions of belief, agency, identity, and religion. Indeed, a number of scholars contend that contemporary environmentalism is a new form of religion which responds to the same quest for order, meaning, and communal embrace other more traditional forms used to provide (Dunlap, 2006; Nelson, 2003).

Whether or not environmentalism should be considered a religion is subject to debate. Still, this line of research opens up exploration of the "meaningful links" that exist between sacredness and environmentalism (Dietz et al., 1998: 465). Insofar as environmentalism, like religion, becomes a "vital expression of a group" (Warner, 1993: 1047) capable of grounding solidarities and collective identity, it is susceptible to the same social psychological phenomena and intergroup dynamics as other social identities, including de-individualization, assimilation of group norms, and intergroup conflict, each with environmental consequences. Bliuc et al. (2015), for instance, demonstrate that believers and skeptics of the causes of climate change have developed distinct social identities in the US and view themselves as sharing goals and values that directly oppose those of the other group. Consciousness of, and commitment to, these opposing identities were found to predict socio-political action and donations across both groups. Bliuc and colleagues conclude that such identity-based dynamics are likely a core reason behind the current polarization and political mobilization associated with the climate change divide in the United States.

Indeed, it is at the intersection of the social and the sacred that so many environmental conflicts take place including, for example, communities opposing mining expansion and gas resource development (Malin, 2015; Urkidi, 2011); farmers and scientists in dispute over water rights (Poff et al., 2003); rural landholders and environmentalists over the protection or reintroduction of threatened species (Farrell, 2017; Opotow & Brook, 2003; Wilson, 1997); and pro- and anti-hunting groups (Knezevic, 2009). These conflicts differ in the specific medium over which an environmental disputes occur, but nevertheless relate to deeply held beliefs and values about the relationship between nature and society. Close examination of their dynamics, including how symbolic boundaries relating to the sacred are drawn and defined, can provide important insight into entrenched ecological conflicts, particularly if we understand religion as Durkheim does by defining it as "a unified system of beliefs and practices relative to sacred things" (Durkheim, 2001: 46). From this perspective, the sacred is an embodiment of the collective, *sui generis.* Concerns, fears, and struggles relating to the sacred express the concerns, fears, and struggles that most relate to and threaten

communal life (Douglas & Wildavsky, 1983; Milton, 2002; Tansey, 2004). As such, the sacred is more than just an account of what has 'ultimate value' but serves as an important background against which collective environmental concerns, fears, and struggles become more intelligible (Szerszynski, 2005: x).

Another body of literature inverts the more common pattern of looking at how religion shapes environmentalism to address how environmental conditions shape lived religion. It builds on studies demonstrating a relationship between existential threat and religious expression by suggesting a similar pattern exists for environmental threats. Bentzen (2013), for example, finds that regions located closer to zones of natural hazard threats—earthquakes, volcanic eruptions, and tropical storms, for instance—are more religious than those farther away. Ager and Ciccone (2018) find a strong link between agricultural risk associated with rainfall variability and membership in religious communities in the US. And Botero et al. (2014) find robust evidence of a positive associate between belief in a moralizing god and factors affecting both climatic stability and the availability of natural resources. These studies direct attention to how environmental conditions may alter religious understandings and practices. They are not arguments for ecological determinism but instead illuminate how religion and the environment intersect. As Botero et al. (2014: 16784) observe, "the emerging picture is neither one of pure cultural transmission nor of simple ecological determinism, but rather a complex mixture of social, cultural, and environmental influences."

Other approaches shift attention to the enduring effects of religion on contemporary environmental practices. These more genealogical accounts trace continuities and discontinuities in the development of current environmental practices in relation to their religious roots. They further examine the implications of these inheritances on the contemporary "moral imagination" and related environmental knowledge claims, problem definitions, and environmental practices. Berry (2015) for example, draws on primary data from several early twentieth century recreationist and outdoor enthusiast groups to illustrate the continuing influence of Protestantism on contemporary environmental movements. He argues that the conceptual origins of these movements are rooted in religious thought, particularly theological notions of salvation, redemption, and spiritual progress. These "central conceptual ingredients" shaped the development of influential organization such as The Sierra Club and the Audubon Society and continue to play crucial roles in "orienting ideas about the natural world, establishing practices of engaging with environments and landscapes, and generating modes of social and political interaction" (Berry, 2015: 5). While these religious roots are no longer explicit, they continue to influence and inform the goals, conceptual boundaries, and values expressed by contemporary environmental movements.

The legacies of religious discourse relate to environmental justice as well. Many historians contend that the ecological and social transformations associated with colonialism were rooted as much in religious ideology as they were in capitalism and territorial annexation (Atherton, 2008; Drayton, 2000; Gascoigne, 2008). The "Doctrine of Discovery", for example, established a legal justification for colonization and seizure of land not inhabited by Christians and has been used to support decisions invalidating or disregarding aboriginal land rights in favor of colonial or post-colonial governments (Newcomb, 2008; Watson, 2010). Strands of religious text, including the Biblical mandate to "be fruitful and multiply and fill the earth and subdue it," were used to further justify the appropriation of land and displacement of native peoples throughout the Americas on the grounds that since they had not "subdued" the land they had "squandered their divine grant" to it (Harrison, 2005: 13). Likewise, the maintenance of slavery as a legal institution and its enduring racial legacies were furthered through the use of religion to uphold and justify the invidious distinction between who could and could not be enslaved (Morgan, 2003). Religion often has been used to legitimize the dispossession of land and subjugation of people, and the ramifications

of these acts persist today. Their legacies are traceable in the uneven rates of displacement and exposure to environmental risks among politically marginalized populations and in environmental policies that inadvertently, or by design, undermine community resilience (Pellow & Gou, 2017). More broadly, environmentalism itself is viewed by some as a western, and largely romantic religious discourse which masks its "parochial genesis" through universalizing tropes (e.g., anthropocentric-biocentric distinctions) in ways that do violence to indigenous understandings, capacities, and struggles (Guha, 1989; Shiva, 2016; Tomalin, 2004: 269). The record is neither unequivocal nor absolute. As Pellow and Gou (2017: 342) point out, "there is nothing inherently anti-ecological or environmentalist about religion and spirituality; it depends on how these traditions are articulated, framed, and deployed." Factors shaping environmental inequalities, including political representation, resource access, and social capital, are affected by religion in both positive and negative ways. The environmental justice movement itself was precipitated by the United Church of Christ's 1987 report on Toxic Waste and Race, and religious leaders and actors remain prominent forces in the movement. Yet, to date, research in environmental justice and political ecology has paid limited attention to the intersection of religion and power, to how environmental inequalities are interwoven with religious discourse, and to the role religious actors and institutions have played, and continue to play, in reinforcing and confronting environmental injustices. Such omissions impede deeper understanding and analyses of power and resistance in relation to the environment (Wilkins, 2020) and limit our capacity to create sustainable societies since sustainability depends not only on generating healthier environmental conditions, but also on social justice, inclusivity, and fairness.

Struggles over the meaning and application of religious discourse have added implications for environmental activism. Kearns (1996, 1997), for example, argues that recent religious-based movements emerged in the US as more established environmental organizations shifted away from religion and the moral language and vision that first animated them. Environmental advocates had to "retool" worldviews in ways that enabled conservative Christians to respond to ecological crises and endow new strategies of action. While environmental mobilization efforts among evangelicals were received positively, Kearns highlights how they also generated counter-efforts among evangelical organizations and elites who sought to reframe environmentalism as contrary to Christian goals and ethics. The resulting conflict created what has been described as "a kind of civil war over global climate change" among conservative Protestant groups (Rock, 2011: 165). These divisions are "emblematic of broader contests between the moderate and conservative wings of evangelicalism," but also relate to larger economic and political conditions and the role of elites operating across institutional spheres (Edgell, 2012; Wilkinson, 2012: 66). Their dynamics show how understandings of the environment as a social problem can transform as organizations draw on religious language to advance competing messages in public domains. The tactical terrains these struggles generate have important implications for the environment as they create a discursive field within which conventions and a range of interpretive possibilities are established, including whether something is a problem, how it relates to other issues, and what, if anything, can and should be done (Hempel et al., 2014; Steinberg, 1998; Wuthnow, 1989). As such, the discursive field constitutes not only a space within which discourse about environmental problems are framed, they also provide the foundational categories in which thinking about the environment takes place (Wuthnow, 1989, 2011). In turn, these logics become embedded in popular discourse and affect public understandings, subjectivities, and the types of eco-politics that emerge.

The research reviewed in this section illuminates how religion is not an institution in stasis, isolated from the larger world, but instead affects, and is affected by, the context in which it is embedded. These contextual conditions differ given their historical, ecological, and sociocultural specificity. As such, the relationship between religion and the environment diverges

from one time to another, from one place to another, one believer to another. Nevertheless, there are discernible patterns and theoretical and methodological tools that can advance our ability to identify and understand them.

Recent developments in institutional analysis offer a rich set of resources to draw on in this respect. Institution analyses focus on the context in which individuals and organizations are embedded and the mechanisms by which institutions promote order, stability, and change. Here, emphasis is given to institutions as "rules, norms, and beliefs that describe reality for the organization, explaining what is and what is not, what can be acted upon and what cannot" (Hoffman, 1999: 351). These logics become embedded in routine practices and organizational forms that shape the dispositions and practices of actors and as well as how actors interpret and respond to events. Thus, newer approaches to institutional analyses emphasize the constituting role of culture in patterning organization and action (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Thornton et al., 2012). In this way, institutional logics operate like worldviews. But instead of focusing only on cognition, or cognition separated from the context in which action occurs, institutional analyses account for the dynamics of *both* material and symbolic elements, recognizing these are entwined and constitute one another (Thornton et al., 2012). As such "disruptive events" (Hoffman, 1999) like environmental disasters alter the context in which religious institutions operate and the substance and expression of religious-based action within them.

Institutional analyses can contribute to a more complete understanding of the contingent social processes by which religious culture produces tangible consequences for the environment. Yet, to date, limited attention has been given to the religious institutional field. This area is ripe for additional theorizing and empirical analysis, including exploration of how doctrinal differences shape institutional logics and the 'style of commitment' of actors within a field, the interaction of religious institutions with other institutional fields, the historical context and processes through which specific institutional logics affect environmental policies and endure in their effects, and the restructuring of religious institutions in the face of changing social and ecological conditions. Research in these directions will shed additional light on the historical and contemporary conditions affecting environmental agency, conflict, and change (Lee & Lounsbury, 2015; Thornton et al., 2012).

A focus on religious ecology broadens the scope of analyses by attending to the embeddedness of religious actors and the conditions within which various modes of environmental practice take place and on which they may depend. Some may see this tack as taking us farther away from the interiority of religion as a source of comfort and what people value highly in the purpose and conduct of their lives. Afterall, religion is often the source of the "bright lines and bright lights" (Hitlin, 2008: 19–20) people use to navigate the world—i.e., those lines we do not cross and the lights we feel called to pursue in living what constitutes a meaningful life (Taylor, 1989). Yet neither religious understanding nor religious-based action happens in a vacuum. Instead, each comes into being "in an ongoing, dynamic relationship with the realities of everyday life" (Orsi, 1997: 7) including the realities of the environment.

## Conclusion

In this chapter I addressed the study of religion and the environment by focusing on lived religion and the ways in which people are shaped by, and draw on, religious resources in their understandings of, and interactions with, the environment. The review was organized around three areas of focus based on current literature and prospects for future research:

1. Religion as meaning systems and the "worldviews" it creates.
2. Religion as practices intertwined with the practices of everyday life and the meanings people attach to them.

3. The study of religious ecology including the circumstances, material and otherwise, in which specific religious expressions emerge and the conditions to which they respond.

Combined, the accounts surveyed make visible how lived religion morphs through time and in relation to people's interactions with the environment in both latent and manifest ways. They demonstrate the powerful effect religion continues to exert on environmentalism and ideas about 'nature', even though new modalities are not always religions in the conventional sense. And they speak to the ways in which religion is drawn through specific practices and processes as people interact with the environment, and reciprocal effects of the environment on practices and processes.

Religion, of course, is just one source to be analyzed in actor's environmental perceptions and actions, but nevertheless it remains a central, if not principal, one. As we broaden our understanding of religion such that it is no longer confined to official doctrine or established traditions, we can better appreciate the many ways in which religion and spirituality are dynamically and distinctively woven through our lives and, consequently, throughout environmental interactions.

But what difference does this make for the environment and environmental sociology? What is the 'real world payoff' of attending to religion in the social sciences when addressing such pressing issues as climate change, natural resource use, and loss of biodiversity? I'd like to suggest five reasons:

First: interpretation. People, of course, have different understandings, meanings, and systems of relevancy they use as they think about environmental issues. Religion plays an important role here because it often shapes how people comprehend the world. Understanding religion as a source of meaning and the signs and practices people use as they navigate the world can illuminate why people look at the environment and environmental issues as they do. Moreover, it sheds light on the logic and reasoning that inform their environmental decision making and practices.

Second: communication. Environmental issues can be 'wicked' problems (Rittel & Webber, 1973) which is to say they're unprecedented challenges for which conventional processes for problem solving won't work. One reason for this impasse is that issues such as climate change involve multiple stakeholders with different logics, priorities, and values. Developing strategies that adapt to these challenges necessitates intercultural communication which engages with, rather than ignores, the fundamental moral and ethical questions environmental issues entail. For instance, how do people conceptualize human welfare? What and who constitutes the 'common' in the common good? Such communication requires more than just a cursory understanding of a religious language as spoken; it necessitates being able to speak it sufficiently well to establish a common ground *and* critique it. Lakoff (2010: 73), for example, appeals to environmentalists to understand interpretive frames and broader system in which they are connected because facts about environmental degradation "must make sense in terms of their system of frames, or they will be ignored."

Third: activism. Almost two centuries ago de Tocqueville highlighted the role religious associations played in placing checks and balances on the state and individualism (Kahan, 2015). Religious congregations continue to be important sites in which civic engagement is fostered (Putnam, 2000) and in which important skills and "spiritual resources" (Bomberg & Hague, 2018) for collective action are cultivated. Insofar as awareness and concern are directed toward issues of environmental degradation and injustice, congregations remain among the most effective sites for organizing and sustaining grassroots activism.

Fourth: connecting with the sacred. Numerous studies highlight the problems that arise when policy makers do not pay attention to people's 'sacred' values or attempt to manipulate them

for political or economic gain (Atran et al., 2007; Daw et al., 2015; Ginges et al., 2011; Halevy et al., 2015). Sacred values are considered incommensurate with other values or goods and differ from material or instrumental ones in that they incorporate moral beliefs that drive action in ways dissociated from material gain. People resist trading off or negotiating such "non-fungible absolutes" (Atran & Axelrod, 2010) because doing so would challenge deeply held values and beliefs. Moreover, opposition to policies increases when such values are ignored. Careful attention to sacred values, practices of sacralization, and environmental interactions in which the sacred is being "produced, encountered, and shared" (Ammerman, 2016: 11) thus become imperative to implementing and sustaining environmental policies that work.

Fifth: strengthening our capacity to affect change. The considerable breadth of challenges we face in addressing environmental problems requires solutions that extend beyond narrowly defined economic and technological objectives and promote collective and transcendent goals. The study of religion strengthens our collective capabilities for this in two important ways. It expands our sociological imagination such that we can better observe and appreciate the relationship between biography and history in our own environmentalism and that of others. It thus enhances our capacity for communicative action. The study of religion also expands the epistemological grounds we use to deliberate by offering different visions of what constitutes a good society, other ways of understanding and interacting with the environment, and alternate models for thinking beyond ourselves in relation to the world. It thus can invigorate and empower change by broadening our ability to reflect and imagine anew.

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# Environmental Governance

16

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## Introduction

Questions of governance and the role of the state in society have long been the focus of sociological inquiry (see Domhoff, 1990; Habermas, 1975; Weber et al., 1978). As the field of environmental sociology emerged in 1970s, one of the main questions driving the growth of this sub-discipline was the degree to which the state can successfully address environmental degradation (Buttel, 2003; Freudenburg & Gramling, 1994). One of the major themes of this research is understanding environmental governance and the degree to which it successfully reduces the creation of environmental bads and environmental destruction, both of which are products of production processes.

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This chapter provides an overview of the ways that environmental sociology has addressed environmental governance. Environmental governance has been the focus of inquiry for research across all of the social sciences and beyond. This chapter, however, draws specifically on the theory and research that engages directly with environmental sociology. Although we include examples from non-Western cases, the main focus is on the more recent work on Western democracies that have been published in the English language.

The chapter is organized into three sections. First, we provide a general overview of the dominant perspectives on how environmental sociology has approached environmental governance theoretically. In this section, we emphasize the ways that the broader theoretical literature addresses environmental governance and highlight the approaches that present viable ways to address environmental challenges. Second, we discuss the various empirical approaches for studying environmental governance today. Although this section briefly introduces the diversity of approaches employed within environmental sociology, this chapter focuses the majority of its attention on the growing work that comes from a social networks perspective. Third and finally, we present examples of recent empirical investigations into environmental governance that employ social network analysis to understand environmental governance. In particular, this section presents two examples: the first comes from a policy network



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approach that looks at climate politics and the second is drawn from an organizational network approach that analyzes urban environmental stewardship. The chapter concludes with a discussion of the likely future directions of research on environmental governance.

## Environmental Sociological Perspectives on Environmental Governance

For decades, much of the scholarship in environmental sociology has focused specifically on a debate among scholars who come to differing conclusions about the feasibility of environmental protection. In general, these authors assess the relationship between economic development and environmental degradation (see particularly Buttel, 2000; Clark & York, 2005; Fisher & Freudenburg, 2004; Frank et al., 2000a, 2000b; Jorgenson & Clark, 2012; York et al., 2003). On the one hand, a number of relatively critical perspectives find that economic development is antithetical to environmental protection, given the growth imperative of modern economic systems and their need for continual resource inputs and increased environmental harm as economies continue to grow. On the other hand, scholars focusing on modernization processes and governance tend to be more optimistic, concluding that environmental protection measures themselves are often associated with economic growth (for an overview of this distinction, see Fisher and Jorgenson, 2019).

Research with a more critical approach has often involved a concern about the degree to which society's growth appears to have come at the expense of the natural environment (e.g., Catton, 1982; Dunlap & Van Liere, 1978, 1984; Foster, 1992; O'Connor, 1991; Schnaiberg & Gould, 1994). Although there is variation in perspective by author and the focus of their work, there are notable commonalities among them. For example, each focuses much of their attention on explaining environmental degradation with a general expectation that environmental regulation will be ineffectual overall. Among these studies, some attention has been paid to the ways that social movements will mobilize, their efforts are anticipated to be impotent overall (Gould et al., 2004; Rudel et al., 2011).

## Environmental Governance and the Environmental State

In contrast to the research that comes from a more critical perspective, most of the scholars who take a more optimistic approach assume the feasibility of a so-called environmental state. As such, this literature tends to focus on the ways that environmental protection functions as an economically beneficial process and basic responsibility of industrialized nation-states (Frank et al., 2000b; Giddens, 1991, 2013). Many scholars have noted how the environmental state expanded its responses to environmental problems in an effort to improve environmental quality (see particularly Buttel, 2003). During the 1980s, state intervention in environmental issues decreased as economic and political trends moved toward deregulation and privatization. In the context of 1990s debates over state failures in effectively coping with the challenges of modernity and industrialization, the bulk of the responsibility for environmental protection shifted toward private economic and civil society actors (Mol, 2003). Debates over the efficacy of top-down environmental policymaking remain highly relevant today. Given the "inability of national regulators to address successfully environmental problems in the decision-making process, and effectively enforce the decisions already made," alternative approaches to environmental governance are crucial in order to move forward with meaningful action on climate change, pollution control, and other significant environmental issues (Fisher et al., 2009: 146). As we will discuss in more detail in the next section, advanced industrialized states rarely act alone in implementing environmental policies. Rather, environmental governance is carried out through hybrid arrangements among the state, market, and civil society actors (Ansell & Gash, 2007; Betsill & Bulkeley, 2006; Koontz et al., 2004; Sirianni,

2009; Spaargaren et al., 2006; van Tatenhove & Leroy, 2003).

Ecological Modernization Theory (EMT) provides an environmental sociological perspective that examines the transformations of social practices and institutions, or patterns of "ecological restructuring," that emerge from environmental concerns in industrialized countries when "the state can no longer be expected to design and prescribe the way society and economic interactions should be organized" (see also Mol, 2001; Mol & Buttel, 2002: 4). In other words, EMT explores how economic growth and industrialization can be amenable to environmental protection and how solutions to environmental crises can evolve within, rather than outside of, the modern market economy (Hajer, 2000; Mol & Jänicke, 2009). EMT emerged in a Western European context and has been most applicable in cases within industrialized countries with established processes for environmental policymaking (Spaargaren & Mol, 1992; see also Galli & Fisher, 2016).

In particular, EMT explores environmental governance in the context of shifting boundaries between state, market, and civil society (Mol & Jänicke, 2009). In contrast to government "command and control" over policymaking and implementation, from this perspective, environmental governance refers to the complex, reciprocal array of arrangements between state, non-governmental, and individual actors that emerge through the definition and pursuit of collective political goals (Betsill & Bulkeley, 2006). EMT is only one strand of a larger literature documenting a shift from government to governance of environmental issues in industrialized countries. As Koontz and colleagues state, "*government*, as a formal institution of the state, ceases to hold sole power through command and control mechanisms, thereby shifting to *governance*, a process that takes place through the collective action of a variety of participants, all of whom retain some control over decision making or implementation" (Koontz et al., 2004: 6 emphasis in original; see also Boyte, 2005).

Political transformations associated with industrialization—namely increased public participation, decreased state centrality, and the rise of privatization—encourage collaborative governance, or governance in which public and private actors work together toward common goals and regulations (Sirianni, 2009). This process of political modernization is characterized by the shift from state-initiated regulation to participatory governance as boundaries between state, market, and civil society blur (Leroy & van Tatenhove, 2000; Mol & Jänicke, 2009; for an alternative perspective, see Beck, 1999).

Participatory governance practices have emerged through different stages of political modernization: following the increase in civil society action that accompanied the rise of the environmental state from the 1960s through the 1980s, participatory governance emerged as a way of compensating for state failure (Fisher et al., 2009). Van Tatenhove and Leroy contend that what they call the "societalization" of governance goes hand-in-hand with "marketization," or the delegation of responsibility for regulation away from the state to privatized agencies (van Tatenhove & Leroy, 2003: 167–168). As state-market interactions shift, economic processes and actors take on new or additional roles in environmental protection (Huber, 1982). In Mol's words, the rise of market practices in which "economic processes of production and consumption are increasingly analyzed and judged, as well as designed and organized from both an economic *and* ecological point of view" (Mol, 2001: 60 emphasis author's). In this "ecologized economy," environmental protection and governance is multidirectional, wherein the purchasing power of "citizen-consumers" combines with more top-down policies and economic tools to achieve environmental protection (for an overview, see Mol et al., 2009).

## Hybrid Arrangements

As detailed by Leroy and Van Tatenhove (Leroy & van Tatenhove, 2000), the institutionalization of "interference zones" between state, market, and civil society creates opportunities for new combinations of governance approaches and the

emergence of unique policy arrangements. Mol, Spaargaren, and other environmental sociologists have described these diverse forms of collaboration between social actors as "hybrid arrangements" (see particularly Spaargaren et al., 2006). The authors note that there has been "enmeshment and hybridization" between "formerly distinct entities" within the environmental state, pointing out that the "roles and responsibilities formerly reserved for the (nation-)state are fulfilled by market actors and civil society groups and organizations, and vice versa" (Spaargaren et al., 2006: 15). Thus, hybrid arrangements, which vary in terms of the actors and sectors involved, create new opportunities for innovative approaches to environmental governance and civic engagement in policy implementation (Fisher & Svendsen, 2013; see also Fisher et al., 2015).

As relationships between civil society groups, businesses, and government agencies have become the norm rather than the exception, scholars have identified new forms of "collaborative governance" practices. Ansell and Gash define collaborative governance as involving "one or more public agencies" working toward policy goals by working with "non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative" (Ansell & Gash, 2007: 545). Moving beyond traditional public-private partnerships that focus predominantly on providing services to consumers, collaborative governance aims to set the agenda for policymaking and implementation. For example, collaborative governance may emerge as a deliberate decision-making and management strategy in cases of "policy deadlock," or when policy makers foresee implementation as being potentially difficult (Ansell & Gash, 2007: 553; see also Ostrom, 2012).

## The Role of the State

In many ways, the collaborative approach to governance has emerged in response to the empirical reality of environmental regulation, where the state is forced to play a more limited role in regulation as the private sector adopts voluntary regulatory measures. At the same time, even with participatory governance relatively common, it is clear that these arrangements do not necessitate the dissolution of the state. Rather than replacing more traditional approaches entirely, new forms of collaborative governance may function side-by-side with top-down environmental policy processes (Mol et al., 2014; Spaargaren et al., 2006). In other cases, the role of the state may shift without disappearing entirely: for example, the state may function as a moderator and facilitator between different interests, rather than acting on those interests directly (Mol & Buttel, 2002).

Because the lines of accountability within hybrid arrangements can be diffuse, state authority may be necessary to anchor environmental policies and provide incentives for effective implementation. For example, state-initiated regulation policies continue to play a role in providing resources, setting imperatives for regulation, incentivizing sustainable innovation, and assisting in the regulation process (Murphy & Gouldson, 2000). State backing of environmental policies can provide much-needed accountability, or what some have called a "stick behind the door" in the event of noncompliance or policy failure (Jänicke & Jörgens, 2009). In Mol's words, the state provides a "credible threat of regulation" that "may help ensure full commitment of all participants" in the governance and decision-making processes (Mol, 2003: 345).

## Multi-Scale and Hybrid Arrangements

Within this context, a variety of hybrid arrangements have developed at multiple levels within the environmental state (Jänicke & Jörgens, 2009), and have been documented in the empirical research. In their study of the impact of integrated pollution control in linking state and market actors in regulatory action in England and Wales, for example, Murphy and Gouldson find that these efforts were successful when there was deep collaboration between state regulators and companies (Murphy & Gouldson, 2000). In light of the delayed response by national governments

to global environmental issues such as climate change, many cities have implemented their own environmental protection programs, which have been referred to as "races to the top" (Rabe & Borick, 2013: 321). In their 2016 study, Galli and Fisher looked at how a federally funded effort to establish a sub-national low carbon energy policy was implemented through hybrid arrangements in communities around the United States (Galli & Fisher, 2016). Since the Trump Administration pulled out of the international Paris Agreement, the "We Are Still In Campaign" provides a more recent example of this type of effort with subnational governmental actors working with businesses and civil society organizations to address the issue of climate change.[1]

As nodes of transnational networks engaged in climate protection, cities often implement bottom-up initiatives to address greenhouse gas reduction and energy conservation (Betsill & Bulkeley, 2007; Bulkeley & Betsill, 2005). Cities act as key players in the transnational response to global climate change by connecting with local stakeholders, integrating climate change into pre-existing policies, and experimenting with innovative programs aimed at cost-effective greenhouse gas reduction and energy efficiency (Corfee-Morlot et al., 2008). Thus, city-level environmental protection programs provide researchers with an opportunity to understand more fully how hybrid arrangements are formed and implemented.

In sum, although environmental governance has been studied quite extensively, scholars note that the hybrid arrangements that are likely to lead to successful outcomes are highly contingent on the institutional, political and cultural contexts in which they emerge (Fisher et al., 2009; Mol, 2003). In some cases, this perspective has been referred to as 'networked governance.' Carlsson and Sandstrom summarize this approach as a way "to cope with the complexity of natural resource systems, institutional arrangements and related management systems should incorporate different actors from different areas of society" (Carlsson & Sandström, 2007: 34) Given that much of the available sociological research on environmental governance stresses these hybrid/networked arrangements, later sections of this chapter focus on research that employs a social networks approach to analyze such arrangements.

## Studying Environmental Governance

Environmental sociologists have employed various methodologies for studying environmental governance including ethnomethodologies (e.g., MacKendrick, 2018; Norgaard, 2011), mixed methods (Fisher, 2004, 2006, 2013; Robertson, 2018), cross national comparisons (Jorgenson & Clark, 2012; Shorette, 2012; York et al., 2003), and geospatial analysis (Collins et al., 2016; Robertson & Collins, 2018). A comparatively smaller but fast growing literature employs social network analysis to understand environmental governance, with much of it drawing from multidisciplinary perspectives. Some authors have made the case for a new understanding of 'networked' governance where the structures in which stakeholders (Provan & Kenis, 2007; Voß et al., 2007), including state, non-state, as well as individual actors, connect can promote social learning and knowledge diffusion (Muñoz-Erickson & Cutts, 2016; Pahl-Wostl, 2009), mitigate risks (Berardo & Scholz, 2010), and solve problems of collective action (van Bueren et al., 2003). The premise of this line of inquiry is that the shape, construction, or typography of the network fundamentally alters the quality of interaction, learning, policy, and therefore governance (Newig et al., 2010; Schusler et al., 2003). In the section that follows, we briefly summarize these varied methods and then focus the remainder of the chapter on the growing efforts to employ social network analysis to understand environmental governance.

Research taking an ethnomethodological approach aims to understand environmental governance structures in their social context. The premise of these methodologies is that social practices are what render the social world available to be researched (Suchman, 2007). Hence,

[1] See https://www.wearestillin.com/ (accessed 12 October 2018).

ethnomethodological approaches often focus on actors, their social practices and how they organize themselves within their respective social context (see e.g., Norgaard, 2011). Recent studies have emphasized the need to map how complex socio-technical relations relate to environmental governance (Wolf & Ghosh, 2019; see also Ghosh, 2018). Arguably, ethnomethodologists often opt for representing these relations through accountability (Lippert, 2015), which is core to ethnographic research on governance. One such example can be seen in the study of environmental accounting standards for carbon governance by Wolf and Ghosh (2019). In this study, the research aimed to provide an insight on how standards were produced and enforced. This practice-centered approach has the benefit of accounting for the structural context of governance and enables the authors to engage in how conventions and standards are related to the problem-solving capabilities of actors.

Other research has taken a mixed methodological approach to compare how social spheres relate to the environment: the environmental physical setting and a social/political setting. For example, environmental data is generally physically focused on resources whilst engaging with actors might be better done through a qualitative study of the incentives and personal opinions of political actors (Fisher, 2006; see also Fisher, 2004). Mixed methods, therefore, have the benefit of joining both parts together, which is particularly useful in observing how political decisions evolve into real-world outcomes. In her study of climate policymaking in the US, Fisher compares natural resource endowment to political decision making (2006). Other mixed methodological approaches are used in an 'environmental management' specific context (Molina-Azorín & López-Gamero, 2016); qualitative research that helps direct and focus quantitative research (Simpson & Samson, 2010); quantitative research on institutions or on natural resources that highlights specific needs, which are then investigated using qualitative methods (e.g., Fisher, 2006); and employing a method of complementarity where the results from a method help make sense of the results from the other method. This form of research frequently focuses on corroboration and mutual confirmation on the same research question from two methods.

Cross-national comparisons aim to understand variations in environmental governance across nation-states. Scholars have frequently employed comparative methods to contrast different governance approaches undertaken by various countries. Most of the data available for such studies help provide good economic and political depictions of where different countries stand environmentally. Such an approach has been used to study the EU's dependency on external governance structures (Lavenex et al., 2009). These sociological studies of global environmental governance can be divided into two streams: (1) a stream focused on the political economy aspect of global environmental governance (Jorgenson, 2014; Jorgenson & Clark, 2012; Jorgenson et al., 2011; see also York et al., 2003); (2) a current nested in the neo-institutionalist perspective (Shorette, 2012; see also Buttel, 2000; Frank et al., 2000a, 2000b).

An alternative perspective takes a comparative approach across subnational entities. For example, Betsill and Bulkeley document how the Cities for Climate Protection program, enacted locally in cities across the world, includes a variety of state and non-state actors in its efforts to lower greenhouse gas emissions (Betsill & Bulkeley, 2006). Similarly, Bulkeley and Schroeder focus on the examples of London and Los Angeles, finding "new forms of public and private authority" in the urban governance of climate change (Bulkeley & Schroeder, 2012: 762). Looking at the case of New York City, Fisher and Svendsen (2013) explore a diverse range of hybrid arrangements in environmental stewardship organizations (Fisher & Svendsen, 2013).

In some cases, this work looks at the spatial dimension of environmental issues in order to observe how environmental governance is fitted spatially (Connolly et al., 2013; Locke et al., 2014). Some recent studies that employ this approach have focused on uneven emissions and various emitters. For example, Galli Robertson and Collins have compared emissions among

corporate facilities of the coal-fired electric utility industry (Robertson & Collins, 2018; see also Robertson, 2018). The geospatial dimension of such questions is core to understanding who emits more and where. Various approaches and data sources can be of use when undertaking such analysis. For example, Collins and colleagues have looked into unequal pollution production and unequal repartition of industrially based exposure (Collins et al., 2016). However, complications from this type of study can occur from the sheer quantity of data needed to analyse varying surfaces. Due to these complications, researchers seeking to undertake geospatial studies often opt for other sources/forms of data. For example, in their study of canopy distribution depending on socio-demographic factors, Watkins and colleagues have leveraged data from non-profit tree-planting organisations which provides them with concise data for their study (Watkins et al., 2017). Another approach to enacting geo-spatial analysis of canopy distribution could have been the use of high-resolution satellite imaging to study equity in tree-canopy distribution (e.g., Landry & Chakraborty, 2009; Schwarz et al., 2015).

The remainder of this section focuses specifically on the ways that scholars have employed social network analysis as a framework to capture the relational nature of environmental governance, which has received growing attention in sociology in recent years. These cases fall into two general categories: networks of organizations (which include examples of social and socio-ecological networks), and policy network analysis. Each category is described in turn with additional examples.

## Network Measurement

The use of networks in the literature can take many forms, from the metaphoric to a measurable structure. In the latter case, networks are defined as a set of nodes, usually individuals, organizations, or other stakeholders involved, and the ties among them. 'Ties' can be measured by communication, exchange of resources or information, co-attendance at different policy forums or other events, and many other relationships. For example, the policy networks literature typically examines bipartite (meaning two types of nodes) networks of actors (one type of node) at the national or international level and uses policies and implementation practices (the second type of nodes) to examine the implementation and diffusion of different environmental policies.[2] Other network studies employ networks solely of beliefs (Hoffman et al., 2014), individual respondents (Barnes et al., 2016a), and countries (Prell et al., 2014), but a large proportion of the literature focuses on relationships among organizations.

Empirical network studies begin with the critical question of who needs to be included as a node in the sample. Depending on the level of analysis, this question can be approached in many different ways—however, decisions regarding whom to include in the network, be these policy instruments, individuals, organizations, countries, or something else entirely can greatly affect the outcome (Prell et al., 2008). In many cases, data collection begins by sampling newspaper articles and well-known events where environmental concerns are being discussed, but work increasingly aims to employ more grass-roots approaches to defining the population of organizations or individuals involved. These methods typically use snowball sampling approaches where organizations mention other groups that are then also sampled (for an overview of these methods, see Goodman, 2011). In snowball sampling methods, unlike others, the boundary of the network is thus provided by the members of the network themselves and is termed

[2] It is important to stress that this list is not meant to be exhaustive regarding the usage of social networks in environmental sociology, rather it focuses on using social networks to understand environmental governance. Scholars also focus their attention on understanding social movements (Diani, 1995; Fisher et al., 2018; Tindall, 2002), belief formation (Hoffman et al., 2014), media coverage of environmental issues (Häussler, 2018; Kukkonen et al., 2018), and scientific communication (Li & Yarime, 2017), among others.

the 'realist' or endogenous population (Laumann & Marsden, 1992).

When sampling methods miss important sets of stakeholders, the resulting analysis is irrevocably skewed (Mbaru & Barnes, 2017), especially as there is a natural sampling bias in favor of larger, better represented organizations if they are mentioned more in the media or have more resources to attend events. As a solution to this problem, some studies have promoted the integration of Social Network Analysis (SNA) with Stakeholder analysis (Prell et al., 2009). The objective of the use of SNA in this scenario is to envision better the network studied. The authors affirm that the "proposed combination of stakeholder analysis and SNA can help identify stakeholder categories, ensure key groups are not marginalized, and specify representatives that are well connected with and respected by the groups they need to represent" (Prell et al., 2009: 514). This work is an important first in addressing how to handle questions of power and representation in a network.

After the organizations or stakeholders who form the 'nodes' in the network are identified, the ties and relationships of the actors are core to understanding the network itself. One of the aims of analyzing bonds between actors is generally to understand how conservation information is diffused (Berardo et al., 2016; Mbaru & Barnes, 2017; see also Jasny et al., 2015, 2018). Two methods are commonly used today for this purpose: collecting interaction data from newspapers, rosters, and registers and directly surveying individuals and organizations. Both of these methods suffer from different missing data problems (Groce et al., 2018). New technologies for capturing interview data in person as well as the inclusion of online data permit advances in these arenas both in the capturing of social as well as ecological data. Innovative sampling methods for empirical studies have emerged, notably the use of citizen sensing which uses low-cost digital technologies to allow citizens to gather data; rendering vast sets of big-data (Gabrys et al., 2016).

Possibilities for citizen collection of environmental data via smartphones and similar technologies include data on noise pollution, meteorological conditions such as UV radiation levels, and water quality (see McGrath & Scanaill, 2013 for details on all), distribution of litter (Lynch, 2018), and animal populations (Dennis et al., 2017; Newman et al., 2012), as well as the collection of social network data (Newman et al., 2012), and how individuals interact with policy and governance (Loader et al., 2014). The use of personal smartphones or other handheld devices to collect environmental or social data carries with it a number of additional possibilities for researchers. The role of such technologies in how they affect the actual sociological processes that underpin these networks should not be discounted either: the technologies and citizen sensing initiatives may influence social movements with environmental justice ramifications (Dhillon, 2017). Moreover, they themselves may facilitate or affect social movements (Stacey, 2018). The amplitude and shape of 'citizen data' requires adaptation to its unusual collective data structure. An illustration of this challenge can be seen in Gabrys et al.'s (2016) use of 'citizen data' to monitor township air quality. The methodology they undertook was one of collecting and cross-referencing data in order to create an air pollution baseline from which they inferred temporal events were occurring when seeing shifts. However, the democratization of research based on this type of data has a long way to go. As Bakker and Ritts emphasize in their analysis of 'smart earth' advancements, "better data does not necessarily lead to better governance" (Bakker & Ritts, 2018: 208). Rather, it us up to the researchers and practitioners to make the necessary links.

## Networks and Environmental Governance

Social network studies of environmental governance are heterogeneous in their choice of methods and focus (Groce et al., 2018; Rockenbauch & Sakdapolrak, 2017). Studies of individual networks look at the position or role of the different actors and whether there are patterns among those who play more prominent roles or

occupy more central positions (Scott & Thomas, 2017), as well as the role of homophily—or similarity—within the network (Borgatti et al., 2014; Fischer & Jasny, 2017). One of the largest contributions of networks to the literature on environmental governance is the clarification and measurement of what is meant by 'brokerage,' 'bridging,' or 'boundary spanning' (Bodin & Crona, 2009; Connolly et al., 2013; Jasny & Lubell, 2015; Wilson & MacDonald, 2018). These are the organizations or individuals that sit at the boundaries between two or more sets of organizations, or that allow two otherwise separate networks to connect and interact (Granovetter, 1983). Even though there are a range of terms to describe such groups, these organizations have similar functions and characteristics—connecting otherwise unconnected network members and facilitating the flow of information or resources. A more diverse and connected network has been shown to bring access to new resources (an example in the context of policy networks might be specific local or historical knowledge), to help solve collective action problems (Beilin et al., 2013), and to help overcome poor socio-ecological fit (Bodin et al., 2014; Ernstson et al., 2010).

The boundaries that these bridging ties cross can be disciplinary, scalar (Andersson et al., 2014; Hamilton & Lubell, 2018), geographic (Fischer & Jasny, 2017), or financial (Barendse et al., 2016), among others. Boundary organizations might be formally created to be so, as is the case of the IPCC and other international scientific assessments (Hoppe et al., 2013; see also Leifeld & Fisher, 2017), or may come to this position as a result of network dynamics and mechanics (Ernstson et al., 2010). While most of the literature is still overwhelmingly positive about the role of brokers in this area, a few studies have highlighted the additional amount of time, work, and resources demanded by these roles, as well as other negative results like decreased trust among those who occupy these positions (Barnes et al., 2016a; Stovel & Shaw, 2012). A particularly vivid example of the successes and failures of brokerage in a governance network is that of CalFed, "the most important collaborative watershed management program in the Sacramento-San Joaquin Delta of Northern California from 1994–2009" (Lubell et al., 2012: 63). Lubell and others argue that, while the program was frequently considered a failure (Dutterer & Margerum, 2015), the legacy of this broker and the organizations that succeeded CalFed to broker these organizations after its demise have contributed substantially to the resilience of the system itself (Booher & Innes, 2010).

Scholars have noted a lack of environmental social networks literature outside of the Western context (Li et al., 2017); however, this is due in part to the diverse and separate outlets for this literature as well as many recent articles. In Africa, many network studies of stakeholder involvement in the policy and governance process have been published (Isaac & Matous, 2017; Matouš et al., 2013) and work across the continent represents the cutting edge of comparative research (Aßmann et al., 2021; Bourne et al., 2017). In the Russian context (Davies et al., 2016) present an analytical framework for the analysis of network governance, and Kropp and Schuhmann (2016) discuss specific examples of environmental governance networks. Latin American examples include work on local communities (Rico García-Amado et al., 2012), regional governance (Armesto et al., 2007; Gelcich et al., 2010), as well as international comparative studies such as those by Di Gregorio et al. (2019) comparing Brazil and Indonesia to build a theoretical framework independent of local cultural contexts. In this particular case, the focus is on how multilevel governance arrangements interact with the issue of climate change, which necessitates a multilevel response.

Most of this literature focuses on one network, but examples of comparative research are growing (Aßmann et al., 2021; Bourne et al., 2017; Jasny et al., 2019), as well as work comparing network measures to environmental outcomes (Barnes et al., 2016b; Bodin et al., 2017). Reviews of this literature regularly call for increasing this comparison, as well as adding longitudinal analysis to see how stable these configurations are (Bodin, 2017; Groce et al., 2018). Future work, and especially comparative

work, is necessary to understand what is common to these networks across different cultural and governance conditions as well as how these networks differ.

## Socio-Ecological Networks

A major shift in the thinking on environmental governance has been the introduction of 'systems' thinking (Liu et al., 2007; Ostrom, 2007), and the focus on how a network perspective can inform our understanding of the linkages between and among the social and ecological actors involved (Guerrero et al., 2018; Janssen et al., 2006). The understanding that social and ecological processes must be simultaneously interrogated and the interactions among them modeled is referenced in a variety of literatures and under a variety of terms such as socio-environmental or socio-ecological synthesis, coupled human-natural systems, and more.

A dominant theoretical perspective in the intersection between socio-ecological synthesis and network science began with Ekstrom and Young's (2009) paper introducing "institution-ecosystem fit analysis," which focuses on identifying gaps in socio-ecological relationships to measure institutional mismatch (Guerrero et al., 2015). In order to adapt the empirical techniques of network research to the socio-ecological nature of natural resource management, academics frequently turn towards the integration of ecological elements into their network models (Garmestani & Benson, 2013; Groce et al., 2018). This practice is already frequent in ecosystem services research where researchers in the vein of Kolosz and colleagues emphasize the need for theories to integrate human and nature interaction to build better predictive and flexible models (Kolosz et al., 2018), and will hopefully become another tool in the environmental sociologists' repertoire.

Recent findings in studies of environmental governance maintain that misalignment between organizational networks and ecosystems reduce environmental problem-solving efficiency (Bodin, 2017; Ekstrom & Young, 2009). Bergsten and colleagues, for example, highlight that successful conservation rests on there being a good fit between social and ecological processes (Bergsten et al., 2014). Similarly, Chaffin and colleagues also highlight the importance of such a fit in achieving a sustainable governance regime (Chaffin et al., 2014). If social processes are, in some way, modified and adapted by cultural norms, then it follows that successful conservation strategies must be adapted to their local contexts in order to achieve this critical fit, which includes how network-based interventions are designed and evaluated.

Frameworks that integrate social and ecological elements often opt for a multi-level network structure (Sayles & Baggio, 2017). Governance networks and biophysical networks are each represented as networks of their own, only to be linked by the connections they share. For a considerable time, and still today, researchers resort to mapping ecosystems spatially with an average value derived from the services the ecosystems provide (Dee et al., 2017). The issue of representing ecosystems in this manner is that it fails to consider the inner dynamics of the ecosystems themselves and fundamentally assumes that spatial zones are independent of each other (Balvanera et al., 2014). The use of network science aims to correct this issue by accounting for the dynamics that make up an ecosystem. One such example can be seen in Ernstson and colleague's proposed analysis of multiple ecological networks in concurrence with analysis of accompanying social networks (Ernstson et al., 2010: 10).

## Policy Networks and Environmental Governance

The policy networks literature is similar to that of local environmental governance in its emphasis of polycentrism and the use of network methods and modeling as well as many of the network motifs like brokerage, centrality, cohesion, and clustering (Ingold & Varone, 2012; McAllister et al., 2014). At the same time, this approach involves different contextual and theoretical

variables like political opportunity (Leifeld & Schneider, 2012), international treaties and alliances (Yun et al., 2014), and regime type (Compston, 2009). Even though much policy is made at the local level, the focus of much of these studies is on the engagement with the national and international policy process (Weible & Sabatier, 2005, but see Henry et al., 2011; Lubell & Fulton, 2008).

Also, where the previous literature looked at the management side of environmental governance and was thus more tied to the literature on management practices, the policy networks literature is linked to a longer history of policy studies outside of environmental management (Rhodes, 1997). It is worth noting that some authors claim that a fundamental difference exists in the study of environmental policy and governance (Jost & Jacob, 2004). A major theoretical framework used in this literature is the Advocacy Coalition Framework, which emphasizes the need to understand coalition formation and cooperation among policy brokers to explain policy formation and implementation (Jenkins-Smith & Sabatier, 1994; Sabatier, 1988; see also Ingold, 2011). The difficulties in collecting network data, modeling interdependencies, and then relating mechanisms to policy outcomes are consistent among studies in this literature, with few studies comparing multiple networks (for an exception, see Ingold & Leifeld, 2016) or across time (for an exception, see Jasny et al., 2018).

## Understanding Environmental Governance Through Social and Policy Networks

This section of the chapter presents two examples from our research to provide detailed accounts of how social network analysis has been employed recently to understand environmental governance. As one of the examples comes from a policy networks perspective to understand climate policymaking in the United States and the other focuses on organizational networks to study urban environmental stewardship, these examples represent diverse approaches to studying environmental governance through social networks. Not only are the units of analysis and the objects of inquiry different, but the scale of governance that is being analyzed also vary from the federal level versus the city level.

### Studying Climate Policy Networks

As has been previously noted, one common approach to studying environmental governance is to focus on the policy networks among elites engaged in decisionmaking. To date, numerous studies have employed a policy networks approach that analyses data collected from policy actors to understand climate politics around the world (see particularly Gronow & Ylä-Anttila, 2016; Jasny et al., 2015, 2018; Wagner & Ylä-Anttila, 2018; Yun et al., 2014). Coming from this perspective, our research also looks at the networks of elite policy actors in one country—the United States—to understand how expert scientific information about climate change is diffused among policy elites.

Rather than information diffusion taking place in a consistent way among policy actors coming from a range of ideological perspectives, our research concludes that scientific information about climate change is diffused through echo chambers—clusters of policy elites who hold the same position on a climate-related issue. In some cases, echo chambers amplify divergence from the consensus position of an issue like that climate change is being caused, in part, by human activity (Jasny et al., 2015; Jasny and Fisher, 2019; for analysis of the climate countermovement, see Farrell, 2016a, 2016b). In other cases, the echo chamber amplifies consensus, as we noted in our paper on the Clean Power Plan (Jasny et al., 2018). These findings have clear effects on environmental governance: "It is important to note that echo chambers themselves are value-free and apolitical; their impacts on policy discussion and debate are an effect of the political context and the ideological positions of the actors within them" (Jasny et al., 2018: 15).

Figure 16.1 presents the individual ego networks of four key members of the climate

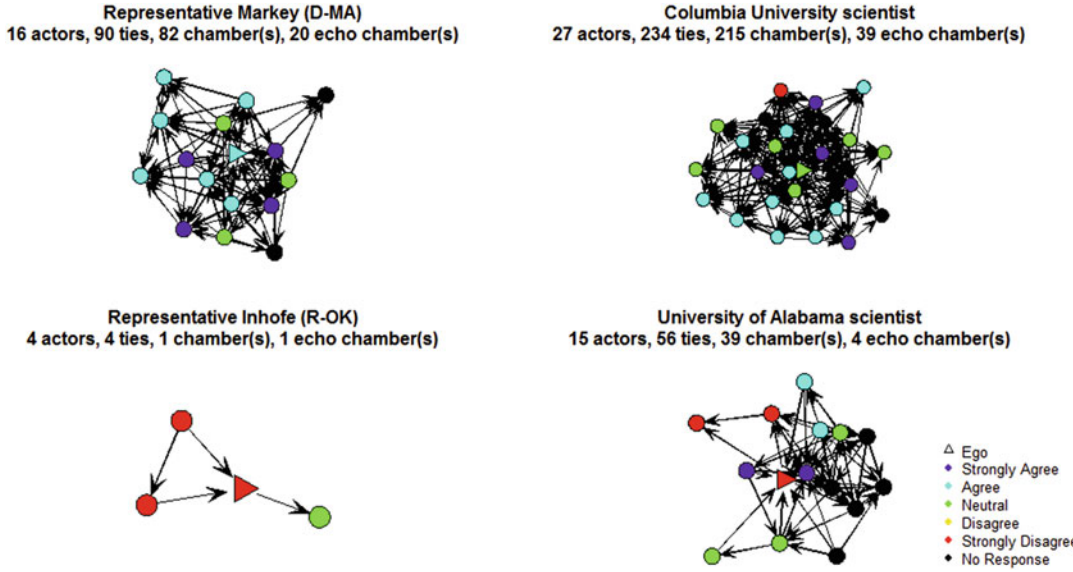


**Fig. 16.1** EGO networks in the climate policy network. (Reproduced from Jasny et al., 2015)

policy network in the United States in 2010 (Jasny et al., 2015). Each network illustrates how expert scientific information passed through these policy actors' personal networks, along with their responses to an attitudinal question that asks them to identify their organization's position from 'strongly agree' to 'strongly disagree' on the statement: There should be an international binding commitment on all nations to reduce greenhouse gas emissions. The top row incudes Representative Ed Markey, one of the Congressmen who sponsored The American Clean Energy and Security Act, and the Columbia University scientist who was well known to support the scientific consensus position in the climate debate. On the bottom row are the then newly seated chairman of the Senate Committee on Environment and Public Works, Senator James Inhofe, and a University of Alabama scientist who had spoken extensively against the scientific consensus that climate change is anthropogenic. These ego networks provide evidence of the ways that information diffuses through a policy network and shows how minority views (in this case strongly disagreeing that there should be an international binding commitment on climate change—indicated by red ties between the nodes) are amplified.

## Studying Urban Environmental Stewardship Networks

Like the policy network approach, which highlights the roles that different policy actors play in environmental governance, the empirical reality of collaborative/hybrid governance involves integration and interaction among diverse civil society and government actors (see particularly Bodin, 2017; Bodin et al., 2017). Because of the complex land use regime in urban areas, the diverse social systems that underpin urban life, as well as the spatial distribution of infrastructure and ecosystems, it is important to understand the networks of organizations and individuals that govern these systems both socially and spatially.

In a paper on environmental stewardship networks—defined as the networks of organizations that participate and collaborate in some kind of stewardship activity such as tree planting or cleaning up litter—in Philadelphia and New York City, measures of spatial and

social distance are used to understand the factors that drive tie formation in this network (Jasny et al., 2019; For an overview of urban environmental stewardship, see Fisher et al., 2012). Social distance in this case is represented by different organizational goals or issue foci based on organizational responses to questions on a survey of stewardship groups. Prior discussion of fit notes that such networks are (problematically) structured around shared interests or activities (e.g., park managers work with park managers), rather than around the needs of ecosystems or nature of the landscape (see Ernstson et al., 2010). An additional complicating factor is the fact that organizations that engage in stewardship activities often do so as an ancillary activity to their main goals. One such example is when a business association plants trees to beautify the neighborhood and attract investment irrespective of the needs of the ecosystem (Mattijssen et al., 2018). Because ecological processes are, in some ways, spatially bounded, or at the very least clustered around green and blue infrastructure, we would expect a network that is more strongly structured around spatial rather than social distance would be a better "fit."

Figure 16.2 presents stewardship networks in Philadelphia and New York City. The nodes (green triangles for respondent organizations and circles for named alters) in this image represent the geographic and social distribution of stewardship organizations. Ties (the lines between the nodes) represent collaboration based on survey responses. As can be seen in the figure, the networks in the two cities exhibit different behaviors in this regard. Specifically, the New York network presents a stronger spatial structuring; in New York, collaboration is strongly predicted by having either closer home offices or sharing work sites. The Philadelphia network, in contrast, is more strongly structured around social similarity/organizational commonalities. The differences in structure between the stewardship networks in these two cities points to the influence of institutions and historical context in the functioning of environmental governance networks. Moreover, this study contributes to the use of traditional social networks methods and ideas (e.g., examining homophily and clustering) by adding integrated spatial analysis.

## Conclusion

These two examples provide illustrations of the diverse ways that social network analysis is being used to understand environmental governance. Although this research tends to be much more empirically focused, these studies connect with the literature on the Environmental State that was cited early in this chapter. In other words, these studies help us to understand environmental governance better, in terms of the roles that different social actors play in decision making, and in relation to the actual environmental realities in which they work. In both cases, the decision-making processes that were studied involved hybrid combinations of social actors who were working on an environmental issue: federal climate policy or environmental stewardship in specific cities. Connecting this research that employs social network methods to understand environmental governance to the broader theoretical debates will contribute more broadly to the field of environmental sociology, as well as to a more general understanding of the complexity of environmental governance more broadly.

Future research must continue to integrate these innovative approaches to studying environmental governance that expands perspectives on the society-environment relationship. By incorporating these complex, interdependent, and often interdisciplinary approaches we gain a better understanding of the complex, interdependent socio-environmental world that environmental governance aims to protect. Where many of the reviews of environmental social network studies call for more empirical comparison or longitudinal data, we hope here to have begun to lay the groundwork for more integration of environmental sociological theory around environmental governance that directly connects with empirical analysis. Most critically, in the emerging interdisciplinary fields of socio-environmental systems and networked governance, sociologists must

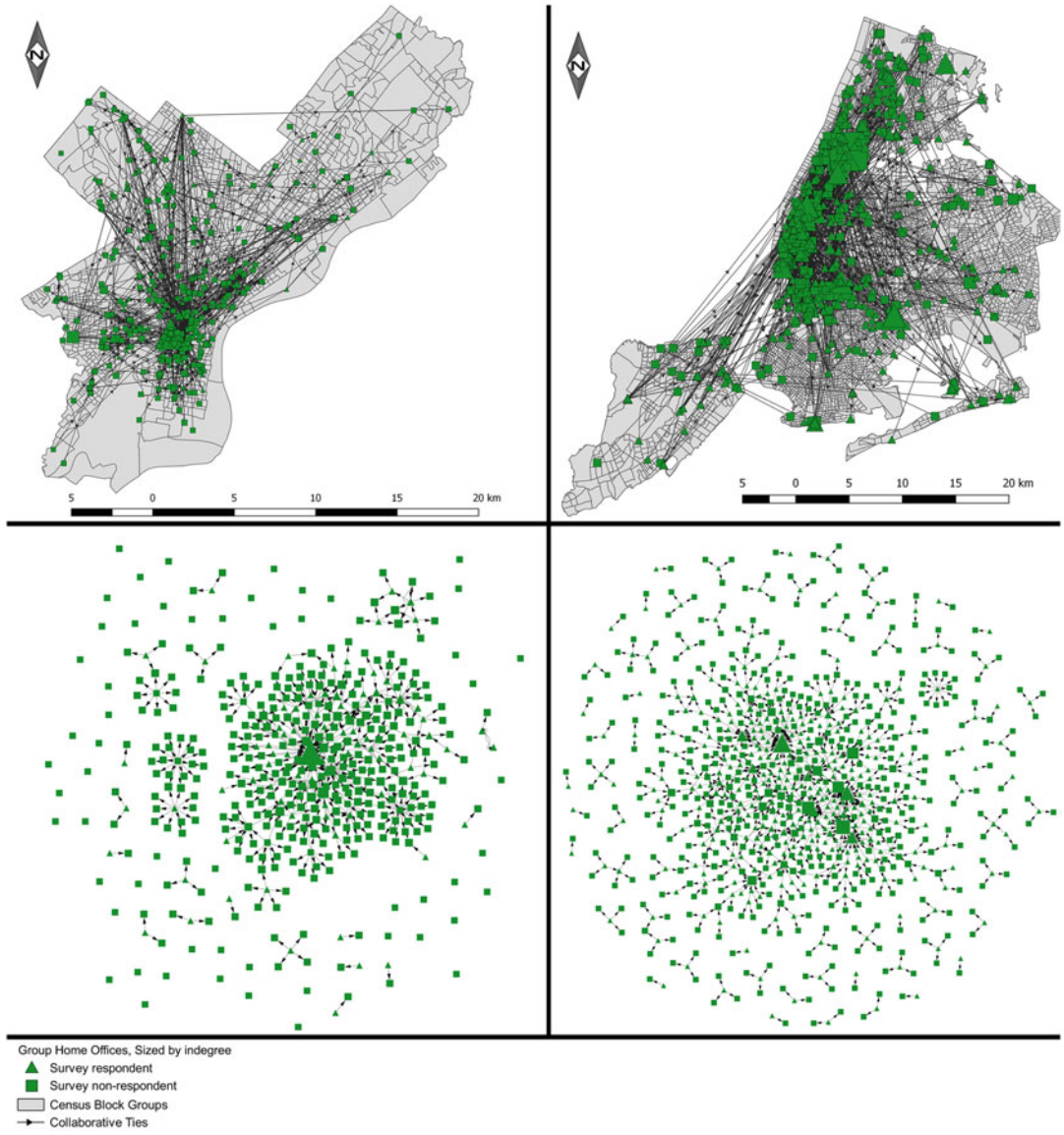


**Fig. 16.2** Environmental stewardship networks in two cities. (Reproduced from Jasny et al., 2019)

engage with other disciplines both to learn from them as well as ensure that the understanding and knowledge developed in our own field is not excluded or re-engineered from scratch.

Beyond advancing theory and methods, within the context of a growing climate crisis, along with related environmental problems, research on environmental governance is needed to assess the success and failure of policy options. Environmental sociologists are particularly well suited to contribute to analysis that helps society to move towards environmentally sound policymaking that is also environmentally just given our increasingly turbulent and unequal world.

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# Green Criminology

17

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The first discussion of green criminology appeared in 1990, when this area of research was proposed as a unique specialty within criminology (Lynch, 1990) and specifically as an extension of radical or Marxist criminology (for discussion see, Lynch & Michalowski, 2006) useful for constructing a political economic and class analysis of crime, law and justice related to environmental destruction. Today, nearly 30 years later, there is impressive diversity in green criminological studies. Here, we draw attention only to the political economic approach to green criminology. When necessary, however, we distinguish the political economic view from other green criminological approaches, referring to PEG-C or political economic green criminology.

We focus on PEG-C for the following reasons. First, unlike any other form of green criminology, PEG-C has increasingly aligned itself with environmental sociology and ecological Marxism. Second, we believe that the further development of—and best path forward within—green criminology is to facilitate its increased integration with environmental sociology, and to promote increased interest in green criminology among environmental sociologists and to encourage their participation in the study of green crime and injustice. Toward the end of this chapter, we will illustrate some ways this might occur.

PEG-C shares its core interests with environmental sociology, namely how humans, societies and nature (in its various forms) intersect and affect one another. That core content also shares an interest in the construction of environmental issues, and includes addressing definitions of environmental harms, how those definitions are constructed and applied, and how definitions affect counting the number, scope, types and costs of environmental crimes. Doing so also defines and acknowledges different victims of green crimes (e.g., humans, nonhuman animals, plants, eco-systems or eco-system elements). Focusing on injustice, PEG-C has also engaged in the study of environmental justice from a political economic perspective. Promoting the greater integration of environmental sociology and PEG-C, in recent years more specific attention has been paid to theoretical positions that include treadmill of production, metabolic rift, and ecological unequal exchange theory.

We begin the following discussion by briefly situating PEG-C within the discipline of criminology more generally. Next, we define the concept of green crime and its scope. We then focus attention on PEG-C and how it is used to examine

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issues of ecological withdrawals and additions to examine crime and justice. Finally, we suggest that PEG-C has developed in ways that move it away from criminology and closer to environment sociology.

## Background: Criminology and Green Criminology

As noted, green criminology developed as a political economic explanation of the causes, injustices associated with, and the social control of green crimes or ecological harms. Below, we define the concept "green crime" in greater detail. Before beginning, however, it is useful to provide some background about the scope and focus of criminology, as well as a few basic concepts central to green criminology.

In broad terms, criminology is defined as the scientific study of crimes and criminals. It overlaps with the study of criminal justice, or the study of criminal justice system processes and outcomes. For purposes of the present discussion, these two areas of research can be collapsed, and referred to as constituting the scope of orthodox criminology. Historically, orthodox criminology has largely encompassed research that employs: (1) positivistic, individual level analysis to identify the causes of crime within individuals (e.g., psychological, biological; see Walsh & Wright, 2015) or as influenced by an individual's associations (e.g., peer, bonds to parents, community, school; e.g., Hirschi, 1969); (2) legal analysis of documents and the rights and privileges stemming from those legal documents; (3) organizational and processual studies of criminal justice agencies or criminal justice processing outcomes (e.g., how a new rule or policy affects a sentencing practice or outcome; Travis & Edwards, 2015); and (4) the philosophical analysis and studies of theories of justice and punishment (Newman, 2017). Though often lacking sound empirical evidence, orthodox criminology reinforces traditional and sometimes widespread views of crime and justice, including assumptions that the causes of crime reside within individuals; that more/better punishment reduces criminal behavior; and that expanding the scope of social control reduces crime. While there is a great deal of empirical research examining orthodox oriented questions within criminology, there is little robust evidence (i.e., high empirical explanatory value; non-contradictory; empirically efficient) supporting any of these particular arguments about the causes or control of crime.

One of the most important observations that should be made about orthodox criminology is that it focuses attention on what are called "street crimes" and "street criminals," and the processes related to street crime (Lynch & Michalowski, 2006; Reiman & Leighton, 2015). Street crimes are also referred to as ordinary crimes, and include the crimes most often reported in the media and addressed by the criminal justice system such as thefts, assaults, robbery, rape and homicide. As radical/Marxist criminologists pointed out in the 1970s (Chambliss, 1975; Quinney, 1974), and before them white collar crime researchers (Sutherland, 1945), street criminals are overwhelmingly poor/lower class individuals who became the subjects of crime control strategies as laws and social control became tools of class control (Reiman and Leighton, 2015). As a result, the formal social control of crime serves a class control function.

One of the first critiques of the class biases evident in criminological research was posed by white-collar crime researchers (for a more general, early critique see, Bonger, 1916). As white collar/corporate crime researchers increasingly pointed out by the mid-twentieth century, street crimes were not the only, nor even the most serious, form of crime that occurred in society (e.g., Sutherland, 1940). Criminologists who criticized orthodox criminology's focus on street crimes and criminals noted that a wide variety of crimes by corporations and governments cost society more financially and in terms of life and limb. Yet, even while calling attention to the crimes of the powerful, criminologists who were expanding the scope of criminology and critiquing its class biases continued to overlook an important form those crimes took: many were environmental harms.

Even as environmental issues became more important social issues in the 1970s, they were not described in any significant way in the white collar/corporate crime literature. By the mid-1980s, one could periodically find a study on environmental harm or social control by a criminologist, but these studies remained the exception, and even then, the primary focus was on worker health and safety issues (Frank, 1985). This was true despite the fact that in other disciplines environmental issues were receiving rapidly increasing attention, and in some disciplines like sociology, new fields of study had been created to address environmental problems, while in other disciplines like toxicology, environmental studies and ecology, evidence of the extensive nature of ecological destruction was mounting more rapidly than at any other point in history.

By the end of the 1980s, radical/Marxist criminology was essentially replaced by several other alternative criminologies including feminist approaches, critical race theories, left-realism and various post-modern approaches, and all of these alternatives were treated more generally as belonging to what is called critical criminology (Lynch & Michalowski, 2006). This was the context in which green criminology was born. It was not only a reaction to observations of class bias related to the study of crime and its control within the discipline of criminology that Marxists and white collar researchers had identified; it was also a reaction to rapidly expanding evidence of corporate crime and ecological harm in the world; and a reaction to the declining significance of Marxist/class analysis within criminology.

A significant problem is that crime is not necessarily an objective thing, but rather a social construction (Spector & Kitsuse, 2001). Due to space limitations, we cannot adequately address this issue of social construction here, and can only make some rudimentary comments. In the PEG-C view, crime is depicted as being "produced." That term is employed to indicate that crime results from the intersection of different social forces and factors. The public has perceptions of behaviors they believe ought to be crimes. Politicians select some of those to incorporate into law, but law is also shaped by other powerful interest groups. This is especially true for environmental law, public health law, and occupational health and safety laws. In addition to creating law, the state decides how to establish a mechanism of enforcement, and the kinds of resources those enforcement mechanisms receive, which affects their ability to enforce laws efficiently (or at all, sometimes). In addition, the idea of crime being produced indicates that we must consider factors that affect social actors who engage in crime. This means considering the factors that motivate and generate opportunities for crime. In abstract terms, if we think of each of these factors as a plane in the space of social relationships, the intersection of all these planes demarcates the space occupied by crime. This may seem like a "messy" way to conceptualize the production of crime, but the production of crime is a messy process.

It is nearly impossible in studies of green crime to completely depict the above in any specific empirical study. Thus, sometimes green criminologists study the behavior of the state. But, there are only a few studies that address this issue from a political economic perspective (Lynch & Stretesky, 2013; Lynch et al., 2010, 2016b, forthcoming), and this is an area in need of further research.

## Conceptualizing Green Crimes and Harms

It is necessary to have a point of reference for conceptualizing green crimes. Within orthodox criminology, a crime is a behavior that violates the law, and not just any law, the criminal law. This is a rather restrictive and subjective definition of crime (for an extended discussion, see Lynch et al., 2015b). As a result, this legal definition of crime often excludes legal rules that define significant social harms in administrative or regulatory laws that apply to corporations. It is subjective to the extent that the scope of the criminal law is not objectively defined a priori by law-making rules. That is, in the criminal law, there is no basic definition of a behavior called

"crime," there are only examples of different individual crimes, but no idea of the concept of crime. Moreover, because the criminal law is politically constructed and subjective, it excludes many harmful behaviors that cause as much or more harm than the behaviors that have been included within the criminal law. Green crimes are an example of the kinds of behaviors that are often excluded from the purview of criminology when the definition of crime is based on an orthodox approach to the study of crime.

Given the limited scope of the definition of crime in orthodox criminology, conceptualizing green crimes requires moving beyond the legal definition of crime. While existing laws may still be useful for defining some behaviors as green crimes, they do not include a broad enough definition of those harms. That is, there are behaviors that cause significant harms that could be treated as green crimes even though they are not labelled as crime by the law. Creating this kind of definition of a green crime, in our view, presents a significant problem. That problem involves constructing a definition that has some objective basis that can be applied consistently in order to avoid the problem of constantly needing to define/redefine the concept of green crime using what we call a "catalog" approach—that is, identifying and adding each new form of green crime as they are "discovered" to a list of green crimes. Here, it is not our intention to review the many different definitions of green crime that have appeared in the literature (see, Lynch et al., 2017a, 2017b, 2017c), but rather to provide an idea of the kinds of definitions of green crime that exist, and more specifically to review how we have attempted to address the problem of multiple (and sometimes contradictory) definitions of green crime through the unification of definitions of environmental harms in environmental sociology, ecological Marxism and physical science literatures.

To begin this discussion, it is necessary to broadly conceptualize the idea of green crime as a harm that damages the environment. At this broad level, three issues are important to consider. First, scientific areas such as toxicology and chemistry can create quite specific definitions of green crimes or harms by referring to chemical toxicity and exposure measurements and studies. Thus, scientifically—which we take as an objective indicator of harm caused by exposure to a pollutant—we can say that certain chemicals (1) either should not be emitted into the environment or a local ecosystem because they will, at any level of exposure, cause ecological harm, or (2) should not be emitted above some concentration level due to the harm they can generate. At this level of analysis, we have only come to understand a green crime in relation to one of its physical attributes—its toxicity. Scientifically, we can also appreciate that significant research exists that addresses other dimensions of the physical harms associated with green crimes, and that some of these indicators such as planetary boundaries (Rockström et al., 2009; for a criminological discussion see Long et al., 2014) and ecological footprints (Jorgenson & Clark, 2011) can also be used to explore concerns defined in environmental sociology such as metabolic rift (Clark & York, 2005; Clausen & Clark, 2005) and ecological unequal exchange (Jorgenson, 2006, 2016) that help conceptualize the boundaries of green crimes.

Second, as environmental sociology and ecological Marxism suggest, the major forms of environmental harms/crimes that occur in the contemporary era are those associated with capitalist production and consumption, or the organization and practices inherent within capitalism. For example, building on James O'Connor's (1991) "second contradiction" argument, Foster (2002) noted that capitalism must consume nature in order to expand and carry out the functional imperatives of capitalism. In so doing, he also exposed and made evident the physical limits of capitalism ecologically. Elsewhere, Foster (1992) argued that this second contradiction constitutes the "absolute general law of environmental degradation" under capitalism, which is "the amassing of wealth at one poll and the accumulation of conditions of resource-depletion, pollution, species and habitat destruction, urban congestion, over-population, and a deteriorating social life environment … at the other" (pp. 78–79). In environmental sociology, this

view is expressed in Schnaiberg's treadmill of production approach, which links the mechanisms of expansion associated with post-World War II capitalism (i.e., increased use of fossil fuel and chemical technologies as energy and manufacturing sources) to two forms of ecosystem destruction or disorganization—ecological withdrawals of resources for production (including fuel and chemical energy), and ecological additions or the emission of pollutants from production. As an extension of these observations, we have argued that this contradiction between nature and capitalism which leads to nature's exploitation and disorganization is also the basis for a political economic definition of green crime (Lynch et al., 2013).

Third, there is extensive empirical evidence and theory consistent with points 1 and 2 above in a variety of disciplines. These arguments support the observation that escalating production and consumption patterns associated with the expansion of capitalism are a driving force behind the structural disorganization and destruction of nature, which can be interpreted as the generation of green crimes and injustice. Examples of relevant research that ties these arguments together include discussions and assessments of: the Anthropocene and the Great Acceleration; climate change; ecological economics; ecological footprint analysis; energy analysis; Gaia theory; general developmental theory of dissipative structures; Jevon's paradox; limits to growth analysis; metabolic/ecological rift; planetary boundary analysis; steady state economics; and ecologically unequal exchange theory and research. While some of these arguments are discussed later in this chapter, underdevelopment of a political-economic approach to green criminology has led to a neglect of how these arguments connect to and expand the scope and explanatory power and utility of green criminology, and a number of these arguments require further elaboration in the literature.

In taking into account the three issues described above, we have proposed the following definition of green crime as consistent with the PEG-C approach. In that view, a green crime is a "human act or behavior that causes or has the potential to cause unnecessary ecological harms that generate scientific evidence of ecological disorganization, or harms that could be avoided if production were organized differently than it is under contemporary capitalism" (Lynch et al., 2017a, 2017b, 2017c: 55; see also Lynch et al., 2013; Stretesky et al., 2013a, 2013b).

In addition to the above, initial conceptualization of the concept of green crime requires an appreciation of the flow of harm produced by those crimes. Conceptualizing this flow of harm also reveals an understanding of the victims of green crimes. The simplest approach here is to divide green crimes into its primary and secondary forms. Primary green crimes are harms that may or may not violate the law, which cause direct destruction or damage. Direct damage/destruction may be caused by polluting ecosystems, harming them through destructive resource withdrawal methods or other harmful ecological modifications (e.g., turning a wetland into a housing project). Primary green crimes also include behaviors that directly harm any living nonhuman species through, for example, killing (legal or illegal hunting), poaching and trafficking.

A secondary green crime occurs when species living in an ecosystem are harmed by a primary green crime. For example, when a waterway is polluted, the primary green crime is the pollution of the waterway ecosystem, which can alter the very nature of that ecosystem. The secondary green crimes are the harms the pollution causes to the various species that live in, or use the waterway, and can include harm to connected ecosystems (e.g., primary pollution of a river can cause secondary pollution of an estuary). This distinction also illustrates that most of the ecological harms or green crimes experienced by living species are secondary or indirect. The division between primary and secondary victimization is important to the extent that ecosystems themselves can be conceptualized as living beings/systems. This is not to suggest that living beings *in* ecosystems are not part of the ecosystem. It is useful, however, to differentiate between primary and secondary victimization since the behavior in question is directed at specific

"targets." This is of particular utility when, for example, animals are victimized through poaching. In such a case, the animal is the primary victim, and the ecosystem may, if poaching reaches a critical level, suffer the secondary victimization. The primary-secondary distinct is also used to indicate a flow in the victimization vector that indicates an increased scope of victimization as the effects of the primary victimization are considered.

Significant attention has been directed to defining green crime and its scope, and as noted above, it is not our intention to review each of these definitions here. It is worthwhile to note that these definitions have different strengths and weaknesses, which can include the breadth of their scope. Ignoring those specific criticisms, one positive outcome of efforts to construct a definition of green crime is that green criminologists have expanded the scope of criminology as a discipline, moving it well beyond the traditional legal definition of crime and the study of street crime and criminals, and expanding the kinds of victims criminology examines. Drawing on the legal definition of crime, orthodox criminology typically only allows room for discussions of humans who suffered victimizations defined by the criminal law. Green criminology expanded the discussion of victimization by moving beyond the criminal law, which then also allowed considering nonhuman victims—ecosystems and nonhuman living beings—as worthy of discussion. In part, green criminologists revealed nonhuman victims by defining green crime in relation to different foundational concepts. For instance, some green criminologists referred to various eco-philosophical positions (e.g., speciesism; biocentrism; ecocentrism) to draw attention to nonhuman animal rights and interpreting harms against nonhuman entities as crimes, including crimes against wildlife, domestic/companion animals, ecosystems/nature and ecosystem components. Other definitions of green crime emerged by considering the form victimization acquired (e.g., through pollution; deforestation), or as part of a broader victimization process (e.g., anthropogenic extinction; climate change).

Some types of green crime or green victimization are the subject of specific forms of green criminology. For example, one strand labeled "nonspeciesist criminology" by Beirne (1999) in his foundational work on this subject, focuses attention on the victimization of nonhuman animals and includes discussions of poaching and wildlife trafficking (e.g., Beirne, 1995, 1996, 1997; Cazaux, 1999; Sollund, 2011). Studies related to eco-crime and ecocide have drawn attention to transnational green crimes (South, 2013), bio-piracy, bio-prospecting (South, 2007), corporate colonization of nature, bio-exploitation and genetically modified foods (South, 2007; Walters, 2004, 2005), deforestation and illegal logging (Bisschop, 2012; Green et al., 2007; van Solinge, 2010, 2014), the exploitation of water resources (Johnson et al., 2016) and laws for the prevention of ecocide (Higgins et al., 2013). Green-cultural criminology examines the social construction of green harms, particularly the media's construction of environmental harms, and the political dynamics of constructing environmental harms (Brisman & South, 2014). In addition, there are two strands of conservation criminology—the Rutger's Model and the Michigan State Model. The Rutger's Model draws specifically on Ronald Clarke's (1980) theory of situational crime prevention. The scope of these studies is not defined by the type of victimization (although to date, all of these studies address wildlife crime/victimization), but rather by the ability to study the effectiveness of policies designed to control ecological victimization or factors that promote ecological victimization. For example, Clarke's approach suggests that items/commodities that are concealable, removable, available, valuable, enjoyable and disposable (CRAVED) increase the opportunity for crime. As a result, controlling crimes—including green or conservation crimes—requires implementing policies that impinge upon these factors and limit their CRAVED attributes. Numerous studies have examined these issues, providing varying support for the Rutger's conservation approach (Clarke & Rolf, 2013; Kurland & Pires, 2017; Lemieux & Clarke, 2009; Petrossian & Clarke, 2014; Petrossian

et al., 2015a, 2015b, 2018; Pires & Clarke, 2011, 2012). The Michigan Model is a multidisciplinary approach for studying green crimes and their prevention that draws on risk assessment and decision-making science literature (Gibbs et al., 2010). A number of these studies focus on conservation management, human-wildlife conflicts, and perceptions of wildlife/ecological issues (Gore et al., 2007, 2008, 2016).

The political economic approach to green criminology (PEG-C) is different than each of the views described briefly above, and that difference begins with the initial conceptualization of green crime and injustice within the political economic context of global capitalism (Lynch, 1990). Other forms of green criminology employ differing philosophical, legal or harms-based definitions, and none of those definitions are tied to a specific theoretical approach that avoids engaging in ahistorical, grand theory (Mills, 1959). In PEG-C, however, the definition of green crime (and hence green injustice) is derived by considering core theoretical arguments in environmental sociology and ecological Marxism (for elaboration see Lynch et al., 2013). That approach states that behaviors that cause ecological disorganization are, from a political economic understanding of the "perspective" of nature, green crimes. As noted above, this argument represents an integration of ecological Marxism and treadmill of production theory. It recognizes that the way in which humans have organized production and consumption under capitalism leads to harming and exploiting nature (as well as humans) through destructive ecological withdrawal methods and ecological addition practices in order to increase production efficiency and profit-making. Green crime and injustice, in other words, can be seen as a result of the contradiction between nature and capitalism (Foster, 1992)—meaning that capitalism, due to the way it is organized, promotes green crimes. The PEG-C definition is derived from a structural model, and its utility is related to understanding that: (1) capitalism *must* cause green crimes (and injustice); (2) that the structure of capitalism will cause green crimes to be structured in terms of (A) types/forms, and that (B) the types/forms will have a distribution across the local and global geography of capitalism; and (3) that the location of nations within global capitalism will affect the types of green crimes and forms of injustice within and between nations, and the forms and extent of law and social control applied to regulating green crimes.

Above, we have described some of the basic issues that need to be addressed when considering the definition of green crime as a concept. Rather than review all the possible definitions, we have focused primarily on conceptual issues relevant to PEG-C. As we noted, PEG-C is the variety of green criminology most closely associated with environmental sociology in general, and with ecological Marxism in particular. In fact, given developments in PEG-C research over the past few years, it may now have a closer affinity to environmental sociology than to criminology.

From an environmental sociological perspective, interesting features of PEG-C include: illustrating societal-environment interactions with respect to crimes committed against and through the environment that harm various species, an issue environmental sociology has not widely addressed; the study of environmental justice in its political economic context; examinations of the political or social construction of environmental laws and regulations and their applications; and theoretical and empirical research linking treadmill of production, metabolic rift and ecologically unequal exchange perspectives to green crimes. We take up these issues in the sections that follow, beginning with a brief history of PEG-C.

## Political Economy and Green Criminology: A Brief History

As noted, the first discussion of green criminology appeared in 1990 in a paper proposing this research area as an extension of radical/Marxist criminology (Lynch, 1990). That proposal framed green criminology as including the study of environmental harms, (in)justice, and environmental law and regulation in their "economic, political and social class contexts" (Lynch, 1990: 3), and

required exploring how the structure of capitalism affects environmental harms/crimes, justice and law. Doing so examines the way that powerful groups shape the law to regulate the "environment to preserve the basis of their power" (Lynch, 1990: 3). Lynch noted that within the political economic context of capitalism, environmental destruction would be "protected" and legitimized by corporate ideology, government consumption patterns, and lax environmental regulation. Primarily, the crimes PEG-C would examine would be those that were sometimes (but rarely) addressed in the corporate crime literature. Examining these issues would also require drawing attention to how green harms/crimes produced an array of victims associated with environmental destruction and predation, including (in addition to humans), plants and other living victims (even insects!), and ecosystems as victims. He acknowledged the global nature of these concerns, pointing toward examining how these problems played out in the political economic context across core and peripheral nations in an effort to reveal "the pervasive political and economic powers that negatively affect all life on this planet each and every day" (p. 12). Referring to the development of green politics in European nations, Lynch (p. 3) also argued that green criminology should connect "action/activism to political economic theory that views environmental destruction as an outcome of the structure of modern, industrialized capitalist production and consumption patterns. . . ."

Though not yet connected to environmental sociology, these preliminary PEG-C themes reflected a wide range of issues and conceptual and theoretical concerns expressed within environmental sociology. This included attention to: how human-environment relationships relate to praxis, structure and agency; the social and political construction of environmental harms; the study of environmental injustice; global environmental harms, laws and regulations; the intersection of humans and the environment in relation to social movements; and the relationship between neoliberalism and environmental regulation (Woodgate, 2010).

Expanding on these themes, Frank and Lynch (1992: 79–96) noted the need for criminologists to expand attention to "green victims" of corporate harms. Here the argument suggested that corporations committed a wide range of acts that produced environmentally-related *violence* normally excluded from criminology because within orthodox criminology (as a result of its tendency to draw on modernization-related arguments), those behavior are typically viewed as the acceptable costs of production. In contrast, Frank and Lynch framed these violent green victimizations as occurring within the political economic organization of capitalism, which attempts to legitimize such harms as normal within the profit orientation of capitalism, and as excusable behaviors associated with "legitimate businesses enterprise." These forms of violent harm and victimization, overlooked by criminologists, they argued, needed to be reconceptualized in relationship to the forces that produce and legitimize these acts within the political economic structure of capitalism (pp. 110–113).

Despite these arguments, little interest was directed toward these issues within criminology. Increased interest in green criminology began to emerge following publication of a special issue on green criminology (1998, volume 2, number 2) of the journal, *Theoretical Criminology*, edited by Piers Beirne and Nigel South. During the mid-1990s, Beirne (1994, 1995, 1996, 1997) had published several articles examining harms against animals from a criminological perspective. In 1999, he published a landmark work on criminological examinations of harms against nonhuman animals, "*For a nonspeciesist criminology*," which significantly affected the development of green criminology and drew increased attention to nonhuman animal crimes/harms. This was not, in the view of most, a political economic analysis. Beirne, however, included relevant materials on political economy in overlooked footnotes to this manuscript. Those footnotes (# 2, # 10, # 11) explored the historical "exploitative" connection between humans and animals through commercial production, including the replacement of human with animal labor. He also refers to the development of anti-animal

cruelty statutes in the nineteenth century as an effort to extend social control over the working class within the political economic relations of capitalism, and especially within the context of capitalism's property interests in animals.

Reflecting this general lack of interest in PEG-C, some PEG-C researchers attempted to stimulate interest in green criminology by drawing attention to a more traditional criminological problem: namely, problems of injustice connected to racial bias. This produced a number of short theoretical and empirical studies of environmental (in)justice, which referred to the association between political economy and environmental justice (Stretesky & Hogan, 1998; Stretesky & Lynch, 1998, 1999). This research connected the problem of race and unequal exposure to the environmental justice literature in particular rather than the environmental sociology literature more generally.

Much of the effort required to establish green criminology involved making space for that view within the criminological literature and establishing that the scope of and harms associated with green crimes required attention. As a result of addressing those issues, more exacting assessments of the intersection between environmental sociology and PEG-C were overlooked. A more complete articulation between PEG-C and environmental sociology only began to emerge more recently (e.g., Long et al., 2012; Stretesky & Lynch, 2009a). In these works, the connection between PEG-C and environmental sociology were drawn much more clearly and definitively, particularly in Stretesky et al.'s (2013a) book, *The Treadmill of Crime: Political Economy and Green Criminology,* and several related publications (Lynch, 2016b; Lynch et al., 2013, 2016b; Stretesky et al., 2013b). We examine those arguments below.

## Green Criminology and the Treadmill of Production

Despite being grounded in political economic theory, most green criminology does not draw directly on that approach. Moreover, most green criminological publications involve discussions of the kinds of behaviors that ought to be included as examples of green crimes, as well as numerous case studies of green crimes. As a result, there has been little development of a theory of green crime or green criminology, and the lack of well-developed green criminological theories has long plagued this area of research.

To address these concerns and reconnect green criminology to its political economic origins, we wrote a series of theoretical and empirical manuscripts connecting green criminology to treadmill of production (ToP) arguments, and to related arguments in environmental sociology and ecological Marxism (Long et al., 2012; Lynch et al., 2013, 2016a, 2016b; Stretesky et al., 2013a, 2013b). Those arguments rest on the observation that nature and capitalism are in contradiction with one another. As a result, continued economic expansion results in continued ecological disorganization through increasing ecological additions and withdrawals, which shift across nations and economic sectors throughout the history of capitalism. These observations have relevance to several important sociological approaches beyond the ToP, such as the second contradiction and absolute general law of environmental degradation under capitalism arguments; metabolic/ecological rift approaches; and the ecologically unequal exchange perspective (EUE). For us as criminologists, these views are important to the extent that they can be related to the volume of green offending and the scope and application of environmental law and social control mechanisms. In PEG-C it is not only important to show how the political economy of capitalism gives rise to green crimes (i.e., how part of the contradiction between capitalism and nature plays out or becomes evident as green crimes), but also how the structure of capitalism shapes environmental laws and forms of social control. From a political economic view critical of capitalism, environmental law and social control are not constraints on capitalism—rather, it legitimizes and facilities ecological disorganization and destruction, and hence other outcomes that promote the expansion of capitalism such as metabolic rift and EUE. We explore these

arguments in greater detail below. It should be noted that in the following, we refer largely to our own work since we have been the primary source of these arguments.

The first effort to link ToP and PEG-C perspectives involved a study of whether coal companies charged with environmental violations attempted to employ their economic power to mitigate the impact of the violations (Long et al., 2012). Drawing on Schnaiberg's (1980) ToP theory, which lays out arguments concerning how different treadmill actors behave, and Marxist theories of the state, it was hypothesized that coal companies charged with environmental violations would attempt to influence the outcome of environmental investigation by employing their economic assets to make political donations *before* environmental investigations were completed. Controlling for lobbying, production volume, and company size, we found clear evidence of increased political donations following environmental charges.

For environmental sociologists, the ToP is a familiar theory which describes how post World War II capitalism escalated production and consumption by increasing the use of fossil fuel and chemical based production techniques. These methods sped up the treadmill of production and required accelerated raw material inputs into the system of production. Extraction of those raw materials (called ecological withdrawals) was also expanded through the use of new industrial technologies. Intensified extraction and production also increased emissions/pollution (ecological additions), and taken together, the expanded pace of the ToP promoted the growth of ecological disorganization, while also intensifying social inequalities.

Addressing the relevance of observations related to ToP theory, PEG-C criminologists have undertaken several empirical studies related to ecological additions, ecological withdrawals and the social control of environmental crimes. These PEG-C studies are reviewed in the sections that follow, however the review that follows should not be considered a review of the broader green criminological literature (e.g., outside the scope of PEG-C arguments).

## Ecological Withdrawals and PEG-C Explanations and Research

Drawing on Durkheim's (Durkheim, 1983) theory of social order and change, various criminological theories suggest a link between social disorder/disruption—or what is typically called social disorganization—and crime. Connecting this issue to resource extraction, Freudenburg (1984) argued that the rapid development of oil boomtowns created forms of social disorganization that increased rates of crime. PEG-C researchers suggested that these traditional criminological assumptions about social disorganization might also be related to ecological disorganization, and that areas adversely affected by social disorganization may also be experiencing ecological disorganization (Stretesky et al., 2013a). In this view, some forms of ecological disorganization may be promoted by efforts to accelerate ecological withdrawals to promote expansion of the ToP, and may in turn contribute to or co-occur in geographic locations suffering from social disorganization (Lynch, 2016a; Lynch & Boggess, 2015). Testing this argument, Stretesky et al. (2018) found an association between the location and volume of oil and natural gas extraction wells in the UK (2004–2015) and levels of property and violent crime.

Within criminology as in sociology and in the ecological literature, numerous studies link the process of modernization and development to both positive and negative outcomes. In the traditional modernization approach within criminology linked to Durkheim, modernization is believed to add complexity to society, and sever small group relationships and social ties, contributing to increased crime. This argument has also been translated into a resource curse hypothesis which suggests that nations with excessive dependence on natural resource extraction economies (e.g., as in the oil boomtown example above) experience rapid social change, normative disruptions, diminished social ties and increased social disorganization, leading to increases in crime. Though criminological studies

posit a possible resource curse-crime effect, the existence and distribution of the resource curse itself has not been explained nor adequately assessed by criminologists. Drawing on ToP theory, PEG-C researchers argued that the distribution and structure of the global ToP influences the physical geography of resource extraction (i.e., ecological withdrawals) across nations, which in turn influences factors (e.g., including social disorganization) that affect crime, and that these effects operate independently of more traditional criminological modernization arguments. Stretesky et al. (2017a) employed multilevel growth models to assess the relationship between ecological withdrawals measured as natural resource rents and homicide rates across 173 nations for the year 2000 through 2012. Multilevel growth models indicated that resource rents were related to homicide rates within but not across nations. In other words, as nations become more economically dependent upon natural resource extraction their homicide rates tend to increase.

Drawing on several arguments in environmental sociology, Jorgenson (2009) proposed that the adverse impacts of certain indicators of economic development on ecological disorganization might be evident in less developed nations. In particular, Jorgenson noted that there is a widespread assumption that foreign direct investments (FDIs) often have positive benefits for nations receiving those payments, but that in the environmental sociology literature numerous studies indicate the existence of widespread adverse ecological disorganization impacts on FDI receiving nations. Consistent with ToP arguments, he found that within less developed nations, increased FDI was related to increased water pollution levels over time, and that in these nations there was also increased evidence of child and infant mortality over time. Extending that argument to ecological withdrawals, Long et al. (2017) assessed the effects of FDI on rates of ecological withdrawals across a sample of 125 less developed nations (for the years 2005–2013). Based on the results, they argued that the structure of global resource withdrawal investment impacts ecological disorganization in less developed countries.

Ecological withdrawals occur in many forms. One of those forms relevant to green criminology is the poaching and trafficking of wildlife species. Outside of PEG-C, criminologists do not conceive of wildlife poaching/trafficking as crimes that relate to the global ToP's influence on ecological withdrawals. Thus, there is little discussion of how political economic theory helps in the conceptualization and testing of assumptions that relate to the intersection of the global ToP and the global trade/trafficking in wildlife. Most green criminological studies of wildlife trade and crime are qualitative and employ case study techniques.

Stretesky et al. (2013a) offered initial discussions of how the ToP affects not only wildlife crimes but crimes against other nonhuman animals (e.g., farm animals). Specifically, they argued that not all animal harms were the proper subject of a PEG-C, and that PEG-C animal harm research should focus on animal harms related to the political economic structure of society. For example, within criminology, some study the psychological attributes of individuals who harm animals, and others argue that harming animals is a pathway to harming humans. Ignoring the utility of such arguments, our point is that these kinds of animal harms exist outside the scope of political economic analysis, and that the goal of a political economic analysis of crimes/harms against animals is to illustrate how the political economic organization of society promotes crimes against animals and routinely overlooks those crimes when and because animals are being employed and exploited for economic purposes (e.g., in farming/food production; pet trade; the animal experimentation treadmill/complex). Moreover, in a political economic view, one should expect that animals that destroy economic value are likely to be killed/destroyed by the state even when those animals are protected by law (Lynch, 2019). In other words, when applying a PEG-C model to animal harms, one must take care to explore contradictions between the content of law (i.e., law as ideology or as a legitimation mechanism), and how the organizational structure of capitalism affects the enforcement of law. In this case, for instance, laws that

protect animals from harm may exist, but enforcement of those laws may be overlooked if enforcement undermines the structural goals of capitalism (i.e., profit-making/accumulation).

PEG-C scholars have also made arguments about the link between wildlife trade/wildlife destruction and anthropogenic development (Lynch et al., 2015a) that are consistent with world systems theory (McKinney et al., 2010; Shandra et al., 2009b). The PEG-C argument has not, however, been widely tested with respect to examining the intersection between political economic forces that impact ecological withdrawals and wildlife crime/trafficking patterns. Stretesky et al.'s (2018) analysis of the global Saker falcon trade addressed the effects of three theories that potentially explain threats to wildlife species due to economic forces: ecological modernization, unequal ecological exchange and treadmill of production theory. While each argument has been employed to examine how economic development impacts ecological conservation, they have not been applied to wildlife trade.

The ecological modernization approach, which is also expressed in the Environmental Kuznets Curve literature, suggests that as societies progress economically and accumulate excess resources, public opinion concerning environmental preservation pressures politicians to enact environmental protection measures, leading to declining ecological destruction and expanding economic progress over time. Here, the argument is that the environment and economy are decoupling, so that additional development does not continue to generate additional environmental degradation. Moreover, it is suggested that technological advances contribute to decoupling (for a more extensive green criminological critique see Lynch, 2016c). In this view, there should be an inverted "U"-shaped relationship between economic development and ecological disorganization over time, meaning that as countries modernize, the falcon trade would decline over time. The protecting factor in this case could, for example, be the setting aside of forested area for the protection of wildlife species.

In contrast, ToP theory suggests that the expansion of the capitalist ToP requires additional ecological resource consumption, so that capitalism and ecological disorganization expand simultaneously, the number of Saker falcons traded would increase. In addition, ecologically unequal exchange (EUE) theory posits that the structure of the global economy organizes a system of unequal exchange relationships between developed and less developed nations that facilitates the flow of ecological resources away from the latter. This ecological trade flow could include the trade in wildlife.

We tested the utility of these explanations on the global Saker falcon trade across 24 countries (for the years 1971–2015) using fixed-effects regression models. The results supported the ToP and EUE hypotheses, and rejected the modernization/Kuznets arguments. In short, it appears that modernization does not slow wildlife trade; rather, as ToP and EUE theories suggest, wildlife trade (a measure of ecological withdrawal/green crimes) increases over time. This outcome can help explain why it is difficult to prevent legal or illegal wildlife trafficking in a global capitalist economy. As illustrated below, one of the more important outcomes of empirical PEG-C research is the observation that the creation and application of environmental regulations is insufficient to slow the continued expansion and forms of ecological disorganization caused by the ToP.

## Ecological Additions and PEG-C Explanations and Research

As noted earlier, ToP arguments posit that the expansion of capitalism following WW II has been facilitated by an increase in ecological withdrawals and ecological additions. PEG-C posits that ecological withdrawals and ecological additions are forms of green crime. In the previous section, we reviewed PEG-C studies that have examined withdrawals, and here turn to the larger PEG-C literature on ecological additions.

One of the difficulties in assessing PEG-C arguments within the context of global theories derived from ToP and EUE arguments relates to

the paucity of and poor quality of data on environmental/green crimes and their control across nations. Drawing on world systems theory and EUE explanations, one would posit that the changing nature of global capitalism over time would impact the location of crimes of ecological addition. Moreover, because much of the ecological addition data examines pollution emissions, and trend data on pollution emissions are not typically found for many nations and are especially difficult to locate for less developed nations, PEG-C hypotheses about ecological additions are often tested with data from a handful of countries, and primarily from the US where these data are more easily accessed and exist over longer periods of time.

From a criminological perspective, a key issue concerning crime is whether the forms of formal social control devised to constrain crime work. By "work" criminologists typically mean that a crime control strategy reduces crimes, and the crime reduction effects of a crime control strategy are often summarized in relation to the theory of deterrence. Deterrence theory is dependent on making individual level assumptions about behavior. In that view, people are rational, and are deterred from crime when the costs of crime outweigh its rewards. A person offends, therefore, when the rewards of crime outweigh its costs. Here, it is not our intention to review all the intricacies of the deterrence argument, but simply to note its general structure and that there is actually little empirical evidence that deterrence works well with respect to deterring street (Paternoster, 2010) or corporate crime (Schell-Busey et al., 2016). We mention this empirical outcome because despite what empirical studies indicate about the limitations of punishment as a deterrent, the public, and most law-makers and law enforcement agencies believe that deterrence works. Moreover, the US EPA often boasts that deterrence is one of the primary mechanisms that makes US environmental law successful.

Consistent with both observations from ToP theory and the results from studies of the deterrent effect of criminal punishments, one would *not* expect environmental punishment to effectively deter corporations from engaging in green crimes linked to ecological additions. Those who have drawn on ToP theory, such as York (2004), have noted that despite the ideological claims made about environmental law and environmental law enforcement, those factors should promote conditions for the continued expansion of the ToP and profit-making. While this observation has been offered in ToP research (see also Schnaiberg, 1980), it has not been empirically assessed in the environmental sociological literature. Such empirical tests, however, have been undertaken within PEG-C research.

Stretesky et al. (2013b) conducted the first direct test of this proposition. Within deterrence theory, it can be assumed that large penalties carry a greater deterrent effect than smaller penalties, and that a deterrent effect would be most likely when penalties were quite high. To incorporate those strict assumptions of deterrence theory into an empirical test of the effect of environmental penalties on re-offending, Stretesky, Long and Lynch drew a sample of the 25 corporations that had received the largest environmental crime fines from the US EPA in 2006, and obtained emissions data for those corporations prior to and following the application of that penalty. Using fixed effects regression models, they examined the effect of the penalty on the pollution-emission behavior of those corporations. The results indicated that large penalties had little impact on the emission behavior of these corporations. They concluded that environmental penalties had little effect on slowing the treadmill of production and the forms of green crimes corporations commit through behaviors that expand ecological additions. Additional studies by PEG-C criminologists have also produced results that suggest that environmental penalties failed to deter corporations from engaging in behaviors that contribute to green crimes through ecological additions. For example Stretesky et al. (2017a, 2017b) examined the effect of modernization, criminal prosecution/social control indicators, and measures of the growth of the US treadmill of production to predict toxic emissions by US corporations from 1988 through 2014. The strongest predictor of emission was growth in gross

domestic product, while neither modernization nor criminal prosecution/social control indicators were related to the toxic emission trend. The effect of monetary penalties/deterrence on firms' compliance with environmental regulations in Michigan were assessed by Barrett et al. (2018). They found that over time, fines had a small effect on noncompliance in the short term. In the long-term, however, fines not only failed to deter corporate behavior by increasing compliance, they actually increased *non*compliance. This led the authors to posit that not only do fines fail to slow the trend in emissions promoted by growth of the ToP, but that continued economic growth associated with ToP expansion actually undermines any deterrent effects that might be associated with fining corporations for green crimes related to toxic emissions.

As indicated, the studies reviewed above by PEG-C researchers indicate that punishments do not change the behavior of treadmill actors or the ToP, and that despite the application of punishment, corporations continue to engage in green crime through ecological additions/toxic emissions. Some argue that the lack of corporate deterrence should not be unexpected given that the application of a punishment to a corporation for violating an environmental regulation is a rare event. Despite negative findings and the limited use of environmental punishments against corporations, one can still find research that suggests that though rare, such punishments have large effects on the corporations to which they are applied, and to other corporations through signaling, or the message sent to corporations about environmental offending through punishment. The idea that rare punishments still deter corporations is known as *Harrington's Paradox* (Harrington, 1988). Harrington's Paradox is an argument in ecological economics that contradicts the rational economic model of behavior made famous by Gary Becker. Harrington's Paradox argues that despite infrequent and unpredictable monitoring of environmental laws, a low likelihood of environmental offense detection, a low likelihood of an applied punishment, and low expected fine amounts, corporations will nevertheless be deterred by environmental law and punishment. As noted above, this argument is inconsistent with the expectations of deterrence theory and ToP theory and at odds with the empirical evidence. From a green criminological perspective, part of the issue here involves evidence related to the actual frequency of environmental punishments. Lynch et al. (2016a, 2016b) argued that the rate of environmental punishment is so low that it would be impossible for those outcomes to deter offenders. In an effort to make sense of this argument, Lynch et al. calculated the probabilities for punishment for 19 different federal environmental statutes in the US from 1983 through 2013. Among the 19 statutes examined, five were never enforced, and 11 other statutes were enforced on average of less than once per year. Thus, among 16 of the 19 statutes, the probability of punishment was close to zero. For the remaining laws, the likelihood of being caught was approximately eight in one million. These outcomes also require some context to more fully interpret. For example, not only is the rate of detection for environmental crimes very low, the likelihood of being incarcerated, and if incarcerated, sent to prison, are so unlikely that they are difficult to quantify (Lynch, 2017). Among individuals sentenced for violating a federal environmental crime statute in the US between 2001–2013 ($N = 428$), the mean sentence to incarceration was 8.7 months, which should be compared to the mean sentence for street crime violations of 59 months (Lynch, 2017). This mean difference also tells us something about the incarceration context: since jail sentences are less than 1 year, and prison sentences are greater than 1 year, we can see from these mean comparisons that environmental and street crime offenders are sent to different kinds of places when they are incarcerated. For this 13 year period, about 33 individuals were sent to jail or prison annually for violating a federal environmental law, while on average about 38,000 people were sent to *prison* (this estimate does not include jail sentences) for violating *federal* street crime laws. These differences—which were well summarized by Jeffrey Reiman in his 1979 book, *The Rich get*

*Richer and the Poor get Prison*—we would argue, have a great deal to do with how law is written and enforced to promote and protect the interest of ToP actors. For instance, of the 120,000 police/investigators employed by the federal government, only 200 work for the US EPA. It has also been illustrated that even at the state level, violations of environmental laws are rarely enforced, the enforced laws tend to involve minor violations, and green offenders received less punishment compared to matched samples of non-green offenders (Cochran et al., 2018; Crow et al., 2013).

The US EPA also employs other compliance strategies in an effort to promote corporate compliance with environmental regulations and to deter corporations from engaging in green crimes through toxic emissions. In 1986, the US EPA created the self-audit program, which was an effort to promote environmental compliance among corporations by allowing them to self-report environmental violations in return for reduced penalties. The US EPA believed that this approach would increase compliance with environmental regulations while decreasing toxic emissions. The effectiveness of the US EPA's self-audit programs has been tested by PEG-C criminologists on several occasions, producing little evidence that this type of policy works (Stretesky, 2006; Stretesky & Lynch, 2009b, 2011b; Stretesky et al., 2017a, 2017b). Still, regulators and corporations often promote self-regulation and enforcement policies as effective mechanisms for constraining corporate environmental violations. Even if these programs succeed in a limited number of cases and to a limited extent, we would suggest that the preference for these strategies is based upon their failure to cause larger scale, structural changes that alter the direction of the ToP in ways that limit ecological destruction and profit making.

If the conclusion we propose above is correct, then the green crime associated with toxic emissions should be more highly influenced by economic trends than by law enforcement behavior. The studies reviewed above provide some indication that this conclusion contains significant merit. However, more appropriate tests of these arguments with respect to their effects on toxic emissions could be undertaken under circumstances where there is a significantly large interruption in the growth of the treadmill of production. Those circumstances were present during the Great Recession. Using US EPA toxic emissions data from before, during and after the Great Recession (2005–2014), Long et al. (2018) were able to demonstrate that the recession had, as one would predict from the perspective of ToP theory, an independent negative effect on toxic releases in the US, and that the recession effect existed controlling for measures of economic development and manufacturing industry productivity.

While green criminologists in general often use water pollution as an example of a serious green crime, references to water pollution crimes in the green criminological literature have largely been anectdotal and have employed cases study examples. In an effort to indicate the widespread nature of water pollution crimes and how those crimes contribute to ecological disorganization, Lynch et al. (2017c) employed US EPA Discharge Monitoring Report data to describe volume and types of pollutants emitted by Publically Owned Treatment Works (POTW) in the US. US POTWs emit *billions* of pounds of water pollutants annually into US waterways, and in doing so facilitate ecological disorganization and hide various pollution emissions (including those from corporations) in a legitimized emission form. By facilitating this form of pollution and failing to adequately protect US waterways from a variety of pollutants, we argued that the state uses POTWs to engage in a form of state-green crime which is facilitated by the organization of the treadmill of production and the its intersection with the treadmill of environmental law and regulation (Lynch et al. 2021, forthcoming; Stretesky et al., 2013a).

Environmental sociologists have undertaken numerous empirical studies of the adverse effects and economic predictors of $CO_2$ pollution across nations (e.g. Jorgenson, 2012; Jorgenson & Clark, 2011). Those studies have generally been limited to direct $CO_2$ emissions, and show that the US plays the most significant role in generating

$CO_2$ pollution. In 2009, Stretesky and Lynch performed the first study examining the indirect effect of international trade/consumption on $CO_2$ pollution across nations. Using international trade data linked to carbon emissions, results indicated an enhanced US effect on $CO_2$ emissions that was significantly higher than prior studies indicated, which only examined direct $CO_2$ pollution. This occurs because the US trade deficit, which measures the balance of imports and exports, increases US pressure on production and $CO_2$ pollution generation in other nations.

## Environmental Justice and PEG-C Explanations and Research

A significant concern within PEG-C involves questions related to environmental justice, such as the distribution of environmental hazards or the enforcement of law and the imposition of penalties against environmental offenders as these outcomes are affected by the demographic characteristics of communities. To be sure, this is not a unique area of research interest, and the study of environmental justice spans across various sub-areas within sociology and political science. Within criminology, there has been some interest in the equal application of the law, which historically only became evident in the 1960s during the Civil Rights Movement in the US. One would imagine that the portion of criminology (criminal justice) that examines the effectiveness and fairness of criminal justice processes would have initiated concern with equity in law long before the 1960s. It was not, however, until the 1960s in the US that significant changes occurred in the racial composition of the population drawn into the criminal justice process. While the criminal justice system has long focused attention on enforcing laws in lower class areas, in most places in the US, the criminal justice process did not become a significant force in the maintenance of race relations until the 1960s. Despite an increase in the number of studies that addressed the existence of racial biases in criminal justice processes from the 1970s onward, criminologists have shown little interest in examining racial biases in the making and application of law more generally.

Early environmental justice research within criminology focused on the location of hazardous waste sites, including Superfund sites, which are the most serious of the known hazardous waste sites, and due to their seriousness, are slated for clean-up/remediation by the US EPA. Stretesky and Hogan (1998) undertook the first green criminological examination of Superfund sites by using data from the state of Florida. Unlike prior studies that had used larger aggregation levels and focused on relationships at one point in time, Stretesky and Hogan employed census tract data and compared outcomes across time (for the years 1970, 1980, 1990). They found evidence that Superfund sites were more proximate to African American and Hispanic communities in Florida, and that this relationship intensified over time.

In the first test on this issue, Stretesky and Lynch (1999) examined whether community class, racial and ethnic composition were related to patterns of accidental chemical releases in Hillsborough County, Florida. Legally, federal law defines an accidental chemical release as an unintended, unplanned or sudden release of a chemical from a manufacturing facility, during a chemical transfer (e.g., shipment via tankers cars), or from a treatment, storage and disposal facility (TSDFs). The term "accidental" provides the impression that these releases are not patterned, and one might assume that they would be randomly distributed. Given that manufacturing industries, TSDFs and chemical transport routes are fixed, the geographic distribution of ACRs may illustrate a spatial pattern, and that spatial pattern may have a discernible structure related to the attributes of the communities in which they occur. Controlling for the location of manufacturing facilities and transportation routes, Stretesky and Lynch found evidence that ACRs occurred most often in communities with elevated percentages of African Americans, Hispanics and low-income groups. Additional research indicates this pattern exists for other locations and time periods, and has an association with chronic health risks

(Derezinski et al., 2003). The environmental justice literature also suggests that community racial, ethnic and class characteristics can impact the quality of environmental enforcement communities receive, and affect the punishment of environmental offenders. Green criminologists have directed some attention to empirical studies examining these kinds of propositions. Lynch et al. (2004a, 2004b) performed two studies assessing the relationship between community characteristics and punishments for environmental violations. In the first study (Lynch et al., 2004a) they found that corporations that violated the federal Clean Air, Clean Water, and Resource Conservation Recovery Acts received reduced fine amounts when they violated those laws in Hispanic communities and lower income communities defined by zip code, and controlling for seriousness of offense, prior record and corporate characteristics. In the second study (Lynch et al., 2004b), which involved violations against petroleum refineries for the same violation types, they found racial and income differences in penalties applied to violators. Controlling for relevant factors, violations that occurred in African American communities were only 31.8% as large as penalties assigned to violations that occurred in White communities. There was a smaller income effect—penalties against violators in low income communities received only 78% of the fine levied against violators who committed their offenses in high income communities. For green criminologists, these findings are considered somewhat surprising since there is evidence that environmental violations occur more often around and in communities with elevated rates of poverty (Stretesky & Lynch, 2011a). In short, the combination of these findings indicates that while corporations are more likely to violate environmental laws near low income communities, those kinds of violations tend to receive less punishment, indicating that low income communities receive less formal/legal protection than other communities from environmental violations (see also Greife et al., 2017). From a political economic/ToP perspective, these results are not surprising, and illustrate how unequal enforcement of the law perhaps encourages environmental violators to target low income and minority communities.

The first broad-scale empirical studies of the relationship between environmental justice and school segregation and characteristics began to appear in the early 2000s (Pastor et al. 2002), and included an examination of this topic by green criminologists (Stretesky & Lynch, 2002). Stretesky and Lynch's analysis employed data for the years 1987–1999 to examine the relationship between school characteristics and proximity to hazardous waste sites in Hillsborough County, Florida. Employing a political economy of race approach in which racial and class structures intersect to produce a geography of race-class linked communities with varying probabilities of exposure and access to goods and harms as background for this analysis, and analyzing proximity with respect to the type of hazards, number of hazards and distances to hazards, they found: (1) that at the cross-sectional level, schools with a higher percent of African Americans were closer to environmental hazards; (2) controlling for community factors that might influence the location of environmental hazards, the more African American-segregated a school was, the closer it was to a toxic waste site; (3) that over time, schools located closer to environmental hazards saw the percentage of African American and Hispanic students increase; and (4) that the percentage of African American and Hispanic free lunch eligible students increased in schools proximate to environmental hazards, indicating a class-race interaction.

As noted, in general, criminologists have done little to examine environmental justice concerns, and have done little to explore how environmental justice and law enforcement equity concerns overlap. Illustrating that point, Lynch and Stretesky (2013) examined the distribution of US EPA sponsored community water monitoring programs. Within criminology, significant attention has been directed to community policing as a mechanism for enhancing bonds between the police and the community in order to improve public perceptions of the police and police-community cooperation as ways to reduce crime. The US EPA employs community water

monitoring programs (CWMP) for somewhat similar reasons, but primarily to augment their ability to monitor waterway pollution in local communities. The US EPA has established a program for training CWMP participants and promoting the formation of CWMPs throughout the US. CWMPs are important sources of information about local water pollution for the US EPA, and can be used to initiate further investigations of water pollution problems and violations.

Lynch & Stretesky's, 2013 study was designed to determine whether the distribution of CWMP was related to community characteristics. The study included information on the 1308 CWMPs in the US in 2009, and examined cross-state correlations, difference tests, and multivariate models. The results suggest the existence of environmental injustice in the formation of CWMP (i.e., more likely in White and high-income communities), and perhaps that US EPA programs that encourage CWMP formation unequally target and promote the programs.

## PEG-C, Environmental Sociology and Moving Beyond the Treadmill

Above, we have examined the origin of green criminology and its concepts, and focused attention primarily on political economic green criminology. As noted, PEG-C and green criminology are both overlooked within the discipline of criminology. PEG-C is avoided due to its political economic orientation, and we have suggested elsewhere that other forms of green criminology tend to be overlooked because criminology is a quantitatively oriented discipline while much of the green criminological literature is qualitative (Lynch et al., 2017a). To address these issues, we have personally been engaged in numerous studies that have laid the foundation for green criminology, tested our arguments, and developed a perspective that has, in recent years, drawn our approach much closer to environmental sociology than was previously the case. Indeed, we would argue that the theoretical and empirical studies we have undertaken over the past several years has moved us away from criminology—even green criminology—and more fully into the field of environmental sociology.

That is, hopefully, a good thing as we believe environmental sociologists can make significant contributions to the further development and application of green criminological research. In the remainder of this section, we provide some discussion of how we believe environmental sociologists and sociology can contribute to the further development of green criminology.

### Exploitation

PEG-C criminology has not elaborated on one of the key observations in environmental sociology—namely that the inherent contradiction between nature and capitalism, which describes capitalism's persistent consumption and exploitation of nature as a necessity for the expansion of capitalism. Building on observations made by Marx, Foster (1997, 1999, 2002) draws attention to the fact that the process/expansion of capitalism requires the dual exploitation of nature and labor. This observation also draws attention to the ways in which these forms of exploitation are promoted by unequal ownership of and access to nature/natural resources, unequal ownership of the means of production, and methods of organizing and exploiting human labor for the extraction and modification of raw materials. These processes are important parts of the world capitalist ToP, and take advantage of international exploitation of the global labor, wage and raw material markets (Jorgenson & Burns, 2007; Kick & McKinney, 2014). The structure of this global system of labor-nature exploitation is linked to the global hierarchy of nations and the locations of nations in a core-periphery/developed-underdeveloped framework useful for understanding the flow of natural resources, which can be described relative to their effects on ecological withdrawals, production/ecological additions and consumption across nations. Here, PEG-C can help green criminologists expand their conceptualization of the definition of green crime, and better explain how ecological disorganization produces green crimes (Lynch et al.,

2013). Expanding the understanding of green crime in this way, we suggest, would allow for reinterpretations of behaviors that constitute green crimes in ways that hopefully open up further empirical studies as illustrated by environmental sociologists (Clausen & Clark, 2005; Jorgenson, 2012; Jorgenson & Clark, 2011; Shandra et al., 2009a, 2009b, 2009c). Addressing this link also requires expanding discussions of metabolic rift and ecological unequal exchange.

## Metabolic/Ecological Rift

The theory of metabolic/ecological rift, particularly as developed by Foster (1999) and Clark and York (Clark & Foster, 2009; Clark & York, 2005; Foster et al., 2011), well known in environmental sociology, has rarely been brought into discussions of green crimes and justice. References to metabolic rift arguments only appear in PEG-C, and there its use has been limited and awaits further exploration. One might imagine that Foster's (1999: 379) argument that metabolic rift involves the "robbery" of metabolic materials from nature through the process of ecological withdrawals might attract greater attention and promote new ways of conceptualizing and studying green crimes and injustice. Since the concept of metabolic rift is about the production of raw materials through the labor supplied by nature, the transfer (exploitation) of nature's labors, and the ecological disorganization of nature through ecological withdrawals (in particular, those related to acts such as deforestation, oil, natural gas and coal extraction), this theory opens up a vast array of areas for study with respect to the field of green criminology. In environmental sociology, there is a tendency—which is quite consistent with Marx's analysis—to describe processes related to metabolic rift as forms of exploitation, and we are not suggesting that this kind of description is inappropriate. However, as Foster suggests, and consistent with PEG-C, it is also useful to describe the processes that generate the metabolic as forms of crime and as injustice—that is, as crimes where the victim is nature. Developing that view further could, for instance, promote richer interpretations of agricultural/biotech/food crimes that have been brought into the green criminological literature by Walters (2004, 2005, 2007). Following metabolic rift analysis and various studies in environmental sociology and in the natural sciences, studies of over-exploitation of the soil in less developed nations, fertilizer/pesticide use/production/pollution, the fertilizer/pesticide industry and soil science itself, mass food production, the global nitrogen/phosphorus cycle, and other examples of the exploitation of nature and the redistribution of ecological withdrawals of metabolic materials can be framed as PEG-C issues of concern. These studies should also explore how adverse consequences associated with metabolic rift produce related harms that constitute green crimes including encroaching on planetary boundaries, effects on plant and species diversity, and human health. Moreover, as Foster and Holleman (Foster & Holleman, 2014, see also, Foster et al. 2011) have suggested, concepts in the theory of metabolic rift can be tied to theories of physics and energy analysis and theory, creating the possibility for describing the production of entropy as a form of green crime affecting the stability of nature. These various arguments require better integration with the kinds of ToP approaches that have been employed to date within PEG-C.

## Ecologically Unequal Exchange

Within sociology, numerous kinds of analysis and traditions that are ignored within criminology have played a role in shaping environmental sociology. For example, discussions of ecological imperialism, dependency/development theories, under-development theory, unequal economic exchange, world-systems theory, and of course, Marx's theory of capitalism and the labor theory of value—among other theories—have been incorporated into various theories and studies in environmental sociology (Foster & Holleman, 2014). While any of these ideas can be elaborated and connected to PEG-C, here we draw attention to ecologically unequal exchange (Jorgenson,

2006). One reason for drawing attention to EUE has to do with its ability to address some of the founding global issues defined as central to green criminology (Lynch, 1990). Another is that EUE theory also contains a discussion of an empirical measure of the relationships between nations that might become useful for testing hypotheses about green crime/justice generated by PEG-C. For instance, as Jorgenson argues, economic relationships between nations establish trade dependency, with some nations benefitting from and some nations being exploited by those relationships. As he has illustrated (Jorgenson, 2003, 2004, 2005), these trade relationships contribute to the pattern of ecological consumption and waste production across nations, including the externalization of pollution and ecological disorganization/destruction by developed nations. This process of externalization of resource extraction, ecological destruction, production and waste generation makes it appear as if less developed nations are driving the ecological crisis when, in fact, the problem remains the economic trade and consumption systems organized to promote the continued consumption behaviors of developed nations. In addition, he argues that this process is facilitated by constant expansionary tendencies of the global ToP, which allows developed nations to employ EUE to externalize ecological disorganization, increase domestic ecological protection, and reduce domestic ecological disorganization over time (Jorgenson, 2006: 688–690). Aspects of this argument have been tested by green criminologists employing carbon emissions and trade data with the US (Stretesky & Lynch, 2009a).

From the above, EUE allows conceptualization of the flow of ecological exchanges in relation to ToP and metabolic rift analysis, and would contribute to a broader PEG-C understanding of the global nature of green crime and injustice. This is, we would argue, an important observation to the extent that green criminology originated from political economic observations about green crime in a global context. While some forms of green criminology claim to draw attention to the global nature of this problem, they—unlike a political economic approach—lack a theory of world relations to frame the explanation of green crime/injustice.

## International Issues: Human Rights, Environmental Justice and Indigenous Peoples

Green criminology is a small field, and within green criminology, few researchers attend to political economic explanations. This leaves much ground uncovered with respect to the PEG-C approach, and the opportunity for numerous research projects. For example, there are no PEG-C studies related to international environmental law, or on most environmental rights/human rights issues that intersect with the environment, or on international environmental justice concerns. The exceptions here included studies that have examined: political economic critiques of situational crime prevention theories applied through, for instance, United Nations' environmental policies and programs (Lynch et al., 2018a); and the killings of Indigenous/Native environmental activists (Crook & Short, 2014; Crook et al., 2018; Lynch et al., 2018b).

## Conclusion

This chapter provided a brief overview and history of green criminology, now almost 30 years old, and in particular its political economic origins and more recently efforts to connect green criminology to treadmill of production theory and ecological Marxism. This historical path illustrates how PEG-C has increasingly turned toward environmental sociology. Through this integration between key green criminological and environmental sociological concepts and perspectives, we believe green criminology is now on stronger theoretical and empirical footing. Similarly, it is our belief that environmental sociology can benefit and grow through a closer relationship with green criminology. In this spirit, we suggested a few of the many possible areas where environmental sociologists could help in the development of PEG-C including, exploitation,

metabolic/ecological rift and ecological unequal exchange. In the end, both PEG-C and much of environmental sociology study the effects of capitalism on the environment, and we hope these two areas can continue to learn from one another and become better integrated. There is a great deal of research that remains to be done, and we in particular welcome environmental sociologists to the PEG-C project.

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# War and the Environment

18

Michael R. Lengefeld, Gregory Hooks, and Chad L. Smith

## Introduction

Sociologists have examined violence in many different forms across macro and micro levels of analysis (Collins, 2008, 2009). The forms of violence implemented by highly coordinated organizations and institutions—such as war and organized crime—are our central concern in this chapter.[1]

[1] Political violence is the focus of many academic specialist fields, and the lack of a coherent conceptual and operational definition is problematic. Shaw (2009) makes the case that war is the archetype of political violence and that analytical clarity is gained by conceptualizing other forms of political violence (e.g., revolution, terrorism, and genocide) in relation to war. "It is in war that violence has been broadly legitimate for thousands of years, and as states have tended to monopolise [sic] legitimate violence, the contrast between the legitimacy of international war and the illegitimacy of violence in a domestic context has grown…" (Shaw, 2009: 100). We therefore limit our discussion and do not include important literatures such as green criminology (see Lynch et al., 2018; South & Beirne, 2006; Stretesky & Lynch, 1999; White, 2010).

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The relationship between warmaking, state formation, and organized crime has an important place in historical and political sociology (Tilly, 1990), but there remain large blind spots in political sociology in terms of warmaking and militarism (Hooks & Rice, 2005). Similarly, there is a lack of sustained attention to the comparative impacts of militarism and organized violence on the environment (Clark & Jorgenson, 2012; Hooks & Smith, 2005; Jorgenson et al., 2012). This chapter considers how prominent environmental sociology theories investigate environmental degradation and inequality in relation to warmaking and large-scale organized violence.

In its early years, environmental sociology all but ignored conflict and war. A growing line of research has begun to fill this gap over the last quarter-century, but much important work remains (Clark & Jorgenson, 2012). Ecosystems are destroyed by militarization "… numerous times and at numerous levels including extraction, production, distribution, testing, transportation, disposal, implementation, and reconstruction" (Gould, 2007: 333). Environmental sociology's contribution to understanding this problem can be solidified by addressing the blind spots within sociological research and pursuing interdisciplinary connections. Similarly, while the last half-century has seen important progress in the historical and sociological study of warfare, critical tasks remain unresolved. Kestnbaum (2005: 249) observes that "Left largely unaddressed… is whether war has an



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internal logic or structure that may vary in sociologically significant ways. Never asked is how warfare actually works." The incomplete and uneven study of war has left blind spots and discontents in environmental (and political) sociology.

## The Historical Transformation of War and the Environmental Scars of War

Violence has been documented in human societies since the first recorded history. Recently, the spirited interdisciplinary debate over the decline of violence in the contemporary era has become a focus of media attention (Horgan, 2015). Historical sociologists point out that this debate is over 150 years old and that theories of war and violence have been dominated by liberal optimism (Mann, 2018). This liberal optimism is embodied by the argument that violence and war are declining, which often cites empirical evidence found in the frequency of interstate conflicts and the contraction in the number of combatant deaths in wars that do occur (Pinker, 2013; Goldstein, 2011; Gat, 2006). A powerful riposte to this claim comes from academics who point out that war and violence have transformed rather than declined (Hooks, 2017; Kaldor, 1999; Mann, 2018; Shaw, 2012, 2009; Smith & Lengefeld, 2019).

Collins (1974) offers insight into one dimension of the change in warfare. Specifically, the contrast between ferocious and callous cruelty underscores the impersonal and bureaucratic form of violence that frequently characterizes modern institutions and the emerging forms of warfare. Vicious battles fought in close proximity with sword and spear typify ferocious violence, where ferocity was a virtue of the warrior; many modern military warriors strike enemies they cannot see with laser-guided bombing technology and long-distance weaponry, where the calculus of bureaucratic indifference can effectively insulate perpetrators of violence from their victims (Mann, 2018). Whereas the ferocious strand of violence is far less pronounced at present, the potency of contemporary weapons and the callousness of contemporary wars sustain widespread human rights abuses and profound damage to the environment.

Hooks and Smith (2005) provide a preliminary overview of the impact of warfare on the environment throughout human history. Environmental degradation is generated by the processes of warfighting (such as organized violence that targets humans, built infrastructures, and the environment) and warmaking (the extraction, production, testing, waste management, transportation, storage, maintenance, and deployment activities carried out in preparation for war). In the ensuing section, we provide a brief overview of these linkages since the Industrial Revolution and highlight these connections for the United States.

### Revolutionizing Industry and Warfare

It is beyond the scope of this chapter to provide a full accounting of the environmental footprint and legacy of warfare over the course of human history. These linkages grew precipitously as nation-states became the dominant political and military organization in the modern world (Tilly, 1990) and the many transformations flowing from the Industrial Revolution—or more precisely with the fusion of industrialism and militarism (McNeill, 1982; see also van Creveld, 1989). An incomplete listing of the environmental consequences of industrializing would include the following. First, industrialization contributed to a dramatic increase in the number of troops deployed, coordinated and actively engaged in combat. In twentieth century wars, millions of troops were deployed. Simply provisioning and transporting such large concentrations caused localized pollution and required industrial output, with attendant pollution. Moreover, transporting troops was energy intensive (with all of the attendant pollution)—and at a time of war—speed is prioritized over fuel efficiency or environmental damage. Arguably, the preceding simply refers to a dramatic increase in the scale of armies and navies, with the environmental impacts roughly similar to large-scale civilian activities. The second consequence of industrializing warfare points to

warfare's unique destructiveness. As Mann (2006) emphasizes, military power is authoritarian and deployed to kill and coerce people. Whereas commercially oriented competition among firms *might* lead to profound environmental damage as the side effect of economic competition, military competition *can and does* set in motion the deliberate degradation of the environment to achieve military objectives.

Over the past 200 years, this has extended to mobilizing industry and science to perpetrate ecocide—destroying the natural environment in the belief that doing so will destroy the enemy's morale or deprive natural resources needed by adversaries. Grisly examples include the use of chemical weapons (World War I, Iran-Iraq War, and twenty-first century Syrian Civil War) and indiscriminate use of herbicides during the Vietnam War and in recent efforts to suppress cocaine in the Andean region (Frey, 2013; Hooks & Smith, 2005; Smith et al., 2014, 2020). As Gould (2007: 331) has observed, "militarization is the single most ecologically destructive human endeavor."

The organized violence of the twenty-first century and the environmental damage resulting from war are not exclusive to nation-states. On the contrary, globalization has facilitated the emergence of other forms of warfare. Revolutionary groups, terrorist networks, and other armed groups have utilized organizational growth to extend their capacity for violence (Malešević, 2017). "New wars" (Kaldor, 1999, 2013), fought by irregular forces and spurred by conflicts of state fragmentation, are steeped in identity politics and "asymmetrical warfare" (Shaw, 2012; Smith & Lengefeld, 2019). War has long held a central role in the transformation of states and societies. It is the archetype of 'political violence,' where the tendency has been for states to monopolize legitimate violence in international conflict while enforcing the illegitimacy of violence within their own borders in economic, cultural, and familial relations (Shaw, 2009). In the contemporary era, various groups engage in political violence to capture power or challenge existing networks of power—and this can have marked environmental impacts.

## The Environmental Legacy and Ongoing Threat Posed by U.S. Militarism

The United States has long been the world's hegemonic military power. We present a case study of the United States to highlight the historical trends discussed in preceding paragraphs and to shed light on the socio-environmental threats posed by militarism within a contemporary context.

Since its founding, the United States displayed a callous disregard for human rights (at least as defined by twenty-first century standards) and a willingness to damage local ecosystems to achieve military goals. Over decades and across the continent, the United States waged formal and informal wars with the Indigenous people of North America. In so doing, it "accepted, legitimized, and encouraged attacks upon and the destruction of noncombatants, villages, and agricultural resources" (Grenier, 2005: 23). These assaults on entire societies were undertaken to "destroy the will of the enemy people or their capacity to resist, employing any means necessary but mainly attacking civilians and their support systems, such as food supply" (Dunbar-Ortiz, 2015: 58). These wars were waged by: formal military units, militia (with varying levels of formal coordination), and "irregular" armed forces. Throughout the eighteenth and nineteenth centuries, armed European settlers committed atrocities with impunity. These wars, land confiscation, forced migration, and assault on natural resources available to Native American people combined to genocidal effect.

Thornton (1990) estimates that the Native American population fell by more than 90% between 1492 and 1900. While a significant portion of this decline was not deliberate (e.g., the horrific toll caused by Old World diseases), war and environmental devastation exacerbated and intensified these processes. The lethality of encounters between European settlers and Native Americans varied over time and across places. In nineteenth century Texas and in northern California, "there was blatant genocide of American Indians by non-Indians" (Thornton, 1990:

49). Even in the absence of calculated genocide, the United States deliberately destroyed "the flora and fauna that American Indians used for food and other purposes" (Thornton, 1990: 51). In the late nineteenth century—amplified by industrialization, train transportation, and surging settler populations—the near extinction of the American bison provides a vivid example. Genocidal wars and destruction of vital plants and animals were accompanied by forced migration and relocation (a near-complete ethnic cleansing of the eastern United States). The United States did not simply conquer and settle North America, it altered ecosystems and pursued a policy of ecological imperialism—from the Atlantic to the Pacific (Crosby, 1986; see also McNeill & Painter, 2009).

The links between environmental degradation and warmaking would intensify as industrialization gained strength and as the United States became the world's leading military power. Military demand for iron and steel grew nearly 400% from 1892 to 1919 as the United States pursued territorial expansion, built a formidable navy, and established a growing archipelago of overseas bases. There were profound—if indirect—consequences of the fusion of militarism and industrialization. During World War I, the American military developed expertise in chemical weapons, and afterward this knowledge was applied to warfare against insects, combined with the new technology of airplanes and the pioneering of the practice of "crop dusting" in the 1920s. McNeill and Painter (2009: 19) argue that the ecological implications of this military-driven development were profound: "This inaugurated a new era in American croplands and their waterways, one in which chemicals—and evolved resistance to them—became a determining factor in the evolutionary success of plants and animals generally and of insects in particular." Significantly, control of oil also became a central concern of military planners in the buildup to World War I as the motorization of warfare spurred automobile and aircraft production (McNeill & Painter, 2009).

During World War II, the U.S. military harnessed science and industry to develop and deploy incendiary bombs and DDT. In 1941, when Pearl Harbor was attacked, the American military had no incendiary bombs; by 1945, they had mass-produced a quarter billion of them (McNeill & Painter, 2009). The human toll and urban destruction from incendiary bombs far outweighed the destruction of the two American nuclear weapons dropped on Japan (McNeill & Painter, 2009). The highly effective but toxic chemical DDT was widely deployed in the Pacific theatre to combat malaria and typhoid-bearing mosquitos (McNeill & Painter, 2009). The chemical bioaccumulates up the food chain in local ecosystems and has been identified in animals thousands of kilometers from the point of application (Opie, 1998).

Since World War II, nuclear weapons have posed an existential threat to human life and to the environment. Nuclear weapons development came to replace colonialism as a globalized structure through which nation-states were organized by a stratified hierarchy (Hecht, 2011a, 2011b). The United States has led the world in the development and deployment of nuclear weapons. The "national sacrifice zones" (Kuletz, 1998, 2001) that house facilities constructed to build, test, and store nuclear weapons are disproportionately on or adjacent to Indigenous peoples (Taylor, 2014) and continue to cause multiple legacies of environmental injustice, including environmental contamination, abandoned mines, cancer clusters and other public health outcomes (Malin, 2015). Throughout its Cold War competition with the USSR, the United States aggressively expanded the size and lethality of its nuclear arsenal. And in so doing, the environmental damage and the risk posed by the U.S. nuclear weapons complex expanded exponentially. The severity of environmental consequences (and risks) grow in tandem with the technological complexity of nuclear weapon systems (Lengefeld, 2018), as described below:

> The U.S. nuclear arsenal also grew dramatically from roughly one thousand warheads in 1953 to approximately eighteen thousand by 1960. Although the United States began to reduce the size of its conventional forces and slow the rate of production of nuclear warheads in the 1970s, each

> new generation of weapons possessed more destructive power, consumed more energy, and had a greater environmental impact (McNeill & Painter, 2009: 20).

The radioactive and toxic substances created for this effort are some of the deadliest substances known to humans, and elements such as plutonium have a half-life of 500,000 years—much longer than any known human civilization has survived. The pursuit of particular nuclear technologies and the commitment to paths of development (or underdevelopment) that generate these substances is a technopolitical decision. These technopolitical decisions are driven by forces operating across numerous spatial, temporal, and political scales (Brugge et al., 2006; Hecht, 2011a, 2011b, 2012; Keeling, 2010; Schmid, 2011).

Even as the total number of warheads has been reduced, the complexity and destructive power of these weapons have increased exponentially. The weapons systems designed and built in the second half of the Cold War emphasized thermonuclear technology, which itself is thousands of times more destructive than the fission bombs dropped on Hiroshima in World War II. A poignant description of this capacity comes from former U.S. Attorney General Ramsey Clark:

> Clark: "We still have twenty-two commissioned Trident nuclear submarines which are first-strike weapons. Any one of those submarines can launch twenty-four missiles simultaneously. Each of those missiles can contain as many as seventeen independently targeted, maneuverable nuclear warheads. And each of those warheads can travel seven thousand nautical miles and supposedly hit within three hundred feet of its predetermined target. If we fire them in opposite directions, we can span fourteen thousand nautical miles: halfway around the world at the equator. This means we can take out 408 centers of human population, hitting each with a nuclear warhead ten times as powerful as the bomb that incinerated Nagasaki."
>
> Question: "This is all from one submarine?"
>
> Clark: "One submarine" (Jensen, 2001).

E.P. Thompson (1982) argued that the Cold War arms race crystallized a dynamic of 'exterminism' in the United States and the Soviet Union, where geopolitical and existential competition drove the manic escalation of nuclear arms races. The general lessons to be drawn from research on the relationship between war and the environment are clear: state warmaking programs have recast the ecology of the homeland in the process of war preparation and warfighting, and the extent of ecological transformation in the case of the United States is intricately linked with the global projection and inertia of American military power.

## Lessons from Environmental and Military History

Research from military history and environmental history has documented the relationship between warfare, society, and environmental change (Closmann, 2009). One critical lesson is that environmental concern is not always subjugated to geopolitical conflict; the demands of the warmaking state do not unilaterally supersede environmental conservation efforts in each instance. In the domestic sphere, popular protest and civil disobedience can undermine national warmaking efforts and provide a check on the expansionary logic of military institutions. The social institutions and historical contexts of a society are not always hospitable to an arrangement where military organizations degrade the local environment, and this can be the case even in the extreme circumstance of multilateral interstate warfare. One striking example comes from the Nazi Regime's efforts to develop the Wutach Gorge for energy production during World War II. Uekötter (2009) challenges the link between the racist ideology and ambitious conservation policies of Nazi Germany, showing that social concern and bureaucratic conservation efforts secured the preservation of the Wutach Gorge despite wartime demands for expanded energy production. He notes that "despite the abnormal circumstances that prevailed, environmental practices remained remarkably stable—normal environmental protection, or an attempt at such, during abnormal times" (Uekötter, 2009: 106). Thus, historical contingency and social and cultural specificity have significant implications for

environmental change in the context of violence. As Closmann (2009: 5) concludes, "... it is too simplistic to say that warfare always shifts bureaucratic priorities away from environmental concern." Violent organizations and their schemas of appropriation will vary relative to historical and social forces and the biophysical context from which these organizations emerge.

## The Post-Cold War Study of Violence and the Environment

The study of violence and the environment has developed in several directions since the end of the Cold War. Following the collapse of the Soviet Union, state policymakers and researchers sought out new configurations for understanding security in the post-Cold War era, and the concept of "environmental security" became prominent (Matthew, 2002). The U.S. National Security Strategy of 1991 marks the first formal U.S. recognition of the relationship between international instability and environmental degradation (Peluso & Watts, 2001). Since then, a spirited debate over the usefulness of the environmental security concept has driven research on violence and the environment. Political scientist Homer-Dixon (2001) has been a central figure in the research on "environmental security", which has been the foundation for political discourse and policy intervention (Peluso & Watts, 2003). Political ecologists and social scientists authored several critical responses to what many argued was a neo-Malthusian recasting of national and international security in the context of an increasingly globalized, stratified, and resource-scarce world rife with environmental degradation (Peluso & Watts, 2001). The remainder of this section examines this debate among environmental security and political ecology perspectives.

The fields of environmental security and political ecology have been at the center of a prominent debate over the causes of environmental violence. The early environmental security work of Homer-Dixon (1999) and Kaplan (1994) was particularly influential in international policy circles, and the concept of environmental security became an arena for the merging of transnational military, intelligence, and defense industry objectives (Matthew, 2002). Political ecology has its origins in the 1970s when the term was offered "...as a way of thinking about questions of access and control over resources (that is to say, the toolkit of political economy), and how this was indispensable for understanding both the forms and geography of environmental disturbance and degradation, and the prospects for green and sustainable alternative" (Peet & Watts, 2004: 6). Scholarship in these fields brings into focus a central debate about the relationship between violence and environmental change.

The work of Homer-Dixon and Robert Kaplan is the most politically influential and perhaps the most controversial work coming out of the field of environmental security. Kaplan, a staunch supporter and defender of Henry Kissinger's realpolitik (Kaplan, 2013), draws heavily from Homer-Dixon's research. He argues that "future wars will be those of communal survival, aggravated or, in many cases, caused by environmental scarcity" (Kaplan, 1994: 1). Although environmental security research has developed considerably beyond this work in its contribution to the understanding of environmental change and conflict (Matthew, 2002), the central underlying claim of the most influential work by Homer-Dixon and Kaplan points to population growth and environmental scarcity as central forces. Political ecologists responded to the neo-Malthusian arguments presented by Homer-Dixon and Kaplan through a series of interdisciplinary retorts that challenged the resource scarcity-driven narrative of ecological violence. In *Violent Environments*, Nancy Peluso and Michael Watts (Peluso & Watts, 2001) and other authors critiqued Homer-Dixon's logic of environmental security in terms of its focus on environmental scarcity and population growth, subjects that preoccupied much scholarship in environmental security. Perhaps the most potent critiques of these research programs challenge their connections with the national military and intelligence agencies, and the readiness of these agencies to embrace the recasting of security doctrine under the banner of environmental security.

Political ecology provides crucial insights into environmental degradation and violence by challenging the dominant environmental security narratives regarding population pressure as the central force driving resource scarcity and the mismanagement of environmental resources, underscoring instead that poverty is a central force in environmental degradation. Early scholarship often drew from Marxist and neo-Marxist social development theory and relied on analytical tools that emphasize land management in the context of multi-directional causality, links between local decision-making and spatial or regional accounts, and elements of the global political economy—but the field itself has often lacked a coherent theoretical stance (Peet & Watts, 2004). Critics of this work charge that much scholarship in political ecology is biased, endorses green romanticism, and falls to the fallacy of begging the question (Vayda & Walters, 1999), although Peet and Watts (2004) offer a thorough retort and observe that the field has turned its focus to issues of knowledge, power, practice, politics, justice, and governance.

The major lessons to be garnered from this debate center on the dynamic interplay of violence and environmental conditions. Important voices in environmental security literature remain focused on the ways that conflicts are triggered by environmental disruption (Baechler, 2010), and this research is important for coming to terms with resource-driven conflicts. But this focus obscures attention from the myriad forms of state-sanctioned violence in *developed* societies that degrades the environment and poses threats to the security of the global ecology. The collected works in Peluso and Watts (2001) demonstrate that there are numerous forms, tactics, and repertoires of environmental violence, and natural resource extraction is only one means by which state and non-state actors damage the environment in the pursuit of geopolitical or economic objectives. Moreover, we draw attention to the environmental security argument that environmental social movements can utilize the language of "security" to align themselves with military and intelligence agencies to challenge anthropogenic global environmental change (Matthew, 2002). The military and intelligence agencies' embrace of the environmental security logic occurred in parallel with the force of neoliberal globalization in the 1990s. Keen observers might also note that state complicity and tolerance of violence against environmental justice activists has reached unprecedented levels in the twenty-first century (Watts & Vidal, 2017). This phenomenon spans the developed and underdeveloped world, and many salient and high-profile examples suggest the dubiousness of this claim (Blitzer, 2016; Skalicky & Davey, 2016; Wong & Levin, 2016). The large focus given to economic forces in driving environmental change cannot be ignored. But as environmental and military history demonstrate, national militaries can have unique relationships with the environment.

## Treadmill Theories

Informed by historical trends in warmaking and its impacts (see above), environmental sociologists have examined contemporary dynamics. The treadmill of production theory is a cornerstone in environmental sociology (Buttel, 2004, 2010; Gould et al., 2008). This line of research emphasizes the logic of economic growth and the corporate pursuit of profit that accelerates environmental degradation, providing a foundation for theorizing the existence of treadmill dynamics driven by other social institutions such as the military. The treadmill of destruction theory argues that environmental destruction can be generated by the inertial growth dynamics of national militaries and militarism (Clark et al., 2010; Hooks & Smith, 2004, 2005). This military-driven growth dynamic is not a derivative of the relationship between the military and the economy (Clark & Jorgenson, 2012). The structural dynamics of militarism and the geopolitics of arms races accelerate environmental inequality in a qualitatively distinct way that cannot be reduced to capitalism, although there is potential for synergy among multiple treadmills (Smith et al., 2014, 2020). These approaches are unique in their explanations of environmental degradation, but they are complementary in their

use of the treadmill image to highlight human activities that stress—and may surpass—the capacity of the environment.

The broader treadmill theoretical tradition highlights the callous violence against the environment carried out by states and corporations. The original work on the treadmill of destruction examines the American military and its connections to environmental harm and inequality. Hooks and Smith (2004, 2005) identify the contingent convergence of Indigenous conquest and the institutional growth of the Pentagon as an explanation for the highly disproportionate siting and proximity of noxious military activities near Native American reservations. During the 18th and 19th centuries, the ferocious violence of conquest and genocide concentrated Native Americans in Western states, while the latter half of the twentieth century saw the emergence of the Pentagon and the drastic expansion of technologically sophisticated and resource-intensive forms of warmaking. Often, these activities contaminated and sacrificed the western lands on which Indigenous populations had been forcibly resettled (Kuletz, 1998, 2001). The history of coercive geopolitical and polity relations between the American government and Native Americans has left Indigenous peoples most exposed to the human and environmental health risks posed by the consequences of warmaking. Thus, "Historical coercion, geopolitics, and the arms race give the treadmill of destruction distinctive expansionary characteristics" (Clark & Jorgenson, 2012: 562). This has had unprecedented environmental consequences.

## Geopolitical Competition and Treadmill Dynamics

From the treadmill of destruction perspective, geopolitics and military action are used to secure political goals, which often include securing natural resources, and these processes have broad social and environmental consequences. The assertion is that a distinct logic of geopolitical competition and arms races expand militarization through technological prowess while exacerbating environmental destruction (Hooks & Smith, 2004, 2005; Jorgenson et al., 2010, 2011, 2012). Technical sophistication in weaponry provides a decisive military advantage, and this advantage supports increased investment in weapons technology that has steadily increased in environmental lethality. A large body of cross-national and case-based empirical research supports the treadmill of destruction theory. This research provides important insights and clarifies the significance of environmental sociology's contribution to the study of war and the environment.

Concern over the environmental impacts of warmaking has penetrated interdisciplinary and global research on the anthropogenics of global climate change (Rosa et al., 2015). Still, the scholarly literature has heavily emphasized economic institutions and processes as major contributors to issues such as climate change, while largely ignoring the military (Jorgenson, 2015; Jorgenson et al., 2012). Building upon the original ideas posed by Hooks and Smith (2004, 2005) much of the research in this area has been global in scope, greatly expanding the theoretical and empirical understanding of these relationships. Quantitative cross-national longitudinal research on the dynamics of treadmills has emphasized their embeddedness and interaction within the global economic arrangement and international polity. These studies introduce several important points of emphasis that explain how the treadmill of destruction drives environmental degradation: (1) the historical transformation of warfare and warmaking technologies; (2) the global structure of international trade and a nation's positioning within that structure relative to its military power; and (3) the dynamic interplay of economic and military institutions.

The argument that states pursue technological prowess in warmaking to secure geopolitical goals and maintain access to critical resources is central to the treadmill of destruction theory. This point is prescient given the historical transformations in warfare that occurred after 1945 (Kaldor, 1999, 2013; Mann, 2018; Shaw, 2002, 2009, 2012). The first two world wars were characterized by the mass industrial production of

armaments and large deployments of troops to the theatre of war. Modern warmaking is characterized by resource-intensive and baroque technologies of war that direct the attendant risks of war—casualties and environmental and human health risks—away from the homeland and its troops, what has been termed "asymmetric war" and "risk-transfer militarism" (Clark & Jorgenson, 2012; Hooks & Smith, 2012; Shaw, 2012). While the consequences of twentieth century warfare have been analyzed extensively, the consequences of asymmetric war are less clear (Smith & Lengefeld, 2019). The "Revolution in Military Affairs" of the 1990s played a dramatic role in the global transformation of warmaking and warfighting, and military organizations are compelled to maintain parity with competitors by upgrading platforms of warfare (Chapman, 2003; Ibrügger, 1998). For environmental sociologists, the scant attention given to the issue is also partially attributable to data limitations. Cross-national empirical analysts have noted that a measure of *total military expenditures* does not properly capture the impact of military technological power on per-capita ecological footprints (Jorgenson, 2005). Environmental sociologists have built upon innovations in political sociology by incorporating measures of *military participation* and *military expenditures per soldier* to capture the high-tech and resource intensive characteristics of militarism (Jorgenson, 2005; Kentor, 2004; Kentor & Kick, 2008). Incorporating measures of military expenditures per soldier draws attention to the variations in the way militarism manifests and impacts the environment in developed and lesser developed countries.

This body of cross-national research shows that the capital-intensiveness of military institutions drives consumption-based environmental impacts, and these effects are driven by both economic development and military technological power (Clark et al., 2010). Jorgenson (2005: 394) finds that "... capital intensity, export dependence, and military technological power are structural driving forces of per-capita natural resource consumption." Economic and military institutions in powerful nations consume larger amounts of natural resources than their counterparts in the lesser developed world, and powerful nations utilize their economic and military power to externalize some of their environmental costs to lesser developed countries, simultaneously suppressing resource consumption in those societies (Jorgenson & Clark, 2009).

There is a clearly bifurcated environmental impact from the military for developed and lesser developed countries. In an analysis of 126 nations from 2000–2010, researchers found a significant impact of military expenditures per soldier on carbon emissions in both developed and lesser developed countries; the impact was positive in the developed countries and negative in the lesser developed countries, and this effect holds when accounting for two global economic recessions (Smith & Lengefeld, 2019). The impact of militarism on per capita carbon dioxide emissions from 1960 to 2014 shows that the relationship is indeed moderated by a nation's level of economic development, but that this relationship intensified after the 1990s (Bradford & Stoner, 2017). Overall, this body of research consistently finds a strong and statistically significant impact of military expenditures per soldier in the developed countries—a measure of high-tech military spending. In other words, both military and economic institutions are central to a dynamic of ecologically unequal exchange but capturing the variation across the developed and lesser developed world requires attention to the historical forms of warmaking that predominate.

The effects of militarization on the environment are similar in studies that utilize carbon emissions, emissions per capita, and total or primary energy consumption as the dependent variable. Yet different types of warmaking generate different environmental effects, and they vary by the historical and social context. Whereas increasing militarization drives carbon emissions, it has also been established that demilitarization effectively reduces carbon emissions. In the context of de-modernization and peripheralization in the former Soviet Republics, York (2008: 385) finds that

militarization is positively associated with carbon emissions, noting that this effect

> . . . is remarkable in light of the fact that this is independent from the overall size of the economy, total government expenditures and other structural factors, as well as democratization. The finding, thus, indicates that the military is particularly carbon intensive, and that other structural factors do not adequately capture its influence on the environment.

Research focusing on nuclear weapons—the pinnacle of resource-intensive and baroque military technologies—also suggests the unique implications of different types of warmaking. Nuclear weapons possession is consistently and powerfully associated with higher levels of carbon emissions, and civilian nuclear energy fails to provide enough efficiency to offset other sources of carbon emissions (Lengefeld & Smith, 2013). In terms of sustainable energy development, civilian nuclear energy does not appear to provide a viable path forward to a carbon-neutral future. Moreover, few of the benefits and many of the risks of carbon-intensive nuclear weapons programs (and the civilian energy programs tied to them via national security arrangements) are transferred to the global South (Hecht, 2009, 2012), or to the internal peripheries of the global North—such as Native American reservations in the United States (Hooks & Smith, 2004, 2005). For both the inertia of nuclear warmaking developed during the Cold War (Thompson, 1982) and the demilitarization of the former Soviet Republics after the Cold War (York, 2008), the historical transformation in the tensions between war and society is critical to understanding their environmental consequences.

## International Trade and Military Power

The structure of international trade and a nation's positioning within that structure shapes the impacts of national military dynamics. The links between the economy, warmaking, and statebuilding have long been explored by sociologists (Skocpol, 1979; Tilly, 1990). The cross-national research on the treadmill of destruction consistently confirms the major role of economic and military institutions in contributing to global carbon emissions and accelerating environmental degradation through energy consumption (Clark & Jorgenson, 2012; Clark et al., 2010). Controlling for urbanization, population age, and gross domestic product per capita, Jorgenson and Clark (2016) find enduring temporal stability in the magnitude of national militaries' impact on the environment via carbon emissions between 1990 and 2010, and these dynamics are contingent upon a nation's level of economic development. Bradford and Stoner (2017) articulate that these effects are most pronounced after the 1990s. The "Revolution in Military Affairs" (Chapman, 2003; Ibrügger, 1998) and the shift towards risk-transfer militarism by national militaries in the developed world, beginning in the 1990s, coincides with a pronounced increase in national militaries' global environmental impact. Other scholarship has focused on the numerous processes that shape how violence is legitimated in a number of locations and how those processes interact with other structural features of society (Bonds, 2011, 2012, 2016; York, 2008). In the context of international relations and trade, for example, military institutions are also associated with the ecologically unequal exchange relationships involved in natural resource extraction (Downey et al., 2010; Jorgenson & Clark, 2009). Thus, a nation's relative economic and military power translate to its ability to control and channel flows of resources both within and beyond its borders.

Cooperation in the international sphere is significantly and independently shaped by military and strategic considerations, and the environmental impacts are far-reaching. In environmental and political sociology, there is considerable overlap in the challenges of understanding human and environmental rights in the context of war and the environment, which are bound up with issues of development (Givens, 2014; Givens et al., 2016). The study of environmental treaty ratification, such as the Kyoto Protocol, faces many of the same challenges of the study of human rights.

Hooks and Rice (2005: 582) observe that in political sociology

> . . . the study of human rights will require a careful consideration of states and war making. By and large, the transnational effort to expand human rights is directed toward the protection of individuals from the police and military of their home states. Moreover, enforcing human rights requires the existence of a supranational power capable of controlling states. . . we must examine the degree to which states are becoming civilized. If there is evidence of a global civilizing process, the question is if this is largely a cultural process (a construction of a process of rationalization that has a long history) or will there emerge a supranational authority with the power and authority to supervise and discipline abusive states.

While the transnational effort to expand human rights has emphasized the protection of the individual from violent organizations within their own state, environmental treaties such as the Kyoto Protocol aim at reducing global greenhouse gas emissions at the national level.

Reducing global greenhouse emissions requires more international collaboration, but also an awareness of the schisms and hostilities that climate change can create (Giddens, 2009). In the context of world society and global climate change negotiations around the Kyoto Protocol, Givens (2014: 21) finds that ". . . increasing military spending in relation to other national economic measures, and increasing military labor force as a percent of the workforce. . . decreases the chances of ratification." Nations with powerful militaries are driven by a desire for both relative gains and the continuous increases necessary to maintain relative gains—as predicted by the expansionary dynamic of the treadmill of destruction. Givens' research suggests that the drive for relative national gains (in economic and military power) undermines the marginal benefit associated with ties to the international polity and that the military should be studied independently from and in addition to economic power, having important global environmental implications.

## The Dynamic Interplay of Economic and Military Institutions and Treadmills

A central task of sociological research, in general, is to seek variation-finding comparisons across resources or sectors, for example, and for environmental sociologists this task remains critical. For example, understanding the variation in economic and military impacts on freshwater withdrawals is vital to addressing threats to the world's water systems. The challenges to freshwater resources have cascading regional and global effects, such that:

> During the next 10 years, many countries important to the United States will experience water problems—shortages, poor water quality, or floods—that will risk instability and state failure, increase regional tensions, and distract them from working with the United States on important US policy objectives. Between now and 2040, fresh water availability will not keep up with demand absent more effective management of water resources. Water problems will hinder the ability of key countries to produce food and generate energy, posing a risk to global food markets and hobbling economic growth. As a result of demographic and economic development pressures, North Africa, the Middle East, and South Asia will face major challenges coping with water problems. (United States Intelligence Community Assessment, 2012: iii).

Although the U.S. intelligence community assessment points out (accurately) that demographic and economic development will drive water conflict, they don't afford military consumption a central role in this problem. Globally between 1997 and 2001, national militaries were a central structural driver of freshwater withdrawals, while several economic variables (gross domestic product per capita, exports as a percentage of GDP, and manufacturing as a percentage of GDP) were found to be non-significant (Alvarez, 2016). These findings are consistent with Gould's (2007) point that militarization is a central component of the ecologically destructive American lifestyle, and that military production has been geared towards securing American transnational corporations' access to markets and natural resources—oil, for example.

While the analysis of freshwater withdrawal underscores the role of the treadmill of destruction in exacerbating natural resource issues, analysis of the Arctic highlights the synergy among national security agencies and corporations in accelerating environmental degradation. Bonds (2016: 13) articulates the climate opportunism strategy proffered by think tanks with ties to dominant corporations and national security strategists, and "... as the corporate community is calling for an expansion of the military into the Arctic, the U.S. government has developed a strategy to promote increased business activity in the region." Through the lens of the treadmills of production and destruction, this climate opportunism in the Arctic is a schema constructed to secure access to newly exploitable resources in a highly sensitive ecosystem. Bonds (2016) therefore reveals an emerging synergy among a treadmill of production and a treadmill of destruction that will have global geopolitical and environmental implications.

Treadmills do not appear to be restricted to the most powerful states and military organizations, nor are they restricted to specific natural resources such as oil. Historical contingency plays a decisive role in shaping which resources are exploited by a treadmill dynamic, and the organizations which control a treadmill vary by social and cultural context. Cocaine and coca are prominent examples of a resource that is not critical to the functioning of the global economy or geopolitical order; narcotraffickers, paramilitaries, and a range of state and non-state actors finance their objectives through coercive and extractive activities. In the context of the Colombian Civil War, the confluence of treadmills of destruction and production has generated severe human and environmental health consequences in some of the most ecologically sensitive areas of the world (Smith et al., 2014, 2020).

Case-based analysis has been utilized to investigate the treadmill dynamics of oppression and resistance as they manifest locally. Comparing the cases of Camp Lejeune and uranium mining on Navajo land, Sbicca (2012) highlights the implications of treadmill dynamics for the discursive practices of elites and social movement repertoires in varying social contexts. Elites discursively framed the health harms as associated with "homeland security" and used organizational tactics to reinforce their institutional power in resisting health claims. Sbicca draws from social movements literature to find variation in the ways that exploited groups resist the treadmill. He shows that despite a history of imperialism and colonialism, an opening in the political opportunity structure permitted the Navajo a chance to construct counter-hegemonic frames to resist the treadmill of destruction, while military families at Camp Lejeune were often confined to framing grievances through the bureaucratic procedures created by the government to protect the political, economic, and military institutions.

The example of a nuclear weapon—and nuclear arsenals—punctuates the metaphor of the military-driven treadmill of destruction. The ecological damage resulting from these activities cannot be adequately explained by the dynamics of capitalism. Uranium is radioactive, but when processed for a nuclear weapon it becomes exponentially deadlier, in tandem with the volume and toxicity of the waste stream generated by its production. A single nuclear weapon is a nominal geopolitical tool and a devastating weapon of war, and producing one requires a highly coordinated military-scientific-industrial complex and access to uranium. History shows that national leaders will spare no expense—human, more-than-human, or otherwise—to possess a nuclear weapon. The current costs of American nuclear warmaking have dramatically expanded since the Cold War, leading to what the Alliance for Nuclear Accountability (2016) refers to as the "Trillion Dollar Trainwreck." Nuclear arsenals are planned decades in advance of their production. They are amassed through extensive cycles of research, development, and testing; profit has never been a primary incentive and the trajectory of nuclear warmaking is not subject to the will of corporate managers or shareholders (Lengefeld, 2018, 2020). The nuclear weapons-systems possessed by modern militaries are technologically sophisticated, resource-intensive, and generate

unprecedented forms and volumes of waste. The social organizations that control these high-risk technologies are prone to "normal accidents" (Perrow, 1999), and the inherent limits on organizational safety result from high interactive complexity and tight coupling (Sagan, 1995). The inertia of nuclear warmaking—driven by geopolitical competition and arms races—has generated unprecedented quantities and forms of waste.

## The Path Forward

The previous sections detail some of the central scholarly contributions to the study of war and the environment. The body of research on the treadmill of destruction provides critical insights into the accomplishments and challenges that lie ahead for the study of war and the environment. Bradford and Stoner's (2017: 320) panel analysis of military spending and carbon emissions identifies a key challenge, namely that there is ". . . heterogeneity in the extent to which military expenditures exert independent effects on carbon emissions." In other words, a "covering law" approach does not provide a complete picture of the historical contingency, social context, and cultural specificity that are central to the growth of military institutions and warmaking strategies as theorized by the treadmill of destruction theory.

Given its prominence in environmental sociology, it is not surprising that scholars have urged the theoretical and methodological reinvigoration of the treadmill of production theory (Buttel, 2004). We augment Buttel's (2004) call by broadening the task to include consideration of the treadmill of destruction. This advocacy requires theorizing and methodological tools that can successfully come to terms with the environmental consequences of social and institutional power by synthesizing the biophysical and social components of global environmental change (Buttel, 2010; Freudenburg et al., 1995). This approach provides a point of convergence that addresses the shortcomings of environmental and political sociology in the study of war and the environment.

The reification of the state tends to facilitate solutions to environmental inequality that rely on the existing institutional arrangement that perpetuates these very injustices. Moreover, the blind spots of political sociology—the overlap between military and political power and the issue of human rights—are attributed to the reification of the nation-state (Hooks & Rice, 2005). Solutions to the environmental injustices of the warmaking state must necessarily come from outside the established institutional framework, but they must also draw from this context. Often political sociology has analyzed the state, not uncritically, but without fully challenging the state as a purveyor of state-sanctioned violence, both within and beyond one's borders. Pellow and Brehm (2013) argue, convincingly, that environmental sociology in the twenty-first century is uniquely positioned to underscore the role of inequality as it relates to the environment. One pathway for this type of research is for environmental sociology to clearly challenge the role of the state as it relates to violence of all kinds, including violence against the powerless, the have-nots, and the more-than-human. The human and more-than-human victims of environmental injustice are socio-ecologically indispensable in the sense that the future of the Global North is intricately tied to that of the Global South, just as the future of the dominant groups within a society are intimately linked with the future of the most oppressed groups at the margins and internal peripheries of society.

The political violence and callous cruelty that drives environmental inequality is an important and understudied subject for environmental sociologists. Likewise, the political sociological study of violence has largely ignored the environment, and the overlap between military and political power and the issue of human rights remains undertheorized, in part due to political sociology's reification of the nation-state (Hooks & Rice, 2005). In environmental sociology, the reification of the nation-state is also problematic (Pellow, 2018). Thus, environmental sociology can illuminate these gaps in political sociology by incorporating nature into the theorizing around distributional networks of social power and

providing a point of convergence for environmental justice and human rights perspectives. Furthermore, a more critical approach to the nation-state can open up connections to other institutions, such as economic, political, and criminal justice systems, enabling research that provides an understanding of social power across multiple scales and institutional types. We argue that a productive path forward is to focus on ontological asymmetry and the meso-scale of analysis.

A focus on ontological asymmetry and the meso-scale of analysis is consistent with the logic that reality is stratified, has emergent causal tendencies, and that these emergent tendencies are multidimensional because they can exert causal force in both directions towards higher and lower strata of phenomena (Bhaskar, 2010; Carolan, 2005a, 2005b). Whereas much of natural science emphasizes both structure and event in identifying causation, a view that embraces ontological asymmetry and the meso-scale is concerned with structure and process, specifically the structural reproduction of a process (Gorski, 2018). War and warmaking are not nominal events that occur at a fixed point in time and space. They are processes that can develop an expansionary logic of their own, as the treadmill of destruction argues. An environmental sociology perspective on war that embraces this logic and scale of analysis thus seeks explanations that differ from the universal laws found in the natural sciences. In such a formulation, causation is a complex and multiple-conjunctural process that is "generative" because its emergent properties are bounded in space and time (Bhaskar, 1978; Gorski, 2018; Steinmetz, 1998). For the study of war and the environment, a focus on ontological asymmetry and the meso-scale reveals the interplay of history, social structure, and the natural world that drives the environmental impacts of warmaking.

A perspective emphasizing ontological asymmetry and the meso-scale of analysis is consistent with an interpretation of reality as a combination of "stratified, rooted, and emergent" conditions (Carolan, 2005a: 5). Because the social realm is an open system, it is problematic to seek universal or invariant explanations, which have a propensity to relinquish or misconstrue historical processes. The debate over this "ontological rift" has been central to the development of environmental sociology as a discipline and continues to be significant in its potential to elevate the unification of natural and social science perspectives (Foster et al., 2010: 23). The ontological asymmetry among the biophysical and social realms that is a central concern to critical realism, however, it is not reducible to causal asymmetry. The atmospheric, biological, and geophysical processes that constitute the biophysical realm shape Earth's climate and have operated independently of human impacts for millions of years and will continue to do so in the absence of humans. Social and cultural realms are open systems, meaning they rely upon and are sensitive to the emergent processes of the biophysical realm—such as changes in the earth's climate. The natural resources and historical context in which military institutions organize their warmaking is conditioned by these emergent biophysical processes.

This understanding positions the biophysical as shaping the conditions from which human material uses of nature emerge. The ontological asymmetry between the biophysical and the social is detailed by Bhaskar (2010: 12) in his reorientation of critical realism towards the issue of climate change, where the ". . . more basic level provides the conditions of possibility or framework for the emergent or higher order level, as, for example, ecology specifies the conditions of possibility of human material practices." Human activity is clearly transforming the planet in ways that challenge our capacity for a safe operating space in the future (Rockström et al., 2009). But it is the cultural schema that imbues social power upon material resources and instructs how they are used in society (Sewell, 1992). The ontological asymmetry and multidirectional causation typical of Bhaskar's (1978, 2010) perspective offers a powerful tool for addressing these contemporary environmental challenges, and the tensions within environmental sociology. Applying such a perspective to the broader treadmill tradition would highlight the historical and contingent conditions from which a treadmill process

can emerge, reproduce, or dissolve, and the ways that this process mobilizes social power and capital (Steinmetz, 2008; Tilly, 2001). Different forms of social power (economic or military) mobilize environmental resources to reproduce patterns of institutional power using different strategies and schemas. In other words, this approach allows the researcher to specify distinctions and overlaps between treadmills of production and destruction by identifying the historical conditions, social context, and structural factors that drive environmental degradation.

A focus on ontological asymmetry and the meso-scale of analysis opens an avenue of comparative work that can highlight variations across place and time and can help researchers distinguish between a general relationship of environmental degradation and violence, and the outcomes unique to a treadmill, effectively redirecting the study of violence and the environment (Hooks et al. 2021). Kestnbaum (2005: 266) notes that with a relational approach to the study of war, "... it is possible to reappropriate in systematic fashion the sense offered by Tocqueville and Weber that warfare varies in sociologically significant ways subject to explanation *and* that some wars or some points in wars possess truly transformative power." Not all military contestations generate a treadmill dynamic—as the geopolitical competition prior to WWII demonstrates. Variation finding comparisons help the researcher articulate the historical contexts and the ideological, military, political, and economic institutional arrangements that permit a treadmill's emergence.

The path dependency method is an example of an approach that is hospitable to the concerns of ontological asymmetry and the meso-scale. Path dependency emphasizes that sensitivity to initial conditions triggers causal processes that are historically sequential. The early antecedent conditions are contingent, but critical junctures initiate a process of reactive sequences that 'lock-in' to a causal pattern. A critical juncture refers to the time and place in which a powerful organization enacts a schema that amasses power and/or capital through the appropriation of nature, generating callous political violence that degrades the environment. Through this path-dependent framework, we would predict that the emergence of a treadmill becomes structurally persistent when causal chains of reactions and counterreactions—reactive sequences—are generated by processes that are institutionally distinct and persist beyond the initial generative conditions (Mahoney, 2000). The path-dependent process is reinforced by institutional reproduction that simultaneously weakens the possibility for alternatives as it gains inertia, a process of "increasing returns" (Pierson, 2000: 252). Alternative paths that may have been available earlier in the reactive sequence are not attainable further down the causal chain. This approach suggests that the callous cruelty and political violence of treadmills is unique, and the path-dependent logic articulates this claim. We would expect that as organizations amass power and capital through a treadmill, the reactive sequences will drive an expansionary dynamic of environmental degradation as the treadmill path of development proceeds towards a 'lock-in'. Treadmills would be more likely to collapse in a context in which they no longer generate capital and power, and comparative historical variation-finding research is well-suited to the task of identifying these path-dependent outcomes.

## Conclusion

This chapter considered the extant research on war and the environment, evaluating the contributions and limitations of this work and identifying a path forward. Research from environmental and military history demonstrates the profound transformation of the homeland that has resulted from the processes of warfighting and war preparation. In the case of the United States, the scale of ecological transformation aligns closely with the intensity and inertia of American military power. Important lessons from the environmental security literature emphasize that environmental disruption and resource scarcity can generate violence and conflict, but political ecologists provide an important counterpoint by underscoring the diverse forms of environmental

violence that occur beyond resource-driven conflict. While the military and intelligence agencies of the dominant nation-states have embraced the environmental security logic, nation-states are simultaneously the greatest purveyors of violence against environmental justice activists and movements. This violence against environmental justice efforts has rapidly accelerated in the twenty-first century. This debate also highlights the central point that the interplay of violence and the environment cannot simply be explained by economic forces and resource scarcity. Military, ideological, and political power interact with economic forces to generate unique environmental outcomes.

Research in environmental sociology has established that the transformation of warfare and warmaking technologies is critical for comprehending the impact of the military on the environment. The shift from the mass industrial warfare of the early twentieth century to the scientific-military-industrial nuclear warmaking of the Cold War marks the start of the Anthropocene, and the diffusion of the 'Revolution in Military Affairs' that began the 1990s signals a shift towards a new historical form of high-tech warmaking termed risk-transfer militarism. The research also finds that the positioning of a nation-state within the global structure of international trade is critically intertwined with that nation's relative military power. Economic and military institutions are powerful social forces that can generate unique paths of development, and each dynamic of environmental degradation can crystallize into its own unique inertia. In the contexts where the institutional goals of economic and military power overlap—such as in the Arctic—a destructive synergy can emerge. As the inertia of environmental damage from military and economic power accelerates, it can 'lock-in' to a path of development that is difficult if not impossible to abrogate. In other words, these social forces can—either individually or in tandem—generate a path dependency.

Pointing to a focus on ontological asymmetry and the meso-scale of analysis, we suggested that the path dependency method addresses this focus. In doing so, it provides novel insights into the relationship between violence and the environment, its operation at different critical historical junctures, and the pertinence of certain schemas of organized violence for states, citizens, and the environment. Research in this vein suggests that violence operates differently at a critical juncture because it transforms nature, and the unique manifestation of this change is shaped by the historical contingency and social context (Lengefeld, 2018, 2020). The particular institutional schema that is enacted to appropriate nature is quite significant in terms of explaining an accelerating and expanding dynamic of environmental degradation and inequality. We contend that a focus on ontological asymmetry and the meso-scale provides a clearer understanding of multi-scalar processes operating in relation to these institutions.

A recent analysis of environmental sociology's presence among the most prestigious sociology journals indicates the importance of a focus on stratification and inequality in pushing environmental research into the disciplinary core (Bohr & Dunlap, 2017; Scott & Johnson, 2017). A critical finding of Bohr and Dunlap's (Bohr & Dunlap, 2017: 10) analysis of key themes in environmental sociology is that "... topics that receive the most attention from environmental sociologists do not align closely with those having the greatest impact, nor do they make the strongest inroads into the mainstream of sociology." Environmental sociologists can push to extend their work into the mainstream by emphasizing the most pressing societal issues at hand while focusing on intersectionality and inter/intradisciplinary synergies. Research at the intersection of violence and the environment meets this call. The current state of sociological knowledge of war—the archetype of political violence—is uneven and bears discontinuities. Domestic politics and processes are prominent objects of study for many sociologists, but there has been a tendency to separate them from their relationship with warmaking, which is an international phenomenon (Hooks & Rice, 2005). Where violence and the environment converge, environmental and political sociology have important

opportunities to synthesize theoretical and methodological approaches.

Research in environmental sociology can innovate conceptually by addressing several tasks. Lidskog and Waterton (2016) identify some of these:

> . . . a more thoroughly global outlook on the kinds of socioenvironmental issues affecting growing proportions of humanity; the challenges of connecting to other (sometimes 'new') disciplines and sub-disciplines; the challenges of spotting and recognising the relevance of emerging socio-ecological configurations and processes in new research; and the challenges of engaging creatively with the idea and the realities of the Anthropocene. (p. 308)

An emphasis on ontological asymmetry and the meso-scale complements the incorporation of social, spatial, and temporal variation into the analysis, and has the potential to illuminate the callous political violence of a treadmill, and the ways it can reinforce organizational and institutional power while driving uneven development, exploitation of natural resources, and environmental pollution. The impact of a treadmill can be linked with its cascading scalar operation across societies, space, and history. Such an approach provides tools for environmental sociologists to pursue an interdisciplinary understanding of distorted socio-ecological configurations. Lengefeld's (2018, 2020) use of the treadmill of destruction mechanism to construct a path dependent explanation of nuclear weapons development attempts this by drawing broadly from research on the developing tension between war and society (Mann, 1986; Shaw, 1988; Thompson, 1982; Tilly, 1990) and incorporating the concept of "mutant ecology" (Masco, 2004, 2006) from cultural anthropology to explain the ubiquitous yet unequally distributed consequences of nuclear weapons development. Nuclear weapons are fundamentally coupled with the Anthropocene concept (Waters et al., 2015).

This chapter has focused on political violence that emerges in a context of highly synergistic military and political power synonymous with a treadmill of destruction, highlighting research that demonstrates the uniquely destructive impacts of this power on the environment. Seeking out variation-finding comparisons of the dynamics that drive environmental degradation in the context of violence is an important role for environmental sociologists. A concern with ontological asymmetry and the meso-scale is hospitable to this task and highlights the multiple lines of causality linking the biophysical realm with the social and cultural realms. It also permits interdisciplinary cross-pollination with political ecology, environmental health, environmental crime, risk, and sustainability literature. Extending the impact of the discipline while sharpening our methodological and theoretical tools demands nothing less than this. Understanding the causes and trajectory of the planet's major environmental dilemmas allows environmental sociologists to identify and contrast the development options available to societies as they pursue environmental sustainability. We have offered a template for investigating the link between callous forms of political violence and the treadmill of destruction in the hopes of providing a productive and strategic path forward for environmental sociology.

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# Part IV

# Population, Place, and Possibilities

# Environmental Demography

19

Lori M. Hunter and Daniel H. Simon

Human population dynamics are central to questions of both the causes and consequences of environmental change and these dynamics have had a long history of public and policy attention. Population growth has been of particular concern; likely as far back as civilization itself (Dietz & Rosa, 1994). Much contemporary focus has, however, been shaped by the writings of Thomas Robert Malthus in the late 1700s. Malthus contended that given its exponential growth pattern, population increase would necessarily outpace increases in the means of subsistence, notably food. He further contended that hunger, misery, and war would ultimately result, bringing population back into check but not without grave human cost (Malthus, 1798). Such population-centric perspectives on environmental change can still be found today within "neo-Malthusian" perspectives emphasizing population growth as a primary driver (Hunter & Prakash, 2019).

Environmental demography complicates the simplistic assumption that human population growth represents a singular, dominant force in environmental change. For instance, to better understand society-environment relationships, environmental demographers disaggregate population change into its constituent elements: fertility, mortality, and migration and consider the interplay between these demographic dynamics and aspects of natural environments. While many demographers make use of individual- or household-scale information, the ultimate goal is to better understand the intersections between social, economic, cultural, and political processes as they combine to shape population outcomes. Environmental demographers bring aspects of the natural environment into demographic inquiry as well.

This chapter provides an overview of environmental demography as an interdisciplinary perspective on myriad aspects of the population-environment connection. Throughout, we offer examples of sociological scholarship that illustrate the utility of the sociological perspective on issues of inequality, sociocultural context, and environmental perceptions. This overview begins with a general introduction to population-environment linkages and includes brief discussion of factors that mediate this association. The three core demographic processes, fertility, mortality, and migration provide the remainder of the chapter's topical structure and for each of these demographic processes, we review several contemporary case studies illustrating their environmental dimensions.

Before proceeding, it is important to note that demography, as the statistical study of population, emerged centuries ago; Population estimates were undertaken as far back as the sixteenth

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century (Bonar, 2014). *Environmental* demography, however, is a relatively new subdiscipline that explicitly focuses on the environmental dimensions of population dynamics. The review provided here is necessarily cursory and the literature presented has been chosen to illustrate core themes within environmental demography's evolution and also as it is today practiced.

## Demographic Dynamics and Their Mediating Factors

Consider a spatially-bounded population be it a city, region, or nation. The absolute size of this population changes as babies are born and as residents die. Any migration into or out of the population also influences its overall size, which combined with consumption patterns, ultimately shapes its environmental impact. Socioeconomic factors, cultural norms, and available technologies act as critical "mediating factors" that add complexity to the population-environment connection beyond the simplistic neo-Malthusian lens (see Fig. 19.1).

The critical influence of mediating factors is clearly demonstrated by cross-national comparison of "ecological footprints", heuristic tools that measure the ecological assets, such as land, oceans, and forests, necessary for a particular population's average consumption. The footprint is presented as the global hectares required to meet a population's needs based on average global productivity per hectare. Underscoring the importance of mediating factors in a population's environmental impact, France, a nation of approximately 66 million residents has an aggregate ecological footprint (301 million hectares) twice that of Bangladesh (126 million hectares) although Bangladesh has two times the residents (Global Footprint Network, 2018). Cultural factors such as lifestyle shape these distinctions, along with technological needs and environmental policies. Ultimately these intersections determine the ways in which human populations impact the environment.

As reflected in the footprint calculation, environmental demographers often make use of quantitative data reflecting characteristics of aggregates such as counties, states, or nations. Household-or individual-scale data are also useful for closer examination of factors such as age, gender, and education as related to smaller scale decisions of environmental consequence, such as consumption. In both cases, statistical approaches can be used to better understand the associations between social and environmental patterns and processes.

For instance, at the macro-scale, sociologists have long been active in empirical investigation of the population-environment particularly within cross-national comparisons. Such scholarship expanded upon the well-known IPAT identity that specified environmental impact as the multiplicative product of population (P), affluence (A) and technology (T) (Commoner et al., 1971; Ehrlich & Holdren, 1972). The expanded model—STIRPAT—allows for differential influence of P, A, and T through estimation of:

$$I_i = aP_i^b A_i^c T_i^d e_i$$

where $a$ represents the constant which scales the model, $e$ is the error term, $i$ represents units of time and $b$, $c$ and $d$ are parameters to be estimated (hence STIRPAT represents "Stochastic Impacts by Regression on Population, Affluence, and Technology") (Dietz & Rosa, 1994). Much of this work reveals important variation in population-emissions associations across settings (e.g., Dietz & Rosa, 1994; Liddle, 2014). For instance, Jorgenson and Clark (2010) use panel data from 1960 to 2005 representing a diverse sample of nations to estimate these connections. While they find population to be a primary driver of total national-level anthropogenic carbon dioxide emissions, the associations vary substantially by region and across time. In particular, the positive impact of population size on carbon dioxide emissions declined between 1960 and 2005 for African nations while remaining the same for most high-income countries (Jorgenson & Clark, 2010). This body of literature undergirds the argument that mediating factors, such as sociocultural patterns, influence aggregate "ecological footprints" by shaping processes such as consumption.

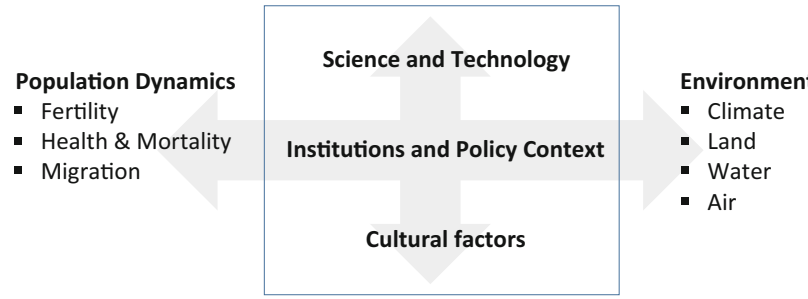


**Fig. 19.1** Mediating factors shape population-environment connections

## Environmental Dimensions of Human Fertility Patterns

From a demographic perspective, fertility refers to the process through which members of a population produce live births, thus, adding new members (Preston et al., 2001). Demographers have long studied fertility patterns and processes, with the Growth of American Families Survey taking place in 1955 and 1960, followed by the 1965 National Fertility Survey. These data collection efforts were designed to allow for examination of marital fertility and family planning in the United States.

Results from scholarship across the globe suggest myriad factors shape fertility including four "proximate determinants": marriage, contraception, abortion, and post-partum infecundity (Bongaarts, 1978) in addition to women's rights (Dixon, 1975). Over the past several decades, demographers have explored the many ways in which social and economic factors interact to influence these proximate determinants, and in turn, influence fertility. Such factors include access to healthcare (Cain, 1983) as well as education and employment opportunities (Singh et al., 1985). In addition, recently expanded investigations into fertility determinants are integrating environmental factors, especially as climate change threatens livelihoods across the globe (Dunlap, 2010; Molnar, 2010; Sellers & Gray, 2018).

The following section reviews contemporary studies on environmental aspects of fertility rates, preferences, and behaviors such as the timing of childbearing. While not an exhaustive review, the section covers several main themes within the broader literature including the Vicious Circle Model (VCM) and issues related to natural hazards and disasters, environmental quality, and land availability and tenure. Taking a sociological lens to these topics calls attention to the sociocultural aspects of fertility-environment linkages, as well as inequalities in the ways in which these linkages manifest.

### The Vicious Circle Model

The Vicious Circle Model (VCM) conceptualizes an inverse relationship between fertility and environmental context, namely that degraded environments yield higher fertility (Dasgupta, 1995). The mechanism underlying this association is household labor demand as children can contribute to household labor supply especially in settings characterized by high levels of agriculture or natural resource-dependence (Caldwell & Caldwell, 1987). Moreover, children provide wealth to parents across their lifetimes as they diversify risk and secure long-term care (Cain, 1983, 2018). The Vicious Circle Model is so-called since high fertility in response to challenging environmental conditions serves to subsequently increase resource pressure (Marcoux, 1999; O'Neill et al., 2001).

A vicious circle has been identified in several locations including Pakistan, South Africa, and Nepal. For instance, in Pakistan, households furthest from critical wood sources have higher fertility (Filmer & Pritchett, 2002) while a similar association has been found in South African settings (Aggarwal et al., 2001). Sociologists Biddlecom et al. (2005) brought issues of

gendered labor into this inquiry. They contended that the notion that children can provide labor for natural resource collection may also underlie the connection in Nepal where the time to collect fodder (typically female labor) has been positively correlated with family size—specifically, longer resource collection time has been associated with desires for more children (Biddlecom et al., 2005). This association holds particularly for women (Brauner-Otto, 2014; Brauner-Otto & Axinn, 2017). In West-Central Africa, in communities already characterized by resource shortage such as scarce local vegetation coverage, declines in "natural capital" have also been associated with higher fertility preferences and actual numbers of children (Sasson & Weinreb, 2017).

It is important to note, however, that while the VCM has been identified in particular locales, it does not hold in all settings due to variation in cultural norms, religion, and the perceived value of children which is often related to inheritance customs (de Sherbinin et al., 2008). For instance, another study in Nepal found higher rates of contraceptive use for those that perceived declines in agricultural productivity—the opposite of what would be predicted by the Vicious Circle Model (Ghimire & Mohai, 2005). Similarly, in dry regions of rural Mexico, conditions more favorable to agricultural productivity have been linked to birth timing, perhaps through enhanced livelihood security (Simon, 2017).

## Land Availability: Farm Size and Tenure

Another approach to conceptualizing the relationship between fertility and the environment emphasizes land availability such that higher fertility rates have been documented in regions where land inheritance is more secure (Easterlin, 1976). Two competing perspectives have emerged to explain this association: the land-labor-demand and the land security hypotheses (Stokes & Schutjer, 1984).

The land-labor-demand perspective suggests that labor demand drives the desire for more children. Empirical evidence of the association is found in Egypt, Iran, Kenya, Peru, and the Philippines (Clay & Johnson, 1992; Easterlin & Crimmins, 1985; Good et al., 1980; Hiday, 1978; Schutjer et al., 1983). As a specific example, in Kenya, land scarcity and diminished farm size led to lower fertility preferences as parents increasingly chose to substitute investments in education in lieu of land inheritance (Shreffler & Nii-Amoo Dodoo, 2009).

In contrast, the land-security perspective emphasizes the importance of land tenure or the formalization of ownership. Here, scholars contend that such ownership confers better living conditions and standards including access to education and health care, and these opportunities lower demand for child labor and, therefore, fertility rates (Stokes & Schutjer, 1984). Such an association has been identified in the Ecuadorian Amazon, where women in households with insecure land access had a 27% higher birth rate as those in households with legal land titles (Pan & Lopez-Carr, 2016). Findings consistent with the land security hypothesis are also found in settings as varied as Egypt, India, Iran, Mexico, and the Philippines (Carr et al., 2006; Good et al., 1980; Hiday, 1978; Schutjer et al., 1983; Vlassoff & Vlassoff, 1980).

Sociologists have long underscored the ways that gender matters, revealing that women tend to have more influence on reproductive decision-making in settings where they have more control of resources including land. This association manifests in Malawi, for instance, where women's sole ownership of land engenders more reproductive health control, while joint ownership with their husband does not (Behrman, 2017).

## Fertility Following Natural Disasters

Natural hazards that generate human disasters also influence fertility. For instance, post-tsunami displacement may lead to reduced demand for children as people settle into new locations (temporarily or permanently) and are forced to find new employment and rebuild assets (Carballo et al., 2005). Such post-disaster displacement

can also impact access to contraceptives, a challenge particularly noted for racial minority women after Hurricane Ike (Leyser-Whalen et al., 2011). Natural disasters can also cause changes in fertility desires especially after the loss of a spouse or partner (Evans et al., 2010; Hamoudi et al., 2014) and can lead to fetal distress risk and abnormal labor outcomes for women exposed to especially disruptive hurricane events (Zahran et al., 2010, 2013). Below, we highlight three case studies that illustrate these mechanisms.

The 2004 Indian Ocean earthquake and tsunami killed over 170,000 people in the coastal areas of Aceh and North Sumatra, Indonesia and roughly 500,000 were displaced (Gray et al., 2014). A survey of communities in coastal Indonesia found that fertility increased following the tsunami since mothers who had lost children were more likely to have a child afterward. In addition, women without children prior to the tsunami were quicker to initiate family building, especially when living in communities with high mortality levels (Nobles et al., 2015). A similar increase in fertility occurred in Nicaragua after Hurricane Mitch, which killed 3800 in 1998 (Davis, 2017). The increase was especially notable in areas most heavily impacted by heavy rainfall, although fertility returned to pre-storm levels after about 6 years (Davis, 2017).

In the U.S., Hurricane Katrina made landfall on the Gulf Coast in August 2005, resulting in the evacuation of 1.5 million residents, with hundreds of thousands ultimately being permanently displaced (Weber & Peek, 2012). The displacement resulted in a 30% decline in births in New Orleans, although with important racial variation. Fertility among African American women remained below expected values through 2010, while fertility among white women increased (Seltzer & Nobles, 2017). These differential fertility values—along with differential return rates sharply divided along race and class lines—have played an important role in New Orleans' changing racial composition as a higher proportion of current city residents are white as compared to historical composition (see Fig. 19.2).

## The Environmental Dimensions of Human Migration

While fertility entails the addition of new members to a population, migration involves moving from one place to another, altering the population size of both origin and destination. Like fertility, human migration is the observable outcome of complex socioeconomic processes and individual and household decision-making. Again sociological perspectives offer critical insight into the sociocultural patterns and processes that shape migration decision-making as well as the underlying social inequalities that are both a cause and consequence of human movement. Below we offer a brief overview of research on the environmental dimensions of migration including discussion of the wide variety of environmental "push" and "pull" factors as well health aspects of the migration-environment connection.

Research designed to understand the patterns and implications of migration is challenged at a basic level by even defining the outcome—a definition of migration requires establishing spatial boundaries that must be crossed, time periods that must be met, and intentions that must be considered. Combining these, researchers often study long-distance and short-distance migration, temporary and permanent migration, and economic motivations as contrasted with others.

Many patterns exist within human mobility and the examination of migration's potential environmental dimensions requires accounting for other known predictors, many of which shape inequalities in resource access and opportunities. For example, higher education, and socioeconomic status more generally, are associated with greater migration probabilities—bringing inequality to the fore as related the human movement. Age also influences movement in that the likelihood of individual migration peaks in early adulthood and again at retirement and, as a result, populations with higher concentrations of individuals at these ages will likely be more mobile. Gender matters too in that motivations for, and patterns of, migration vary in

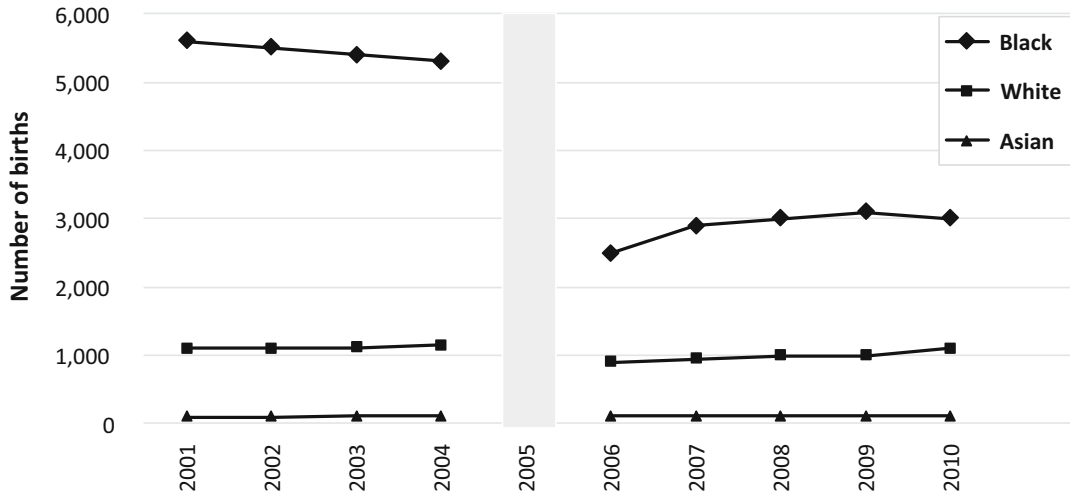


**Fig. 19.2** Number of births by race, before and after Hurricane Katrina (2005), Orleans Parish, Louisiana (Orleans Parish (equivalent of a U.S. county) encompasses New Orleans). (Data source: Seltzer & Nobles, 2017)

some settings for men and women. Historically, women have been more likely to migrate for marriage as compared to men, although such disparities are declining and women are increasingly likely to migrate for economic, educational opportunity, or other reasons, as well as increasingly migrate on their own (United Nations, 2017). There are also spatial patterns—rural-to-urban migration tends to be greater than the reverse, in part demonstrating the dominance of economic motivations within migration decision-making.

## Migration's Environmental Aspects

In the past two decades, demographers have moved beyond analysis of these well-known socioeconomic and spatial determinants to investigate migration's environmental dimensions. Climate change research, in particular, has raised awareness of the migration-environment connection and the demographic research community has responded with the development of case studies from areas across the globe (Hunter et al., 2015). Much of this research expands on this prior knowledge of migration patterns by exploring the effect on migration of environmental conditions and/or change after controlling for the other known migration correlates. The vast majority of this work has, indeed, found an 'environmental signal' suggesting that the environment plays a role in human movements.

Figure 19.3 presents an oft-used conceptual framework from the UK Foresight Project that integrates migration's environmental dimensions with known micro-, meso-, and macro-scale factors. Age, gender, and education, as noted above, represent micro-scale factors that shape migration decision-making, while social networks and regional policy represent important meso-scale influences. On networks, much sociological research has demonstrated the importance of social connections as migrants follow in the footsteps of acquaintances who can provide assistance in employment and housing searches. As an example, such movement has greatly influenced the Mexico-U.S. migration stream as demonstrated by research documenting this "cumulative causation" ultimately leading to self-sustaining migrant flows (Garip & Asad, 2016). This stream also reveals the critically important influence of the meso-scale influence of policy since the ups and downs in Mexico-US migration have been shaped by a variety of immigration policies including the Bracero Program

between 1942 and 1964, which facilitated movement of temporary workers and the 1986 Immigration Reform and Control Act (IRCA), which legalized undocumented immigrants that had arrived before 1982.

Today, the political and cultural climate combined with increased U.S. border enforcement and changes in economic opportunities following the Great Recession have all influenced the decline in Mexico-US migrant flows (Gonzalez-Barrera et al., 2015). The role of economic conditions is represented in the Foresight conceptual framework as a macro-scale influence on migration patterns; indeed, economic conditions in both origin and potential destination areas have a strong impact on migration, with much research suggesting their dominance in decision-making (e.g., Neumann & Hermans, 2017). That said, economic factors are not the only macro force acting upon migration; population composition, socio-cultural prejudice, and expectations regarding family caretaking represent additional influences. Again, considering Mexico-US streams, destination choices are shaped by population composition in that cumulative causation processes may increase the likelihood of migration to destinations with larger immigrant proportions. Also, characteristic of broader socio-cultural forces, Mexican laborers in the U.S. experience individual and institutional forms of prejudice and discrimination with important implications for health (Finch et al., 2001), while also shaping desires to return home (Moran-Taylor & Menjivar, 2005). Such desires are also affected by culturally-derived responsibilities to family, with traditional Mexican culture emphasizing values related to interdependence and family obligation (Markus & Kitayama, 1991).

Beyond these macro-scale sociocultural, demographic, and economic migratory influences, a particularly useful aspect of the Foresight framework is its explicit integration of environmental dimensions. Consider the impact on subsistence agriculture of chronic and more acute extreme events such as drought and flooding which have been linked to migration in a wide variety of settings including rural Bangladesh, Tanzania, and Mexico (Haeffner et al., 2018; Hassani-Mahmooei & Parris, 2012; Kubik & Maurel, 2016). Environmental factors can also yield indirect influence on other macro factors such as employment opportunities. For instance, when Hurricane Katrina devastated the U.S. Gulf Coast in 2005, the dramatic loss of local businesses lessened economic opportunities for residents interested in returning, especially in hard-hit sectors such as state and local government, education and health services, and leisure and hospitality (Groen & Polivka, 2008; Vigdor, 2008). More generally, Hurricane Katrina impacted the historical migration "system", or longstanding spatial patterns on in- and out-migration connecting the region with the nation (Fussell et al., 2014).

## Environmental "Push" Factors

Findings from several settings illustrate key themes in the connection of migration and drought, temperature change, and natural disasters. As an example and as noted above, much is known about the correlates of Mexico-U.S. migration streams and this strong foundation has offered an excellent base from which researchers have examined potential environmental aspects. Mexico-U.S. migration streams have important connections with temperature and rainfall patterns, above and beyond sociodemographic and economic correlates. Specifically, net of these sociodemographic and economic correlates, the likelihood of a household sending a migrant to the U.S. is greater from dry regions. Such connection is logical in that rural Mexican livelihoods are heavily agricultural-dependent (Eakin, 2006). Even so, the connection isn't quite so simple since research has demonstrated that periods of rainfall shortage are associated with U.S. migration only from Mexican cities with low levels of marginalization—areas with higher levels of education and income. This association suggests that international migration from rural Mexico is not typically a response to climate pressures for the most impoverished households in the most

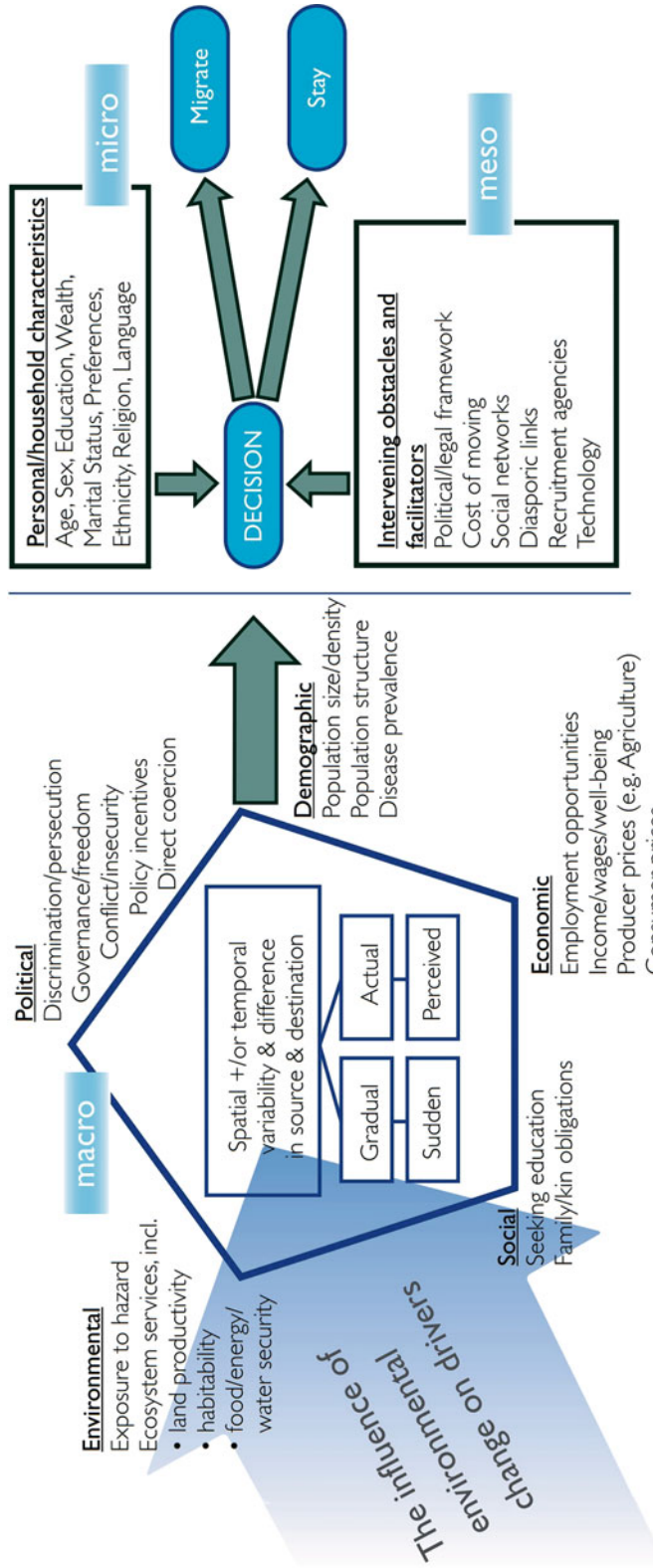


**Fig. 19.3** The environmental dimensions of human migration. (Source: Black et al., 2011)

impoverished places. Instead, since migration is often costly, it is more likely to be used by households with some level of available resources (Riosmena et al., 2018).

Such resources are not solely financial; social networks are a resource as well. Networks facilitate movement by offering connections to help reduce some of migration's uncertainty in finding housing or employment and other aspects of settling in. Back to the Mexico example, recent research finds that the association between drought and U.S. migration also predominantly characterizes movement from places with strong transnational migration networks (Hunter et al., 2013; Riosmena et al., 2018). Such networks are often reflected by measures of proportion of households receiving remittances from abroad or recently having sent or received an international migrant.

In addition to shifts in rainfall, temperature changes have also been associated with migration. In Indonesia, for instance, higher temperatures are linked with lower levels of migration, potentially due to the positive benefits of warm spells on agricultural production in this geographic setting (Thiede & Gray, 2017). A related association has been found casting a wider contextual net as well. In a study including over 150 nations, the migration-environment connection was also mediated by agricultural reliance. That said, instead of generally reducing migration, it was periods of extreme heat that demonstrated an effect through yielding higher levels of international migration during these periods of environmental strain (Thiede et al., 2016).

These two studies of migration as linked to temperature changes represent a critically important finding of the broader literature on migration-environment: the specific association is highly context specific. Thinking back to Fig. 19.3 this should be no surprise given the wide variety of additional factors that ultimately shape the environmental dimensions of migration.

A continuum becomes a useful tool for organizing some of the context-specific nuance inherent in the migration-environment connection (Fig. 19.4). Livelihood-related migration, such as that noted above, can potentially be seen as more voluntary—as a household strategy to diversify income sources and thereby spread risk (Arango, 2017). As a contrast, residents of areas experiencing ongoing dire conditions may have little choice. Pacific Islanders, notably those on Tuvalu and the Marshall Islands, provide powerful examples and were some of the first to receive both scholarly and policy attention with regard to the migratory implications of sea level rise (e.g., Mortreux & Barnett, 2009). Today, relocation options are constrained for residents of small island states due to customary land tenure rights of potential destinations within the region. Restrictive migratory policies in other locations, such as the United States and Australia, also inhibit movement (Crate & Nuttall, 2016). Several "mediating factors" are represented in this example such as culture (i.e., land ownership norms) and policy (i.e., immigration policy). The absence of sustainable technological solutions (i.e., sea walls) also shapes these migration flows.

## Migration's Environmental Impact

An intriguing association also exists with regard to the environmental impacts of migration itself. There are at least two pathways through which such impacts manifest. First, migrants may influence population pressures within the places where they move. That said, scholarship in the U.S. has found that immigrants tend to have less environmentally impactful consumption patterns that native-born residents. Using a STIRPAT approach, an urban-focused analysis in the U.S. found that counties with a relatively larger foreign-born populations had lower levels of some harmful emissions than counties with relatively more native-born residents (Squalli, 2009).

A second pathway through which migration brings environmental impacts is through the remittances that return to origin households. As an example, research in Ghana has found that remittances are used to finance infrastructure within the origin households as well as to support consumption needs. As related to the

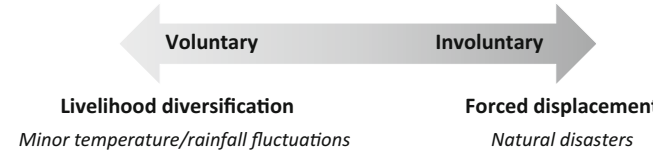


**Fig. 19.4** The continuum of migration-environment connections

environment, remittances were used to buy fishing nets, dig wells, build water harvesting infrastructure, and buy fertilizer—all of which shift population-environment dynamics (Musah-Surugu et al., 2018).

## Environmental "Pull" Factors

While climate strain or other environmental challenges may act as "push" factors for would-be migrants, environmental characteristics can "pull" migrants too. Consider the high levels of population growth in amenity regions of the American West which offer access to environments often found appealing such as coastlines and mountain vistas. As contrasted with overall rural population loss, amenity-rich rural areas in the U.S. grew nearly 20% between 1990 and 2015 (Florida, 2018). Such movement is occurring in rural areas across the globe, from Costa Rica to Spain (Elizburu, 2007; Matarrita-Cascante et al., 2015). Environmentally-related amenity migration to rural areas has environmental implications of its own since residential expansion and shifts in the use of private lands impact habitat and reshape local resource demands (Abrams et al., 2012).

Research explicitly examining urban-rural distinctions in the "pull" of natural amenities tends to find stronger associations in rural regions as compared to urban (Chi & Marcouiller, 2013; Rickman & Wang, 2017). Even so, natural amenities can drive economic growth in major urban areas, thereby pulling new residents (Rickman & Wang, 2017). Consider the challenges facing high-amenity metropolitan areas such as Seattle where economic and population growth have intersected to create affordability and ecological challenges (e.g., Robinson et al., 2005; Sirianni, 2007; Voith & Wachter, 2009).

## Environmental Dimensions of Population Health

In her 2007 Presidential Address to the annual meeting of the Population Association of America (PAA), Sociologist Barbara Entwisle implored demographers to better consider the ways in which "places—local, social, and spatial contexts" impact populations and their health (Entwisle, 2007: 687). Subsequent research has shown that local contexts—where we live, work, and play—influence our mental health, risk of experiencing violence and injury, and even how long we live (e.g., Arcaya et al., 2016; Ross, 2000; Wray et al., 2011). In fact, there are entire literatures devoted to the ways in which specific characteristics of neighborhoods (e.g., quality of the built environment, order/disorder, access to fresh food and other amenities, proximity to toxins and hazards) improve or deteriorate public health. Below we provide a brief overview of climate-health connections followed by several examples of innovative research on health-environment from an environmental demographic perspective focused on several African settings, as related to mental health, and finally as linked to climate-related migration.

## An Overview of Climate-Health

Climate and environmental factors influence health both directly and indirectly (Levy & Patz, 2015). Such connections include morbidity and mortality from heat waves (Basu, 2015), respiratory and allergic disorders (Kinney et al., 2015), water- and food-borne diseases (Rose & Wu, 2015), malnutrition and food security (Dangour et al., 2015), mental health effects of extreme heat and drought (Doherty, 2015) and neighborhood disadvantage (Downey & Van Willigen, 2005;

Ross, 2000), and collective violence (Levy & Sidel, 2015). Moreover, the most recent IPCC 1.5 report warns of the many threats to human health if the planet continues to warm at its current pace (Ebi et al., 2018). Some estimates suggest that climate change will cause 250,000 excess deaths per year between the years 2030 and 2050 (WHO, 2018). While the IPCC 1.5 report describes the future health impacts of continued warming, the consequences of climate change for human health are already being felt. In the U.S., the most recent National Climate Assessment makes clear that climate change affects the health of all Americans through altered exposures to heat waves, floods, droughts, and other extreme events; changes to the quality and safety of the air we breathe; and stresses to mental health and well-being (Ebi et al., 2018).

The health impacts of climate change reviewed above are not, however, equally distributed—offering a critical point of entry for sociologists. Climate scientists predict greater temperature increases over land and at higher latitudes, while precipitation changes will make mid to lower-latitude areas more arid. Coastal populations will be forced to contend with more frequent and severe flooding and rising sea-levels (Field et al., 2014). Prior climate-health research has largely focused on health impacts from heat stress, extreme weather, and infectious disease (McMichael et al., 2006). Such work documents that heat extremes are often deadly (Mora et al., 2017), especially for vulnerable populations like those with mental illness (Curriero et al., 2002), children and youth (O'Neill et al., 2003; Zahran et al., 2008), the elderly (Díaz et al., 2002), and low-income populations (Klinenberg, 2015). Urban environments are particularly sensitive to heat waves, known as the urban heat island effect, whereby the built environment (e.g., concrete) absorbs and retains heat, further amplifying the rise in temperatures (McGeehin & Mirabelli, 2001). Figure 19.5 reveals many such climate-health connections.

Also linked to climate change, sea-level rise can indirectly influence health through impaired crops, livestock, and fisheries, which in turn have negative impacts on agricultural yields and nutrition. The right-hand side of Fig. 19.5 illustrates how environmental degradation to land, coastal ecosystems, and fisheries can displace populations and worsen mental health outcomes as a result of lost livelihoods (Durkalec et al., 2015; Ellis & Albrecht, 2017). In Western Australia, for example, farmers' sense of place is intimately tied to their health, as weather influences their emotional and psychological states (Ellis & Albrecht, 2017). Changes to land and sea ecosystems may also alter vector-pathogen-host relationships and impact infectious disease patterns, spread, and seasonality (Wu et al., 2016). In this way, cholera and salmonella multiply more rapidly in higher temperatures and Dengue fever is sensitive to climatic variation associated with El Nino and La Nina events (Hales et al., 1999; Hopp & Foley, 2003).

## Innovative Considerations of Climate-Health in African Settings

To illustrate how environmental conditions interact with social factors to influence health, we highlight three studies from the African context. Taken together, they demonstrate that failing to consider environmental conditions may result in an incomplete understanding of the mechanisms underlying health disparities and outcomes. Further, these environment-health connections will likely become even more significant as climate change progresses, with the impacts disproportionately burdening marginalized groups and poor nations.

**HIV and Water Quality in Kenya** Local environments shape what populations eat, where they work, and where they play. For communities in Nyanza Province on the shores of Kenya's Lake Victoria, the local environment also shapes one's risk of contracting HIV as changes in the lake's ecology have been connected to early and high HIV prevalence.

Sociologist Mojola (2011) offered a groundbreaking argument that the eco-social context must be considered in any public health

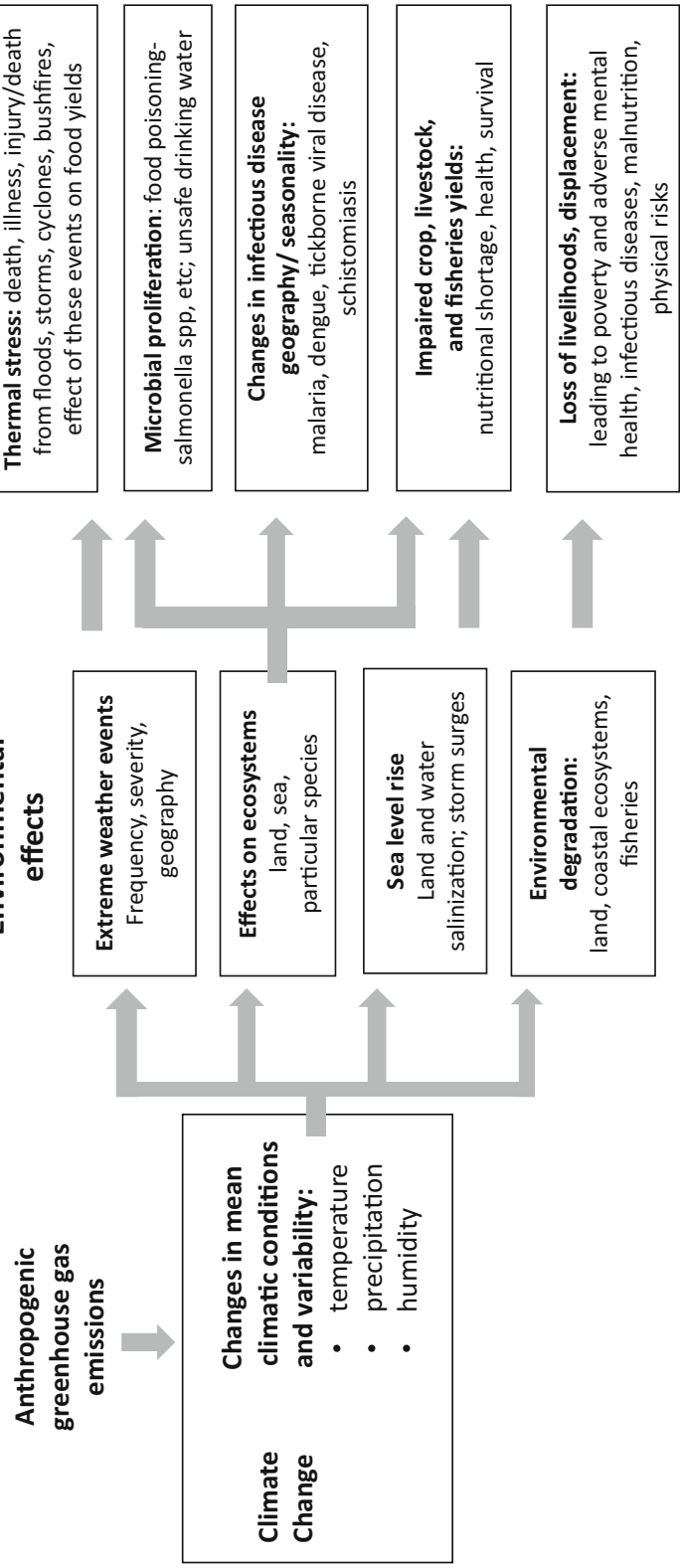


**Fig. 19.5** Main pathways by which climate change affects population health. (Adapted from McMichael, Woodruff, and Hales 2006)

intervention designed to lessen HIV prevalence. Her research uncovered important eco-social connections in that, first, nutrient changes in Lake Victoria resulted from a variety of pressures including deforestation, loss of wetlands, and untreated sewage. The nutrient changes fueled growth of water hyacinths which led to fish populations migrating to the lake's relatively less polluted sections. As a result, male fishers migrated too. The Lake Victoria fishing economy is heavily gendered—men catch fish while women sell the fish at market—and as fishers migrated, they developed relationships with new female business partners over which they had leverage given overall decline of fish populations. Male dominance reduced women's control over condom use and, therefore, over protection against sexually transmitted diseases, ultimately increasing HIV prevalence (Mojola, 2011). In all, lake ecology was an important factor in the number of sexual partners and efforts to prevent disease spread.

**Natural Resource Buffer for HIV-impacted Households in South Africa** Local environments also influence household food security, as natural resources offer important sustenance. A survey in northeastern South Africa found 90% of households make use of wild vegetables, while over two-thirds use wild fruit in their diets (Hunter et al., 2007). These resources are also used for income generation as households sell collected materials and/or resource-derived products such as baskets and mats (Mbiba et al., 2019).

Like Kenya, South Africa has been hard hit by HIV/AIDS. In fact, South Africa has the largest HIV epidemic in the world. The nation is home to 19% of the global number of people living with HIV and 11% of AIDS-related deaths (UNAIDS, 2019). In the nation's rural regions, local natural resources provide a critical safety net when households experience health crises—notably, adult mortality from HIV/AIDS. Natural resources play a critical role in fending off hunger especially in the face of household loss of a male breadwinner. Wild foods act as a substitute for previously purchased goods (Hunter et al., 2007).

**Climate Strain and Infant Health Outcomes Across Africa** Reproductive and infant health outcomes are also influenced by climate variability and related extremes in temperature and precipitation (e.g., Bakhtsiyarava et al., 2018). For example, environmental stress can adversely affect the dietary intake of pregnant women which can impact fetal growth. The utero period is critical for human development and low birth weight is associated with many negative longer-term outcomes, such as future health challenges and lower educational attainment and income (Walker et al., 2007). This connection between environmental conditions and birth weight outcomes has been documented across 19 African countries (Grace et al., 2015).

## Climate and Mental Health

Existing research also documents both direct and indirect climate impacts on human mental health. Direct mechanisms include exposure to trauma as a result of elevated rates of violence and aggression (Berry et al., 2010), while indirect mechanisms include impacts to physical health (e.g., heat exhaustion) and damages to community environments such as schools and churches, with negative consequences for social cohesion (Berry et al., 2010; Klinenberg, 2018).

The mental health outcomes of drought are similar, largely resulting from economic loss and challenges to livelihoods, reductions in social support, and lost sense of place attachment (Vins et al., 2015). To illustrate, the relative risk of suicide is 15% greater for rural males in Australia during drought (Hanigan et al., 2012). As another example, challenges to one's relationship to place have impacted the mental health of indigenous Inuit communities in Canada surrounded by declining sea ice (Durkalec et al., 2015; Ellis & Albrecht, 2017).

Reviewing dozens of studies that analyzed the relationship between climate change and mental health outcomes, Thompson et al. (2018) conclude that the strongest evidence exists for the link between warmer temperatures and suicide. In California, between 2005 and 2013, rising

temperatures were linked to more emergency room visits for mental health disorders, suicide, and intentional injury/homicides (Basu et al., 2017). Case studies from around the world, including the United States, Mexico, India, and Australia support these links too. In India, where suicide rates have doubled since 1980, Carleton (2017) suspected that suicides might increase following climate extremes that lower crop yields. Indeed, once above 20 degrees Celsius in the growing season, every one degree increase has been associated with 70 additional suicides, on average (Carleton, 2017). Similarly, across U.S. counties, a one degree Celsius rise in the monthly average temperature has been linked to 0.7% higher suicide rates; In Mexican municipalities, such rates rose by 2.1% (Burke et al., 2018). These relationships cannot be dismissed as entirely spurious, as the same researchers found that the use of depressive language on social media also increased during warmer periods (Burke et al., 2018).

## The Complex Relationship Between Migration, Health, and Climate

We conclude this section on climate-health by focusing on migration as a particular demographic outcome and its relationship with climate and health. As reviewed above, considerable research has documented the myriad ways in which climatic changes and environmental factors shape human migration (Hunter et al., 2015). The literature further shows that migration also has important health dynamics. For example, international migration tends to be positively selective on health, meaning that migrants often exhibit better health than their non-migrant counterparts in places of origin. This association makes intuitive sense as migration is inherently a difficult process—involving relocation from one's known cultural, economic, and political context. Additionally, both temporary and permanent forms of voluntary migration strain social relationships and require the establishment of new ones. As such, the "healthy migrant effect" asserts that migration is not a random process, but rather a selective one (Akresh & Frank, 2008; Riosmena et al., 2013).

In addition to health and as reflected in Fig. 19.3, other personal characteristics (e.g., age, sex) and meso-level factors (e.g., economic, political contexts) shape one's ability to relocate following climate stressors such as drought (Schwerdtle et al., 2018). Yet, challenging climates may influence the health profiles of migrants seeking to relocate (McMichael et al., 2012). In this way, Hunter and Simon (2017) investigated whether drought might alter the "healthy migrant" effect for the international migration stream between Mexico and the U.S.

In semi-dry regions of Mexico, healthy selectivity is lower in times of rainfall scarcity. In other words, in periods where climate stress challenges livelihoods, migration is not related to health—both healthy and unhealthy household heads are equally likely to move. On the other hand, in periods of more rainfall, health selectivity is greater. During these times, livelihoods are less challenged, perhaps allowing these health selection processes to take place, as relatively healthy households have a greater likelihood of sending a migrant to the U.S. In this way, periods of reduced climatic strain might allow for greater selection in that there is less migration and those that do move are in better health. Such intersections are important in that they can shape health service needs in both sending and receiving areas. Even so, examination of this triad from a demographic perspective is nascent and more research is needed to fully elucidate the complexities within the migration-health-climate intersection.

## Conclusion

The complexity of the society-environment connection requires investigation from multiple perspectives and environmental demography offers one such lens. The demographic perspective, particularly the social demographic perspective, interrogates the intersections between social, economic, cultural, and political processes as they

combine to shape population outcomes. Here, we have offered several glimpses into how environmental factors are embedded within social demographic inquiry including climate context and fertility, migration, and population health and mortality. Specifically considering the sociological perspective, the discipline's lens highlights the ways in which structural inequalities shape the population-environment association. Examples include research on gendered perceptions of resource constraints and their relation with desired family size (Biddlecom et al., 2005), the importance influence of social networks in shaping the viability of migration as an adaptation to environmental stress (Riosmena et al., 2018), and differential vulnerability to HIV/AIDS as a consequence of inequalities in access to resources along the shores of Lake Victoria (Mojola, 2011).

A central benefit of taking a broad population perspective is the potential to shed light on how individual- and household-scale processes aggregate to generate population outcomes. There is a wide variety of contemporary topics that require additional research attention as such scholarship should motivate and inform policy. Many such questions arise as populations across the world—indeed, the global population—face climate change. For instance, what is the appropriate response as populations are faced with relocation due to sea-level rise? In what ways might climate change shift migration patterns such that health policy should be adjusted in both sending and receiving regions? What of differential increases in suicide risk in particular? What are the implications for reproductive health policy as women increasingly encounter disasters and other environmental stressors that challenge the sustainability of their livelihoods? Such questions certainly do not fall solely within the purview of environmental demographers, but a population lens can offer important insight—insight that becomes all the more important as the world faces a changing, uncertain climate future.

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# Land Use and Land Use Change

20

Thomas K. Rudel

## Introduction

Humans carry out fundamental activities like agriculture, mineral extraction, and home building on land. Through these activities, they inscribe revealing patterns in landscapes, patterns that promote affluence, degrade habitats, and indicate growing inequalities among humans. For this reason, changes in land use provide an important window on changes in coupled human and natural systems (CHANS).[1] This chapter describes the most important of these changes in land use over the past century. It presents a series of historical generalizations about land use changes. The chapter begins by describing how the spread of markets in land during the twentieth century shaped the human imprint on the earth's surface. Two activities made a visible imprint on the earth's surface: the expansion of agriculture around the globe and the growth in the size and geographical extent of cities. The spread of markets in land and the corresponding intensification of land use introduced dramatic changes in urban, suburban, and rural communities that advantaged elites, disadvantaged the poor, precipitated unprecedented losses of biodiversity, and destabilized the climate. The turmoil and environmental abuse from these changes spurred a countervailing set of changes aimed at protecting landscapes, both in remote frontier forests of the Global South and in peri-urban settings outside of cities in both the Global North and the Global South. What Polanyi (1944) referred to as a double movement had occurred, a movement followed by a counter movement, both in remote rural places and in rural-urban fringe places. The first stage in the double movement destroyed and degraded natural resources. In the second stage, people mobilize to restore or spur the recovery of the damaged natural resources. In this sense, the double movement represents a dynamic. The activities in the first stage shape a reaction that defines what happens in the second stage.

This chapter describes the substance of the double movement in land use. The chapter begins by describing the demographic and economic context for these changes in land use. Then it describes the first movement in land use, an expansion in markets for land, both in remote rural places and around cities. The first movement generates a second movement. Market expansion and the corresponding degradation in habitat spurred counter movements, again in remote rural places and around cities. The chapter concludes on a speculative note, with a description of the ways in which international climate

[1] This approach focuses on the interface between human and natural systems and makes a conscious effort to understand this interaction through an analytic coupling of human and natural variables (Liu et al., 2007).

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stabilization efforts, made tangible in the 2015 Paris agreements, entail the creation of a global system of land use planning that, in a fully operational form, would curtail the influence of markets over land use.

## The Historical Context for Land Use Changes: An Emerging 'Anthropocene'

Over the past two decades, increasing numbers of commentators have argued that the influence of human activities in the biosphere has become so pronounced that we have entered a new geological era that they call the 'Anthropocene' (Crutzen & Stoermer, 2000). During this period, trends in human activities have become one of a small set of the primary drivers of change in the earth's system. The human drivers have come in four forms: technological, demographic, economic, and political. Humans have invented a wide range of new technologies, the most significant of them, medical and transport related. The medical advances lowered infant mortality dramatically, and largely as a result, world population increased from 2 to 7.6 billion persons from 1927 to 2018. Faster transport on land, in oceans, and in the air expanded the possibilities for trade between distant places. With the gains from trade between distant places, people developed new expectations about material affluence. Strategically situated groups benefited from the new trading links and manifested a willingness to defend these trading arrangements with force. In the Belgian Congo, colonial officials forced indigenous smallholders to grow cotton to supply textile mills in Belgium (Likaka, 1997). In Honduras, companies established large banana plantations and built entire towns devoted to growing bananas, shipping them, and providing services for plantation workers. The companies also used their outsized political influence to get large concessions of land from governments (Soluri, 2005). Both imperialists and, later, neo-liberal elites sought to maintain their advantaged positions in these burgeoning markets.

Taken together, the growth in human populations and the growing levels of affluence have spurred substantial and continuing increases in demand for raw materials to feed people, increase animal protein in human diets, construct larger homes, and expand human settlements. Elites have met these demands and profited from them largely through the geographic expansion of intensified land uses throughout the globe. This is the first movement in the double movement. These processes of market expansion and the associated environmental degradation are outlined in more detail below.

## The Movement: Globalization and Land Use Change

The dramatic growth in the scale of the human enterprise, sometimes referred to as 'The Great Acceleration' (McNeill & Engelke, 2015), has entailed an expansion in two kinds of markets, those that distribute agricultural products throughout the world and those that sell newly manufactured products and constructed buildings in expanding urban settlements. Farmers convert tropical rain forests into pastures, fields for row crops, or tree plantations for forest products. Similarly, real estate developers and recently arrived rural-urban migrants convert fields and forests on the outskirts of cities into multi-family housing, subdivisions of single-family homes, and clusters of shanties. The following paragraphs describe the expansion of these intensified land uses and the environmental degradation that accompanied these land use changes.

### Agricultural Expansion and the Acceleration of Tropical Deforestation, 1960–2015

Rapid economic growth between 1946 and 1970 in North America and Western Europe led to large increases in global demands for raw materials. Accelerated economic growth after 1980 in large-scale developing countries like Brazil, China, and India added to the growth in

global demand for raw materials and foodstuffs. These increases in market demand accelerated the expansion of agriculture in the humid parts of the Global South, in particular in insular Southeast Asia, the Amazon basin, and the Chaco region of South America.

The middle of the twentieth century also saw a major reordering of the international system. Decolonization meant the creation of newly independent states in the Global South. The leaders of the newly independent states wanted to secure their rule over remote forested areas, so they promoted new land settlement schemes, oftentimes referred to as 'colonization projects' (Nelson, 1973), in places like the Southeastern Amazon basin and the outer islands of Indonesia. These new settlements, populated by settlers loyal to the new government, secured the government's rule over these peripheral regions (Rudel, 2005). With the new settlements came penetration roads that, once constructed, linked these remote regions with the more populous, economically developed regions of nations (Laurance, 2012). Burgeoning international demand for agricultural commodities like soybeans (Nepstad et al., 2006) and cattle (Shane, 1986) led to the construction of additional infrastructure to facilitate international trade. For example, the Brazilian government built roads that connected soybean producing regions in the southern Amazon basin with newly constructed port facilities on the lower Amazon River. The creation of the new roads and related infrastructure in turn encouraged the deforestation of lands adjacent to the roads, creating corridors of cleared land along roads in largely forested regions (Smith, 1982). All of these changes presented economic opportunities to prospective landowners as the value of claimed land increased with their clearing and with the completion of nearby infrastructure. The familiar question in real estate development, how does one raise the value of land, so common in urbanizing communities, occurred in remote frontier settings as well (Rudel & Horowitz, 1993).

Sometimes, miners and oil companies provided the impetus for agricultural expansion. Miners and oil companies extracted minerals from subterranean deposits and built networks of roads, pipelines, and refineries that transported these materials and readied them for human consumption (Bebbington & Bury, 2013). This infrastructure often ended up serving a dual purpose. The new roads made it possible to maintain pipelines or transport processed ores to ports on oceans. The new roads also provided access to heretofore unclaimed and forested roadside lands by colonists who wanted to establish farms along the new roads (Hiroaka & Yamamoto, 1980). Often the colonists came from the ranks of workers in the extractive industries. They would clear the forests on their newly claimed lands on their days off. Herring-bone patterns of deforestation occurred along penetration roads and feeder roads that linked small farms to markets in regions like Rondonia in Brazil.

Desires among consumers to upgrade their diets rather than increases in population appear to have driven most of the recent expansion in agriculture (Lambin, 2014). The large-scale increases in the extent of agriculture and deforestation have stemmed in most instances from increases in land devoted to the cultivation of oilseed plants. Soybeans, grown largely to provide feed for animals, and oil palm, grown largely for use in cooking and in the preparation of processed foods, showed the largest increases in cultivated land after 2000. In this sense, increases in the consumption of animal protein and prepared food appears to have driven the continuation of tropical deforestation and the corresponding losses of species and accelerated climate change (Winders & Ransom, 2019).

Changes in patterns of landholding have accompanied the changes in land use in agricultural districts in the Global South. Between 1960 and 2000, continued population growth in poorer agricultural districts in Sub-Saharan Africa and South Asia has led to the frequent subdivision of farmland, largely through inheritance. Trends in the distribution of farmland went in the opposite direction in the wealthier countries in the Global North. Farmland continued to concentrate into larger farms (Lowder et al., 2016). Given the slower pace of increases in the prices of agricultural commodities relative to manufactured goods after World War II, farmers could only keep up

economically if they achieved additional economies of scale over time. They had to 'get big or get out'. In this context, savings from specialization and attendant economies of scale drove a concentration in landholdings since World War II (Hart, 2004). Large farms in the American Middle West typically currently produce only one or two crops (corn, soybeans) or only one type of animal (pigs).

This trend towards agglomeration in landholdings and in land clearing has spread to the Global South during the past two decades. New land clearings in predominantly forested regions in the tropics have become larger over time (Austin et al., 2017). Shifting cultivation by indigenous peoples has declined in extent in regions like Southeast Asia where it was pervasive during the mid-twentieth century (van Vliet et al., 2012). This trend has coincided, historically, with an increase in land grabbing in poor nations in the humid tropics (Borras et al., 2011). Land grabbing refers to the purchase of large tracts of land in poor nations by consortia of wealthy investors from outside the country. Harvests from these lands and the profits from these operations usually go to overseas consumers and investors, leaving next to nothing for the local peoples who had cultivated these lands prior to the arrival of the outside investors. Remote sensing analyses of changes in land use that occur after investors grab these lands indicate that, at least in Cambodia, the grabbed land is more likely to be deforested than other lands in the years immediately after the grabbing (Davis et al., 2015; Rudel, 2015).

The spatial signature of deforestation has changed with the composition of deforestation's drivers. Corridors of cleared land became less common, and large, contiguous blocks of cleared land became more common. The newly cleared land in these blocks tend to be level lowlands. Their shape and slope make these tracts of land easy to cultivate with large machines.

The agricultural expansion onto level lands and the reliance on industrial farming techniques has unleashed a set of land use changes that has promoted the spread of invasive species on tropical farmlands. Bracken Fern (*Pteridium*), Marabou (*Dichrostachys cinera*), and Alang-alang (*Imperata cyclindrica*) grasses have become much more common in Mexico, Cuba, and Indonesia, respectively, during the last 30 years (Guillen & Fernandez, 2017; Lambin et al., 2013; Schneider, 2006). The amount of farmland in Cuba infested with Marabou has increased from about 3% in 1950 to 17% of all farmland in 2017 (Guillen & Fernandez, 2017; Nelson, 1950). All three invasive species do well in fire prone landscapes because they have subterranean root systems that fires on the surface of the ground do not damage. Because droughts become more severe with climate change and the droughts in turn induce more fires, there is a plausible interaction between climate change and the spread of these invasive species: the more severe the climate change, the more frequent the fires, and the more rapid the spread of the invasives. Because these invasive species have very difficult to destroy root systems, they impede the restoration of agriculture on lands where invasives now predominate.

Different trajectories of agricultural expansion and environmental degradation characterized humid and semi-arid zones in the tropics. The dry forests constituted an appreciable amount (42%) of the world's tropical forests in 2013. The people who inhabit these open canopy forests are the world's poorest people, in part because crop yields in these semi-arid zones are only about 60% as high as they are in humid zones. A greater proportion of people in dry forests practice agriculture. These households also have some of the world's highest fertility rates. The deforestation and environmental degradation in the dry zones does not stem from international trade in tropical commodities as it does in the humid zones. Instead, local population growth in urban and rural communities and the production of food for these peoples appears to be the most consistently associated factor with deforestation in semi-arid zones (Rudel, 2017). The loss of forests in these settings reduces transpiration after rains, so it may reduce both the amount of subsequent rainfall and the crop yields on deforested lands in dry forest zones. The resulting forest losses may explain the simultaneous

increase in bare ground in many of these poor, semi-arid districts (Song et al., 2018).

Somewhat different trajectories of change have characterized land uses in productive, already settled, and cleared agricultural districts. By the year 2000 these already settled agricultural regions constituted about half of all of the humid tropics in the world. Intensification characterized land uses in these zones as well, but the dynamics of this process differed dramatically from the processes that prevailed in the frontier forests. For example, in agricultural zones in India, new road construction has recently prompted nearby increases in forest cover (Kaczan, 2017). Landowners planted the new forests in order to produce forest products for growing urban markets. The planted forests in these places are field crops that produce a commodity for sale to urban populations. Planted or managed forests in these places follow the temporal logic of a treadmill of production (Gould et al., 2008). The same logic describes other forest producing economies like those in Scandinavian countries even though these forests are located far from the largest urban markets for their forest products. Farmers and other landowners in an increasing number of settings have gotten caught up in similar routines of production. Under these circumstances, most new forests throughout the globe are regenerating forests that are slated for harvesting as soon as possible (Rudel et al., 2016).

Workplaces organized around the treadmill run in a highly mechanized manner that requires relatively few workers. For this reason, they create few jobs. Young persons leave these treadmill communities in search of work, so these places lose population over time (Carr & Kefalas, 2009). Those who remain 'migrate to the blacktop'. When they abandon farming, they often move from old houses on their farms to new homes or trailers on blacktop roads from which they can commute more easily to jobs in sometimes distant cities (Hart, 1998). The new homes, mobile homes, and trailers string out along the faster, more frequently travelled, blacktop roads. This dynamic applies in rural areas of the Global South as well as the Global North. In the Ecuadorian Amazon, indigenous peoples like the Shuar have built homes along interprovincial roads to be closer to schools and to take advantage of the commercial opportunities afforded by having a home along a major thoroughfare (Rudel & Horowitz, 1993).

The fields that remain in production get larger which in turn facilitates the mechanization of cultivation among the remaining farmers. These big fields become the recipients of inputs that over time have increased in volume. These inputs include water as well as herbicides, pesticides, and fertilizers. Semi-arid agricultural regions like the American Great Plains have seen an increase in irrigation systems that have drawn down the ground water in underground aquifers. Farmers in more humid areas have also increased the volume of inputs that they put on the land. The run off from these applications have interacted with the longer and warmer growing seasons induced by climate change to create over time more long lasting and toxic algae blooms in bodies of water like Lake Erie.[2]

## Urban Sprawl

Growth in urban economies has driven the expansion in agricultural and forest product markets described above. The growth has demographic, geographic, and economic components. As our numbers increase, a larger proportion of us reside in cities. Rural to urban migration continues to occur in both rich and poor countries. The most dramatic spatial expansion of cities after 1980 occurred in East Asia, propelled by dramatic economic growth in the region and the related, very rapid rates of rural to urban migration in China (Seto et al., 2010). Real estate development in the outskirts of large Chinese cities has been extremely rapid, and, with it, real estate developers have converted large amounts of farmland close to cities into sites for large buildings that house either people or assembly lines for manufactured products. Cities in less economically vibrant regions like Sub-Saharan

[2] https://www.cleveland.com/expo/news/erry-2018/07/49b4353a83940/lake-eries-2018-harmful-algal.html

Africa also have experienced urban sprawl, but the sprawl has taken the form of shantytowns with minimal public services that rural to urban migrants have created for themselves. In cities set in mountainous terrain like Tegucigalpa, Rio de Janeiro, and Quito many of these spontaneous neighborhoods climbed steep slopes, creating hazards like landslides during wet periods of weather.

Urban sprawl has also shaped landscapes in the affluent regions of Europe and North America, but the sprawl has taken different forms in different regions. In Western Europe, city officials have taken care to preserve the historical urban cores of cities at the same time that they have allowed warehouses and residential suburbs to grow up around the historical centers of cities (Couch et al., 2007). In the United States, the construction of interstate highways, and the emergence of mass produced subdivisions of single family homes during the 1950s led to the creation of many spacious, middle class suburbs during the 1960s and 1970s (Rome, 2001). Coalitions of strategically situated bankers, farmers, real estate developers, and local politicians came together to promote and profit from suburban real estate development (Logan & Molotch, 1987; Molotch, 1976). These growth coalitions have converted extensive areas of farmland into residential areas.

After 1990, middle-class sprawl in the United States gradually gave way to an upper class sprawl. Houses grew in size and the minimum lot areas required for each single family home also grew in extent. At the same time, attached housing units in cities grew in number as developers tried to profit from the influx of younger people into cities. After 2000 cities in older metropolitan areas, for the first time in decades grew more rapidly than did their suburbs (Rudel et al., 2011). This historical shift in the shape of sprawl reflected the growth in income inequality in American society after 1980 (Piketty & Saez, 2014). While the incomes of the people purchasing the smaller, starter, single-family homes stagnated, the incomes of the wealthy expanded and commensurate increases in the size of their already larger homes occurred. Commentators began to refer to suburban tracts of land covered by 'mega-mansions'. The political economic drivers of real estate development, the growth coalitions described above, remained substantially the same despite the upward shifts in the size and prices of housing.

In both richer and the poorer cities, growth in the stock of housing gave people positional goods, whose value resided largely in their exclusivity (Hirsch, 1978). Goods, like big homes in prestigious neighborhoods, had value because few other people could afford to have them. People possessing these goods responded to local changes in a conservative way because they did not want the changes in land use to diminish the value of their positional goods. Longtime residents would typically mutter, in response to a proposal for an additional real estate development, that the construction of the new development would, if allowed, convert their community into 'just another nondescript suburb' (Rudel, 1989).

At the same time because cities and suburbs have become engines of economic growth, they endow their residents with a newfound affluence. City residents, especially in the rapidly growing East Asian region, spend some of their income and wealth on a richer diet with more animal protein. Additional income goes for raw materials like fossil fuel that miners and oil industry workers extract from deposits in rural areas. In this manner, urban economic growth sustains the continuing high demand for products extracted from or cultivated in rural places (Foster, 1999). The spatial concentration of economic activity in cities encourages economies of scale. Entrepreneurs form large enterprises to profit from the large-scale demand for commodities and the high volume of trade in these locales. By promoting large enterprises and placing lots of pressure on natural resources, urban populations spur the exploitation of the natural environment throughout the globe (Jorgenson & Clark, 2011).

When, if ever, do these patterns of exploitation diminish? Economic collapses reduce the pressure on natural resources as does political resistance to the exploitation. While economic collapses are notoriously hard to predict, political

resistance and responses to environmental degradation follow a more discernible pattern. Widespread environmental degradation of the land triggers these counter movements. When they succeed, the counter movements restore natural resources or, at least, expedite their recovery.

## The Counter Movements: Landscape Preservation and Restoration

Diminished exploitation of landscapes often occurs only when a counter movement dedicated to landscape conservation or restoration emerges. These counter movements typically emerge as a reaction to landscape degradation, much as Polanyi (1944) theorized in his discussion of the double movement. He argued that counter movements, when politically successful, curtail the ability of markets to determine the use of land. The following pages outline the political-economic dynamics of counter movements with particular attention to the factors that strengthen them. I describe these dynamics, first, in the frontier forests of the relatively impoverished Global South and, then, in the suburban districts of the affluent Global North.

### Forest Preservation and Restoration in Rural Regions of the Global South

When road building in remote rural regions of the Global South accelerated during the 1960s and the associated agricultural expansion led to widespread losses of primary forests, tropical ecologists and geographers brought it to the attention of audiences in renown fora like the United Nations and the National Academies of Science in the United States (Myers, 1979). These reports emphasized the threats to biodiversity from the forest losses. The reports of these scientific elites caught the attention of political elites in the Global South, and efforts began in Brazil and other Amazon basin countries to create national parks to conserve some primary forests. The political leaders contracted with foreign advisors, often ecologists, to map out systems of parks (Foresta, 1991). These efforts led to the rapid creation of parks during the late 1980s and the early 1990s. By 2000 Latin American countries had set aside a larger proportion of their lands for parks than had nations in the affluent North.

The newly proposed parks included provisions for small populations of 'inholders', usually small groups of indigenous peoples who through foraging and shifting cultivation earned their livelihoods without disturbing the forest in major ways. During the following two decades, indigenous peoples organized and launched campaigns to acquire title to lands in these remote, forested regions. Often, the impetus for these efforts to acquire title came from outsiders who threatened to dispossess indigenous peoples of lands that they had inhabited for hundreds of years. The outsiders planned to exploit mineral deposits or clear forests for cattle ranching or soybean cultivation (Hiroaka & Yamamoto, 1980; Shane, 1986). In response, indigenous peoples, sometimes with assistance from international NGOs like Friends of the Earth and the World Bank, organized campaigns to secure titles to the targeted lands. Indigenous peoples did acquire lands through these campaigns. Between 1980 and 2000, indigenous peoples in the Global South received titles to approximately 250 million hectares of forest, an area about the size of Argentina (Barry & Meinzen-Dick, 2014). In most instances, the indigenous peoples managed their recently titled lands in a sustainable manner.

A somewhat different dynamic led to forest restoration in regions where already cleared lands predominated. Over the course of many seasons, farmers would assess the relative productivity of their fields. They frequently found that sloped fields at higher elevations yielded smaller harvests than did fields with level terrain at lower elevations. The same farmers in Western Europe and the United States also faced labor shortages because they continued over long periods to lose farm laborers to higher paying jobs in cities. Under these circumstances, farmers often made a series of agricultural adjustments (Mather & Needle, 1998). They abandoned the higher elevation fields with sloped land, and forests reemerged on these abandoned fields.

With these changes, forests began to redistribute themselves across the landscape. Increasingly, forests concentrated in mountainous terrain, and croplands concentrated on level terrain in valleys (Nanni & Grau, 2014). This redistribution of forests towards the more topographically rugged places has occurred first in the Global North and, more recently, in the Global South.

In other settings where land scarcity prevented farmers from abandoning agriculture on sloped land, the continued practice of agriculture on sloped lands had deleterious consequences. Soil erosion from run off increased in magnitude. The more rapid rate of run off from cleared land sometimes led to downstream flooding, with disastrous consequences. These disasters spurred policy changes. In France in the mid-nineteenth century, legislators passed the Restoration of Mountain Terrain Act in 1860 in order to prevent further lowland flooding. They hoped that the restoration of forests in the mountains would reduce the lowland flooding (Mather et al., 1999). In China, the 1997 flooding in the Yangtze River basin spurred the adoption of the Grain for Green program. Participating farmers would reduce the extent of lands that they cultivated, and the abandoned lands would reforest. In return for reforesting a portion of their lands, participating farmers would receive a supplement of grain that they could sell to compensate for the loss of income that they experienced when they ceased cultivating some fields (Delang & Yuan, 2015).

In those settings where rural to urban migration spurred the abandonment of agricultural lands at higher elevations or where policy initiatives by the central government led to an expansion in forest plantations, reforestation sometimes exceeded deforestation, and analysts argued that 'a forest transition' had occurred (Mather & Needle, 1998). Pushing this line of argument further, some analysts have argued that one could expect a forest transition to occur wherever societies have undergone extensive urbanization and industrialization. Analysts have pointed out that forest transitions have occurred in diverse locales, in Western Europe, North America, the Caribbean, and Brazil. These observations have led some analysts to argue that 'a global forest transition' could occur (Meyfroidt & Lambin, 2011).

The most recent and comprehensive survey of global forest cover (Song et al., 2018) shows a pattern of resurgence in forests that roughly follows the forest transition idea. It catalogs changes in forest cover between 1982 and 2016 using LANDSAT remote sensing imagery. This analysis finds a 7.1% increase in global forest cover over the 34 year period. Forest gains in Eastern Europe, Russia, China, and North America, often in challenging terrain, exceeded forest losses in insular Southeast Asia and in South America in the Amazon basin and the Gran Chaco region. Some of these forest gains have occurred in the high latitudes where global warming has induced tree growth in boreal landscapes. In a pattern consistent with the forest transition argument, montane landscapes gained tree cover while arid and semi-arid landscapes lost tree cover. Bare ground became more prevalent in dryland regions (Song et al., 2018).

Points of inflection in a forest transition sometimes occurred when leaders became aware of some disquieting trends in land use and states intervened to stop them. Leaders recognized, as in Brazil in the mid-2000s, that deforestation and the associated destruction had accelerated. A series of poor harvests, a loss of farm laborers to cities, and finally, downstream floods exacerbated by cleared land in the headwaters of watersheds persuaded political leaders that they needed to restore the upland regions. Land use trends that destroyed nature only seemed to generate a restorative countermovement when land users recognized in a visceral and immediate way the damage that had been done to the landscape. In these instances, a destructive movement appears to contain the seeds of a restorative counter movement.

Counter movements under these conditions represented in some instances a kind of 'defensive environmentalism' (Rudel, 2013). Activists sought to preserve or restore the natural environment close to home. Given this locational dynamic, activists often benefited personally from environmental activism. These traits

distinguished environmentalists who take 'close to home' counter measures from other activists who focused on global environmental goods like a stable climate and did not stand to benefit from its provision more than any other person. In some instances, defensive environmentalism involved indigenous peoples and the preservation of a forest based or riverine livelihood in a frontier forest setting. Much of the resistance to mining ventures by indigenous groups in the upper Amazon basin has taken this defensive form (Bebbington & Bury, 2013; Rudel, 2018; Sawyer, 2004). It also occurred, as outlined below, in the outer reaches of metropolitan areas.

Ultimately, the state has played an important role in reforms that curtailed markets in land and made it possible to restore forests in ravaged regions. One clear avenue of state influence has been through the creation of a system of secure land tenure. People with secure titles to land have an incentive to conserve in the short-term (Robinson et al., 2014). A landowner with secure title can rest assured that if s/he allows the trees on his/her land to grow, s/he will reap the value in the tree when s/he harvests the tree. The title to the land gives the owner the right to benefit from harvesting trees that have grown on the land. This expectation presumes that the government will enforce property rights to land. Quite frequently, governments have either failed to enforce these rights or, they have failed to clarify rights in land. When governments have clarified and secured land tenure, the positive association between secure land tenure and forest preservation has become evident.

The work of Chris Reij in Niger provides a clear example of this relationship between secure land tenure and the restoration of forests. During the first six decades of the twentieth century when Niger was a French colony, the colonial government in a misguided effort to protect trees made them all property of the state and imposed a penalty on anyone who chopped down a tree. The context for this set of rules was a semi-arid Sahelian landscape with relatively few trees. One consequence of the colonial rule was that no one cared for the trees because they were the property of the state. In a drought prone region, this set of rules did not benefit trees because it gave small farmers no incentive to care for trees through, for example, occasional watering. At independence, the new government retained the French rules. Two decades later, with little additional tree growth and a continuing drought, the government of Niger decided to change tree tenure. It made trees the property of the person who owned the land on which the tree grew. In effect, local people became the owners of trees rather than the state. The prospect of tree ownership incentivized small farmers, and they began to plant trees during the 1980s and the 1990s. Comparisons of remote sensing analyses of trends in tree cover in Niger and Nigeria during the first decade of the twenty-first century make it clear that the clarification of tree tenure and the corresponding increase in secure tree tenure led to a substantial increase in forest cover in Niger (Reij, 2014). This case underscores the importance of a government's land tenure arrangements for promoting the restoration of forests on degraded lands. Regimes that do not have clear rules regarding land tenure that incentivize tree survival or do not have the capacity to enforce land tenure rules will find it difficult to restore degraded or deforested landscapes. Forest reforms, like the one in Niger, demonstrate the crucial role that states have played in recent, restorative, rural counter movements.

## Conservation in the Exurban Outskirts of Cities

Expansion in the networks of highways for automobiles that began in the interwar years of the 1920s and the 1930s created a wealth of economic opportunities for real estate developers in the rural communities that surrounded cities in the affluent societies of the Global North. Builders intensified land use. In the United States beginning in the 1950s, real estate developers converted fields and forests into extensive subdivisions of single family homes. In their scale and numbers, the new homes often dwarfed the older houses surrounded by fields or clustered at the intersection of roads. The proposed

developments, either in single-family homes or in attached housing, often contained as many units as the entire stock of other homes in the community. The influx of new residents that came with the new developments called into question the positional good of the pre-existing community. Would the new residents devalue a place of residence, turning it into just another middle or lower income urban community? These fears frequently sparked a counter movement of the existing residents in the community (Rudel, 1989). They intended to preserve the 'country atmosphere' and landscape of the community by blocking the proposed real estate development and creating conservation land trusts that preserve low intensity land uses.

Although vastly different from the indigenous people who have resisted agricultural and mining interests in the Amazon basin, these economically comfortable suburban residents also practiced defensive environmentalism. Their resistance to developers produced tangible, close-to-home benefits for themselves in the form of a quieter, more spacious residential atmosphere than they would have enjoyed if the proposed real estate development had been constructed as originally proposed by the developer.

The suburban activists sought to limit the extent of the new development, both in the number of housing units and the extent of the land area occupied by the new housing. The political pressure from members of the counter movement often reduced the size of the new developments, and in the aftermath of the land use conflicts, the land freed from development became parks or forest preserves. Through this dynamic, the amount of preserved open space in northwestern New Jersey, for an example, increased from 7.6% to 29.1% of all land between 1975 and 2002 (Rudel et al., 2011). In some instances, the open space remained in forests. In other cases, the preserved lands remained in agricultural uses, and in still other cases, the agricultural lands reverted to forest. In all of these instances, the changes enhanced the carbon sequestering capacity of landscapes.

The funds for preserving these lands have most frequently come from a variety of sources that activists have cobbled together during the prolonged disputes about the extent of a proposed real estate development. In New Jersey, bonds approved by local taxpayers, donations from well funded foundations like the Nature Conservancy, one-time appropriations from the federal government, and donations by neighboring landowners financed the acquisition of the open space. Often, these disputes take years to resolve, and a resolution only happens after the developers, for whom time is money, decide to make an appreciable proportion of their lands into a conservation reserves. Here, as with the dynamic surrounding tropical deforestation, the counter movement begins first with the threat of further environmental degradation. In this instance, the degradation comes in the form of more impervious surfaces and more automobile traffic. Unlike the dynamic surrounding the losses of frontier forest, the land use conflicts on the outskirts of cities also involve threats to positional goods. By degrading the environment, the proposed developments threaten the attractiveness of these residential communities and makes them less desirable to potential homeowners. Declines in the exclusivity of the housing stock occur. The positional value of residing in the community goes down as do the prices of houses in the community.

Growth in the extent of preserved and restored forests has also occurred outside of suburban locations in the affluent North. It has occurred in amenity-rich areas of urban as well as rural locales, in the Global South as well as in the Global North. The residents of amenity-rich rural areas in North America where many people maintain second homes or retirement homes have been the sites of controversies over additional real estate development. For example, lakeside homeowners in northwestern Wisconsin have opposed additional lakeshore real estate development near their homes (Schewe et al., 2012). Similar controversies over additional real estate development have erupted around other amenity rich, rural areas near ski areas, scenic mountain ranges, or beach resorts in the affluent countries. The same dynamic also characterizes some of the more prosperous rural places in middle income,

developing countries. In Florianopolis along the southern coast of Brazil, lands within the city limits near new coastal resorts have revegetated after the creation of parks in these areas (Baptista, 2006). Similarly, environmental activists and hotel owners established a cluster of six biological preserves and a protected forest between 1985 and 2005 in Mindo, Ecuador, some 62 miles from the capital city of Quito, after Mindo gained international renown as a site for birding in the tropics (Widener, 2011). In this instance, the reserves together created a larger conservation corridor or cluster that protected more biodiversity than would have occurred in a more fragmented set of reserves. In Mindo, the environmental activism by the eco-tourism industry had a defensive quality to it in that it focused on the immediate environs of the tourist facilities, so it defended, in addition to the environment, some high-end economic interests.

The focus in the preceding pages on examples of counter movements among rural and exurban peoples does not signify that city dwellers in the Global North and South willingly accept environmental degradation. In these settings, local residents resist large-scale urban transformations, but the objects of controversy are often much smaller spaces than they are in rural or suburban places. Controversies revolve around the height of buildings, the fate of oddly shaped urban lots, or the preservation of older, architecturally significant buildings. The dynamics of contention resemble those in rural and suburban places even though the objects of controversy are much smaller in scale in urban areas. The double movement dynamic appears to apply to urban as well as to rural and suburban land uses.

## Going Beyond the Local Counter Movements: Climate Change and Global Land Use Planning

The preceding discussion of counter movements describes efforts by social movements, comprised for the most part of local peoples, to limit intensified land uses by adopting rules that curtail large-scale land use initiatives by farmers, real estate developers, and outside investors. The scale of these defensive environmental efforts has almost always been small. The opponents of the intensified uses have pursued changes in land use regulations in the community or on particular tracts of land affected by the proposed intensification. As a result, myriad, small biological reserves or restrictive land use plans have emerged in a rain forest or along the rural-urban fringe of a major metropolitan area.

The history of these market limiting land use plans suggests that they are not always small in scale. The scale of land use plans fluctuated in the United States during the latter part of the twentieth century. During the 1970s, several states like Vermont and New Jersey adopted land use plans that restricted real estate development across multiple communities on the slopes of high mountains or in the Appalachian highlands. For a brief period during the mid-1970s politicians in the federal government considered enacting a national land use plan (Popper, 1988). With the strengthening of neoliberal political persuasions during the 1980s, counter movement activists abandoned these large-scale land use planning initiatives (Babb, 2013).

The unmistakable onset of global climate change may have begun to alter this 40-year long localization dynamic in land use planning. In other words, in response to macro-ecological climate change driven shifts in landscapes, governments have begun to put together land use plans that would counter climate change driven destruction. I outline below two of these large-scale land use planning efforts below, one associated with sea level rise and another with carbon sequestering forest expansion.

Sea level rise, in the form of significant increases in tidal flooding and devastating inundations after ever strengthening hurricanes, has prompted initiatives to revise land use plans. In particular, land use planners have begun to call for ‘managed retreats’ from existing shorelines (O’Neill & Abs, 2016; Union of Concerned Scientists, 2018). The retreats have taken a variety of forms. New regulations imposed after storms or damaging floods have required that

residents build their residences high than they had been, literally to keep the houses above the ocean waters. The retreats have concentrated in poorer communities where homeowners did not have flood insurance and did not have the financial means to make repairs after the storms. Under these circumstances, people up and down the coast abandoned the damaged properties.

In poorer, shoreline regions of the Global South like the delta regions of Bangladesh, the retreat from inundated areas may entail fewer attempts to preserve housing and farmland. States would not have the capital to spend on these preservation efforts. Assistance from wealthier nations, while written into the climate compacts sponsored by the UNFCCC (United Nations Framework Convention on Climate Change), would have to become available on a massive scale to make efforts to preserve delta lowlands feasible.

The need to mitigate rather than adapt to climate change appears to have resuscitated efforts at the large-scale land use planning of forests. With the adoption of a 'propose and review' regimen for greenhouse gas (ghg) emissions by the signatories to the 2015 Paris Agreement, countries have accepted the responsibility for planning to reduce their emissions. These plans stipulate changes in energy use that move countries away from carbon based fuels. The plans also outline changes in land use. Because reforesting and afforesting landscapes absorb carbon, they represent one of the few ways to achieve short-term reductions of carbon in the atmosphere. For this reason, large numbers of countries with commitments from the Paris agreement have placed a high priority on restoring or enhancing forest cover within their boundaries.[3] In effect, these plans for emission reductions contain plans for landscape transformations at national scales. The countries who have committed to the Paris Accord will reconvene on a regular basis to assess their progress in reducing emissions. These reassessments should provide the basis for revising national plans for emissions reductions and carbon sequestration. The revisions will likely include revisions to plans for land use. Countries will no doubt base their revisions in part on what comparable countries are proposing to do with their use of land in order to achieve emissions reductions. In this manner, the Paris Accord provides a framework for concerting the plans of nations for forest restoration and land use. A global plan for land use might emerge from these post-Paris deliberations. These planning meetings should occur every 5 years, beginning in 2020.

Of course, countries will not adopt identical plans given the differences between nations in their energy economies, but the Paris Agreement signifies the emergence of a counter movement at a global scale. As Polanyi (1944) saw so clearly, movements beget counter movements, but they only do so when the initial movement has exploited and destabilized natural and human communities to an unprecedented degree. Can the counter movements reestablish a measure of stability and well-being among the earth's living communities? Will they occur before the initial exploitative impact of market expansion has rendered the earth all but uninhabitable? Will, for example, a social movement to curtail the consumption of meat become sufficiently strong in an era of destructive climate change to cause declines in beef consumption and a corresponding reversion of tropical pastures into tropical forests?

Further work by environmental sociologists may point to ways that the movement—countermovement dynamic can lead to more efficacious reform efforts and, in so doing, limit the damage done to the environment by neo-liberals who celebrate self-regulating markets. For example, how do we account for the presence of counter movements in some but not other places? How do social movements that begin as counter movements contribute to the resilience of impacted communities in the aftermath of climate change induced disasters? These questions seem especially pressing during an era of destructive climate change.

[3] Outlines of the Paris plans for individual countries can be accessed at the World Resources Institute https://www.wri.org/our-work/project/cait-climate-data-explorer

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# Structural Human Ecology

# 21

Thomas Dietz and Richard York

## Towards a Structural Human Ecology

Structural human ecology (SHE) is an effort to link environmental sociology with work in the other environmental social sciences, but also with work in the ecological and physical environmental sciences, and via ethical considerations and historical analyses, with the humanities. SHE is not a theory in the sense of a specification of key variables and concepts with proposals about how they interact. Rather it is what Mullins referred to as a theory group, a network of linked papers and scholars who share common concerns (Mullins, 1973). SHE is concerned with bringing sociological insights to analyses of human-environment dynamics. But it also seeks to inform environmental sociology with perspectives and results from approaches outside sociology. Some of this work is interdisciplinary in the sense that it engages perspectives from multiple perspectives, but much of SHE strives to be transdisciplinary both in the sense of trying to develop a synthesis that spans disciplines and in the recognition of the need for broad discourse in advancing science in the service of social change (O'Rourke et al., 2013). Scholars working in the discourse of SHE adopt approaches and emphasize problems that facilitate the interplay between sociology and other environmental disciplines. In this chapter, we outline some of those concepts and issues, building on previous programmatic statements (Burns & Rudel, 2015; Dietz & Jorgenson, 2013, 2015). We emphasize that SHE is an evolving approach so what we offer is a snapshot at a particular point in time. Since SHE is a network of scholars, of publications that cite each other, and of shared ideas, the key themes will look different from different vantage points in the network. This overview is from our perspective; we view different perspectives as a healthy part of the conversation that shapes SHE.

Why the label structural human ecology, rather than, for example, political ecology or simply environmental sociology? While there are always risks of being misinterpreted when offering a new term, in this case we feel the label is useful to give some sense of identity, albeit a fluid identity, to concerns and approaches that attract the attention of those who engage in this evolving network of scholars. Human ecology is a venerable term in sociology. In its earliest forms, it struggled to form concepts parallel to those then prevalent in biological ecology (Catton, 1994; Freese, 1997a). However, later self-identified human ecologists, notably Amos Hawley, rejected the link to ecology, pushing the field to be inward looking (Hawley, 1986). While Otis Dudley Duncan had

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continued to push for a human ecology that was conformable with biological ecology, his rather functionalist framework led to diminished inlfuence as environmental sociology emerged in the 1970s and 1980s (Duncan, 1964).[1] Other efforts, notably by Lee Freese and William Catton, continued to bridge between sociology and the ecological sciences (Catton, 1994; Freese, 1997a, 1997b). Such efforts are also underway by scholars not yet engaged in the evolving SHE network, some grounded in sociology and some in other disciplines (Burch et al., 2017; Dyball & Newell, 2014; Liu et al., 2007a, 2007b, 2013, 2018; Moran, 2006).

However, outside of sociology, human ecology as the study of human-environment interactions was thriving, and in particular was moving beyond the functionalism that typified both sociology and biological ecology in the 1960s to a more evolutionary and dynamic approach (McCay & Vayda, 1975; Richerson, 1977). The rejection of the functionalist tradition opened human ecology to a greater emphasis on conflict within and across societies and to focus on change rather than concern with homeostasis that typify functionalist views. Thus this turn led the way to theoretical insights derived from neo-Marxist and critical theory that have been highly influential in environmental sociology at least since the 1980s (Anderson, 1976; Buttel, 1985; Foster, 1994; O'Connor, 1989; Schnaiberg, 1980). SHE is particularly resonant with the institutional materialist framework in world-systems research, since both emphasize the materialist basis for society, evolutionary processes and the interplay between structure and agency in social dynamics (Chase-Dunn & Hall, 1997; Chase-Dunn & Jorgenson, 2003). More recently, York and Mancus (2009) developed the critical human ecology perspective, which is allied with SHE, to bring together Marxian and human ecological traditions. Marxism and human ecology share a grounding in materialism and are concerned with the larger historical context of societies, giving these different traditions important connections. Scholars working in the human ecology tradition have also engaged with critical theory, especially but not exclusively the work of Habermas (Brulle, 1993; Dietz, 1994; Gunderson, 2014, 2015a, 2015b). Of course, the neo-Marxist and critical traditions also entrain some difficulties in dealing with the tension between agency and structure, and while those problems were never central to debates in environmental sociology, they were nevertheless a source of potential problems. However, the emergent new human ecology that led to SHE was strongly influenced by work on cultural evolution and thus a framing of the relationship between structure and agency that is inspired by philosophers of science who have examined the logical structure of evolutionary arguments (Dietz & Burns, 1992; McLaughlin, 2012c). The approach emphasizes the interplay between the micro and the macro, arguing that structure constrains agency but that agency, over time, shapes structure. While any particular research project may engage the macro level or the micro, and some analyses will focus on agency and others on structure, the evolutionary perspective emphasizes the interplay of micro and macro and structure and agency.

At present, work in SHE engages one or more of six major themes: evolutionary thinking, linking the micro and the macro, risk as a framework for thinking about environmental and sustainability issues, examining the tension between reform and transformation, thinking about all drivers of change in consort, and taking account of non-humans. No single research project engages all these themes. But, in the spirit of Mullens's idea of a theory group, these themes define a network of scholars and research topics that inform one another. So in reviewing the state of SHE, we will examine each theme in turn.

[1] In a series of annual volumes titled *Advances in Human Ecology*, Lee Freese brought together papers that were intended, in part, to reconnect sociological human ecology with the broader conceptualization of human ecology we describe next. Also, a school of human ecology emerged from home economics, focused on reclaiming key critical insights from the founder of that field, Ellen Swallow Richards (Bubolz, 1996; Bubolz & Sontag, 1988; Bubolz et al., 1979; Sontag & Bubolz, 1993).

## Population and Evolutionary Thinking

Many sociologists tend to think of evolutionary theory as a theory of stages. This is not surprising. Many sociological theorists have discussed major transitions in human history, in particular the social transformations from food foraging societies through horticulture and agriculture to industrial societies, with attendant transitions in political economy, as a macro-level process, even while differing in the explanations offered for these social transformations. But such "evolutionist" stage theories are antithetical to fundamental ideas in evolutionary/population thinking (Dietz et al., 1990). In contrast to this evolutionist approach of stages and transitions, evolutionary theory emphasizes the importance of historical contingency. Thus, evolutionary theory examines both individuals acting with agency and the structure that facilitates and constrains their actions, and in particular how structure and agency shape each other.

Starting in the 1980s, theories of cultural evolution posited that human action was substantially shaped by information learned from others. The processes by which information is transmitted from one individual to another, and thus spreads through a population, and by which information leads to actions with positive and negative consequences for individuals, are modeled using mathematical tools and a logic developed from parallel approaches in biological evolutionary theory. However, cultural evolutionary models were developed initially to confront the genetic determinism that characterized the then popular sociobiology. The early cultural evolution work argued that simple sociobiological models were not realistic descriptions of humans and perhaps not of other species as well (Boyd & Richerson, 1976, 1985; Henrich, 2015). Most work on cultural evolution has emphasized the long sweep of human history, especially our global success as food foragers, and broad cross-cultural comparisons (Boyd, 2017; Henrich, 2015; Henrich et al., 2004, 2005, 2010; Richerson & Boyd, 2005). These are rather different problems than those that occupy most environmental sociologists.[2] In turn, only recently have scholars working on cultural evolution turned their attention to issues such as sustainability that are of interest to environmental sociologists (Brooks et al., 2018; Waring, 2010). So it is not surprising that most environmental sociologists have not engaged the literature on cultural evolution. But, as McLaughlin has noted in a series of analyses, evolutionary or population thinking could be very helpful to environmental sociology (McLaughlin, 2001, 2012a, 2012b, 2012c; McLaughlin & Dietz, 2008). For this reason evolutionary thinking has long been a theme in SHE and has strongly influenced other work in human ecology including Ostrom's analysis of the commons (Burns & Dietz, 1992; Dietz, 2005; Dietz & Burns, 1992; Dietz et al., 2003).

The core of population or evolutionary thinking is viewing individuals interacting in contexts shaped by structure, while structure is modified by the actions of individuals. The effect of an individual action depends on how the biophysical environment responds to that action, but since humans live socially, it also depends crucially on social responses. So individual actions shape culture and are shaped by culture and by the institutions and networks that organize our interactions.[3] Power thus becomes central to structural human ecology, including not only the immediate exercise of power to encourage or sanction the actions of others but also power embedded in social structure, including informal norms and the formal rules of governance systems, "the mobilization of bias" (Bachrach & Baratz, 1970). In this evolutionary view, social change is not a result of an inexorable unfolding

[2] A limit of SHE as it has developed to date, and of much though not all environmental sociology, is that most work examines people in Western, educated, industrial, rich democracies (WEIRD) (Henrich et al., 2010a, 2010b). There are important exceptions, of course, but more broadly cross-cultural and deeply historical work would certainly benefit the field.

[3] Institutional analysis is central to the work of Ostrom and thus easily linked to ongoing work in structural human ecology (Ostrom, 1990, 2005). The network perspective is an important complement to SHE and needs to be better integrated (Henry, 2009; Henry & Vollan, 2014).

of historical processes, nor are societies structured to maintain homeostasis. Rather social structure is the result of historical human agency now embedded in formal and informal rules. Social change comes about through a variety of forces that disrupt the status quo, including environmental change, technological change with unintended consequences and ongoing struggles by human agents, including powerful individuals and groups, social movements and individuals whose actions cumulate into change (Dietz et al., 2020; Givens, 2017).[4]

While most work by the SHE community is not at the micro-scale, one of the dominant theories of environmental social psychology, Values-Beliefs-Norms (VBN) theory is grounded in the evolutionary and structural considerations at the heart of SHE. VBN theory is a theory of pro-environmental behavior by individuals. At the core of the theory are altruistic values and norms, including both altruism towards other humans and towards other species and the biosphere (Dietz, 2015a; Steg, 2016; Stern et al., 1999). VBN theory was developed around the idea that altruism is usually necessary to overcome the commons dilemmas or collective action problems that characterize most environmental issues. Thus the processes in cultural evolution that can either support or block altruism emerging in a social group become a key background in the theory. And from the start VBN theory emphasized how social structure and in particular inequality and oppression or, in contrast, privilege, can lead some groups, particularly women and minorities, to be more altruistic than dominant groups (Dietz & Whitley, 2018; Stern et al., 1993).[5]

## Reconciling the Micro and the Macro

The SHE approach places strong emphasis on embedding micro-scale processes such as those examined in environmental social psychology within larger macro-scale processes. We have well developed methodologies that allow us to understand how individual scale processes are embedded in larger social structures and how structural features influence those micro-processes (Raudenbush & Bryk, 2002; Snijders & Bosker, 2012). However, we generally lack data that allows these methods to be deployed for the study of human ecology; the major exception is the study of public opinion on the environment (Givens & Jorgenson, 2011, 2013; Jorgenson & Givens, 2014; Marquart-Pyatt, 2013, 2013–2014; Marquart-Pyatt et al., 2014). This lack of data has discouraged very detailed development of theory beyond the core acknowledgements of the linkages between micro and macro (Waring et al., 2015).

Thus it will not be surprising that scholars in the structural human ecology community work at both the micro and macro scales with individual scholars often engaging in some work at each scale. Perhaps the most prominent element in the SHE literature is the effort to identify the macro-scale (typically nation-state) drivers of environmental stress, the "STIRPAT" tradition (Dietz & Rosa, 1994, 1997; York et al., 2003b).[6] STIRPAT began with the IPAT equation that emerged in a debate between Barry Commoner on the one hand and Paul Ehrlich and John Holdren on the other:

$$\text{Impact} = \text{Population} \times \text{Affluence} \times \text{Technology} \quad (21.1)$$

Data are found for I, P and A with T being calculated as the Impact per unit (Population*Affluence); that is T = I/(P*A). While this approach will strike sociologists as very simplistic, it did have the advantage of suggesting the

[4] Structural human ecology notes the importance of "the animal other" as we will note below and thus allows for agency on the part of non-human animals.

[5] The emphasis on cultural change allows a link between SHE and emerging work on network dynamics in social learning for sustainability (Bener et al., 2016; Frank, 2011; Henry, 2009, 2018; Henry & Vollan, 2014; Masuda et al., 2018).

[6] Gene Rosa proposed the term, which means both "Stirp of IPAT" and STochastic Impacts by Regression on Population, Affluence and Technology."

need for empirical analysis in debates about drivers and the value of a multiplicative functional form. A version that further decomposes T into greenhouse gas emissions per unit energy and energy per unit total affluence (P × A), called the Kaya equation, is still frequently used in generating climate scenarios (Kaya & Yokobori, 1997).

STIRPAT changes IPAT into a stochastic form:

$$I = aP^bA^cT^de \quad (21.2)$$

Then data can be found on I, P, A and T and standard statistical tools can be used to estimate the parameters a, b, c, d and e. The coefficients of the variables are elasticities, while the error term is the effect of all variables not explicitly included in the model. Applications of STIRPAT add variables that capture key aspects of power relations, such as inequality, trade dependence, and world systems position (Jorgenson, 2013; Jorgenson et al., 2019; McGee et al., 2015; York et al., 2002, 2003a). Thus the original equation in (21.2) is seen as merely a starting point for specifying models that capture the complex dynamics that drive environmental stressors. There are now hundreds of papers that explore a wide variety of measures of stress and many theories of structural drivers using the STIRPAT approach (Dietz, 2017; Jorgenson et al., 2019).

Most STIRPAT analyses use data on aggregate geopolitical units such as nation-states, U.S. states or Chinese provinces. This choice allows the investigation of structural features of the political economy that cannot be readily studied at the micro-scale because we lack data sets that provide micro-scale data across a variety of political economic forms. But STIRPAT scholars are well aware that there are micro-scale processes that underpin the observed structural relationships, and there are examples of micro-scale (household) analyses (e.g., Adua et al., 2016).

A recent development in this literature is to think of sustainability as an effort to balance enhanced human well-being with reduced stress placed on the environment (Dietz, 2015b; Dietz et al., 2009b; Jorgenson, 2014; Jorgenson et al., 2014; Rosa, 1997). This approach was anticipated in a pioneering paper by Mazur and Rosa that demonstrated that energy consumption and lifestyle were not tightly coupled (Mazur, 2013; Mazur & Rosa, 1974). Human well-being can be conceptualized as produced by deploying physical resources (infrastructure), human resources and natural resources. Then well-being can be modeled as a production function with these inputs and political economic factors influencing the efficiency of production. The SHE approach asks which nations or other geopolitical units or even households are especially efficient in producing substantial well-being with minimal resources. This suggests examining the Environmental Intensity of Well-Being (EIWB; the amount of environmental impact produced per unit of well-being). The structural question then becomes what features of the political economy, such as inequality and power relations, lead some nations to produce high well-being with minimal environmental stress while others place great stress relative to the human well-being produced. Much of the EIWB literature to date has focused on greenhouse gas emissions as a key measure of environmental stress and life expectancy as a measure of well-being (Givens, 2017, 2018; Jorgenson, 2014; Jorgenson & Dietz, 2015; Jorgenson & Givens, 2015; Jorgenson et al., 2017; Kelly, 2020). Emerging work on rural areas and developing countries is linking the SHE approach to ecosystem services as a basis for human well-being (Yang et al., 2015, 2016, 2018).

## Uncertainty

Research on how human decision making deviated from the standard rational actor model dominant in economics led to the conclusions that humans have difficulty in processing probabilities and other forms of uncertainty (Fischhoff et al., 1978, 1981; Jaeger et al., 2001; Kahneman, 2011). In the early 1980s this awareness of human information processing, coupled with controversies over nuclear power, toxic chemicals

and a variety of other environmental and technology issues, led to the emergence of risk analysis as a foundational aspect of environmental policy in the U.S. and elsewhere starting (Regens et al., 1983; Ruckleshaus, 1983). That in turn led to a growing sociology of risk that complemented the growing concern with environmental justice (Frey et al., 2007; Short, 1984). A substantial literature, including work by the SHE community, offers theories of how society engages with environmental and technological risk, arguing that risk is a central organizing theme in contemporary social structure (Kasperson, 2013; Renn et al., 2013; Rosa et al., 2013; Stern, 2013).

The SHE community has placed special emphasis on how uncertainty in scientific assessments influences the application of science to policy, drawing on the philosophy and sociology of science (Aven et al., 2011; Kasperson, 2013; Rosa, 1998b, 2010; Rosa & Clarke, 2012; Rosa et al., 2012). A key point of this literature is that our abstract model of science is based on fields where replication is relatively commonplace and where results are rather ostensible. This can lead to strong conclusions about general principles, for example, about the toxic action of lead in model organisms. But practical application of that science to risk assessments requires attention to the details of a particular context where a problem occurs. So however well known the laboratory dose-response curve for lead toxicity may be, use of that information to formulate programs and policies requires understanding exposure routes in a particular community, including the routine behavior of community members their competing risks and much else. In dealing with risk in particular contexts, application of science moves from a domain of high repeatability and ostensibility to a domain where conclusions are much more uncertain. The SHE literature emphasizes three points about such circumstances.

First, because of the increased uncertainty, scientific assessment must avoid hubris. There is a long history of local activism in response to both proposed projects such as nuclear power plants or oil and gas pipelines and to community exposure to toxics. Some have argued that these strong public objections are the result of a lack of understanding of scientific analysis on the part of the public (Starr, 1969). But, given the heightened uncertainty that comes with applying general scientific results to local contexts, public skepticism may be appropriate. As Rosa put it: "The typical objections of laypersons, then, is not to science per se . . .but to institutions that attempt to maintain a monopoly on knowledge claims and which sometimes misapply abstract science to the peculiarities of local settings" (Rosa, 1998a). This implies that in the face of uncertainty, the best path forward is through linking scientific analysis to deliberation with interested and affected parties and acknowledging that multiple forms of expertise are required in decision making (Dietz, 2013b; Gunderson, 2016; Gunderson & Dietz, 2018; Renn et al., 2013; Stern, 2013).

Second, applying science to local circumstances requires engagement of multiple forms of expertise. Of course, most environmental analyses are inherently multidisciplinary. But here we think of expertise that is grounded in indigenous and local knowledge and the idea that in addition to scientific expertise assessments to inform policy decisions should engage many forms of expertise in addition to science, including community expertise, expertise about local political opportunities and constraints, expertise about effective processes for dealing with conflicts, etc. (Dietz, 2013b). An emerging literature discusses effective mechanisms for linking such expertise, especially indigenous and local knowledge, to traditional science in ongoing processes of adaptive risk management (U.S. National Research Council, 2008; Whyte, 2013; Whyte et al., 2015).

Third, because societies are shaped by many complexly interacting forces, including those spanning ecological contexts and social structures, which change over the course of historical time, social science theories will never fully capture completely the dynamic processes that lead to social change (York, 2013; York & Clark, 2007). Therefore, even empirically well-established theoretical and statistical models, which are unavoidably based on data collected in specific historical contexts, are vulnerable to

failing in new circumstances as historical background conditions change. For example, the failure of economic models to predict the 2007–2008 global financial crisis in part stemmed from the fact that prominently used models for predicting financial risk were based on correlations among factors established based on a narrow temporal context in which housing prices where typically rising. When housing prices began to fall, changing the context, these correlations did not hold and the economy did not follow the predictions of the models (York, 2013). Thus, SHE emphasizes the importance of thinking in historical terms and recognizing how background conditions of all types change. This is a particularly important point in our time, where the global environment is changing rapidly, making problematic the use of economic, ecological and other models developed in times of plentiful resources and a more stable climate.

## Reform Versus Transformation

The first years of the macro-SHE research program paid considerable attention to the ongoing debate between ecological modernization (EMT) theorists on the one hand and various varieties of neo-Marxist theory on the other (York & Rosa, 2003). EMT theorists argued that as societies became more affluent, the stress they placed on the environment would increase. However, at some point the upward trajectory of environmental stress would slow, level off and begin to decline.[7] In contrast, several versions of theory inspired by neo-Marxist analysis suggested that capitalist societies are inherently unsustainable because they push for endless economic growth and organize production so as to generate profits for corporations rather than improve human quality of life or protect the environment (Foster, 1994; Schnaiberg, 1980). The human ecology tradition, with its recognition that humans are not exempt from natural laws and that ecological limits constrain population and economic growth, is also at odds with the Promethean character of EMT and mainstream economics.[8] One of the initial motivations for the STIRPAT research program was to discipline these theoretical arguments with empirical evidence and to complement case studies with statistical analyses. While the STIRPAT literature addressing the debate between Marxian, human ecological, and EM theories is immense and nuanced, a broad summary is that there is very limited empirical evidence for the EMT trajectory for environmental stressors, such as greenhouse gas emissions, that constitute a global commons. However, there is some evidence that increasing affluence can reduce stressors that have localized impact, such as air and water pollution (Jorgenson et al., 2019; Rosa & Dietz, 2012; York & Rosa, 2003; York et al., 2010). Recently, EM theorists and reformist environmentalists take the position that technological innovations and refinements are key to solving our environmental problems, while Marxian scholars and human ecologists typically think that more fundamental changes are necessary to address environmental crises. A key questions is the degree to which energy efficiency efforts and renewable energy technologies can contribute to reducing climate risk.

SHE work on efficiency has deployed cross-national comparisons, examining how effectively technological changes are at reducing energy consumption and limiting greenhouse gas emissions. There is evidence that improvements in the energy intensity of national economies—defined as energy consumption per unit of GDP—frequently do not substantially curtail energy

[7] In economics, environmental Kuzents curve (EKC) theory offers essentially the same argument—impact at first increases with growing affluence then as affluence continues to increase, impact begins to decline (Carson, 2010; Kaika & Zervas, 2013a, 2013b; Sarkodie & Strezov, 2019; Selden & Song, 1994).

[8] Of course, neo-classical economic analysis can take account of environmental damages by including them as costs. Our point here is not that economics has ignored human well-being and environmental damage. Rather our point is that the dominant discourse, especially around public policy, tends to make rather simplistic assumptions that tend to equate economics growth with well-being, while discourse in the private sector is dominated by a logic of profits.

consumption and even are commonly associated with *higher* energy consumption, instances of the Jevons Paradox (York, 2010, 2012a; York & McGee, 2016). The reasons efficiency does not necessarily lead to reduced emissions are various and differ across contexts, but are likely in large part due to the fact that in modern economies efficiency improvements are typically implemented to increase profits for corporations or to otherwise support further economic growth, so their potential benefits are at least partially offset by increased energy demand from economic growth.

A similar pattern emerges around climate friendly energy technologies, especially renewables. Over the past 50 or so years in most nations of the world, expansion of non-fossil fuel energy sources has not been associated with substantial suppression of fossil fuel consumption (Jorgenson, 2012; York, 2012b). To a large degree new energy sources have been added on top of, not in place of, established energy sources, so overall consumption of energy has grown in tandem. It appears that new climate friendly technologies are not substantially displacing older technologies (York & Bell, 2019). Again, the reasons for this are likely diverse and vary across contexts. But as with the common failure of efficiency improvements to lead to dramatic emissions reductions, the failure of non-fossil energy sources to displace fossil energy is in large part connected to political-economic forces that create new markets for more and more commodities and drive continual expansions of production and consumption (York, 2017b). These findings suggest that environmental problems are not best understood as simply technological problems, but rather as political-economic ones that require restructuring societies in line with ecological principles.

At the micro-scale, there is reason to believe that incremental actions by households can contribute in non-trivial ways to reductions in greenhouse gas emissions (Dietz et al., 2009a). It is also clear that household actions, while contributing to climate risk reduction, will not be nearly sufficient to reduce climate forcing to acceptable levels of risk. But even while acknowledging that household actions can reduce emission and thus risk, the problem of rebound effects has to be addressed (Adua et al., 2016). It is possible that small actions by households lead to moral disinhibition, in which small actions are seen as fulfilling an ethical obligation to act and issues about the scale of consumption are not addressed (York, 2017a). Thus there is a concern that household consumer actions with small impacts will block actions with greater consequences and that consumer actions may also block political actions. However, it is also possible that small actions are gateways that facilitate further actions, and that consumer actions may motivate political actions. The issue needs further theoretical elaboration and empirical investigation (Truelove et al., 2014). The evidence to date on spillover effects at the micro-scale is mixed and may be highly context dependent (Dimitropoulos et al., 2018).

At the mesoscale, there are many examples of corporations and other organizations acting effectively to reduce stress on the environment, a movement that has been labeled "private environmental governance" (Gilligan & Vandenbergh, 2020; Vandenbergh & Gilligan, 2017). There are also clear examples of the private sector and their allies acting to block environmental, health and safety concerns and to create confusion about scientific assessment of risks (McCright, 2000; McCright & Dunlap, 2010; Michaels, 2008; Michaels & Monforton, 2005). As the macro-analyses we have discussed demonstrate, there is little reason to believe that economic growth and standard processes of reform will lead to adequate reductions in risk from climate change and other aspects of global change. But the SHE emphasis on risk and on disciplining theoretical arguments with empirical evidence also suggests that it is possible that private environmental governance might produce significant if not wholly adequate risk reductions. It is also possible, following the logic of spillover effects, that private actions to reduce environmental stress might either facilitate or retard larger efforts. Reform efforts are an important topic for careful theoretical specification and especially for quantitative and historical analyses that clarify how these processes are unfolding.

And of course, the degree to which reform can succeed is dependent on context and the balance of political power. As Shwom has argued in her "middle range theory", government policy can indeed induce impactful reforms of the sort expected by EMT when environmentalists have substantial political power (Shwom, 2011). However, when they lack power, governance processes seem more akin to a treadmill of production process, where private profits are prioritized over public and environmental well-being. For example, a STIRPAT analysis demonstrates the power of the environmental movement in U.S. states has a substantial influence on moderating greenhouse gas emissions from that state (Dietz et al., 2015). And of course, the ability to mobilize and exert political power is differentially distributed across social structural divisions, so that those who control financial resources find it much easier to mobilize political action than those who are less affluent (Dietz & Whitley, 2018). It takes a great deal of altruism and collective action on the part of the less powerful to overcome the self-interest of the powerful.

## All the Drivers Matter

The STIRPAT model in its simplest form asserts that population, affluence and technology all have effects in driving stress on the environment. In practice, nearly all STIRPAT models also incorporate aspects of political economy as drivers. A major point of the SHE approach is that no driver acts in isolation. The role of technology in environmental issues and debates about growth illustrate the need to avoid "one variable at a time" thinking.

Most human interaction with the environment is mediated by technology. SHE work on risk and on macro-comparative analysis, as well as the related VBN theory in social psychology, grew directly from the sociology of energy that emerged in the late 1970s and 1980s (Gunderson, 2018; Rosa & Machlis, 1983; Rosa et al., 1988). So the SHE approach assumes that we are always dealing with a sociology of environment and technology. Of course technology is not an exogenous force; rather there are struggles over what technologies will be developed and adopted. These struggles are major sites where social groups exert agency. Sociologists first became strongly attuned to this in examining the struggles around nuclear power and alternative energy systems (Freudenburg & Rosa, 1984; Rosa, 1978).

An important insight of the human ecological tradition is that technology cannot be understood as developing based simply on cultural propensities for innovation, but rather as emerging out of a complex interaction between a variety of societal characteristics (e.g., demographic, organizational) and biophysical context (Duncan, 1964). Thus, as noted in the previous section, SHE does not see technology in isolation as either the primary cause of or solution to our environmental problems. Rather, the environmental implications of technological developments depend on politics, economics, ecological context, and other structural factors. Thus, framing environmental problems as primarily technological problems and hoping for techno-fixes is a misguided way to address the climate crises and other challenges.

Debates about growth also show the value of the SHE approach. Contentious arguments about the effects of human population size and growth on the environment stretch back centuries (Dietz & Rosa, 1994). STIRPAT models assume that population size might have an effect on environmental stress, but use data to estimate whether that effect is near zero or substantial. In most cross-national analyses population appears to have a substantial but not overwhelming effect, net of other factors (Jorgenson & Clark, 2010). But the SHE approach also encourages decomposing variables into components that might differentially impact the environment and sustainability. For example, there is evidence that in the U.S. it is not simply the number of people who drive environmental stress but the number of households since much of environmentally damaging consumption is done by the household as a unit (Cramer, 1997, 1998; Liu et al., 2003; York & Rosa, 2012). So the form of population growth

that may be most consequential for the environment is not increases in the number of people per se but increases in household units in locations and equipped with technologies that encourage environmentally significant consumption.

Debates about economic growth also can benefit from empirical analysis and from careful unpacking of what we mean by growth. As noted, there is little evidence that increasing affluence leads to reduced environmental impact; rather increased affluence is generally associated with increased environmental stress although the effects vary over time and across countries (Jorgenson, 2013; Jorgenson & Clark, 2012). Recent work on the environmental intensity of well-being also suggests that increasing affluence does not reduce such intensity, while inequality may exacerbate it (Givens, 2018; Givens et al., 2019; Jorgenson, 2014, 2015; Jorgenson & Dietz, 2015; Jorgenson et al., 2015).

In most analyses affluence is measured as gross domestic product per capita (GDPPC), and multiplying GDPPC by population yields total Gross Domestic Product (GDP), the size of the economy measured as the monetary value of all goods and services purchased in a geopolitical unit in particular year. Policy discussions of economic growth are almost always discussions of changes in GDP. For example, a recession is generally defined as a decline in GDP for two quarters in succession, with no accounting made of changes in human well-being or stress on the environment. This is not surprising since the dynamics of profit seeking in a capitalist economy pushes for continued increases in economic activity and thus in GDP. The Marxist critique of growth that is closely related to SHE is an argument that continuous increases in economic activity are not sustainable, all other things being equal. Of course, it might be that technological changes could compensate for increases in economic activity. But while further work is certainly warranted, the evidence reviewed above suggests that technological changes are not compensating for increases in the amount of economic activity.

Ecological economists have long recognized that GDP, while measuring what it is intended to measure—the amount of market-based activity taking place valued in money—is flawed as a measure of human well-being. There is a large and sophisticated literature on the measurement of well-being that is being deployed in SHE analyses (Diener, 2013; Fitoussi & Durand, 2018; OECD, 2013; Stiglitz et al., 2018). The idea of theorizing and then empirically estimating what actually contributes to well-being, noted above in section "Reconciling the Micro and the Macro", allows for a critical assessment of what aspects of economic activity, and what political economic arrangements, actually contribute to well-being (Diener et al., 2015; Easterlin, 2015). As with population, the results are likely to be nuanced. For example, there is long debate about the relationship between economic growth and well-being, and it appears that the relationship depends on both how one measures well-being and what sorts of differences in income, wealth and consumption are considered. This complexity mirrors the finding offered over 45 years ago when Mazur and Rosa showed quality of life was not a lockstep function of energy consumption. Of course, in looking across the globe, and across inequalities within even the most affluent nations, there are still many whose well-being would benefit from increased affluence. And while economic growth is generally a driver of environmental stress, in some areas growth in economic activity might be achieved with limited harm to the environment. For example, Marquart-Pyatt has demonstrated that in West Africa, economic growth does not increase most forms of stress on the environment ($CO_2$ emissions are the exception) while population growth does (Marquart-Pyatt, 2015).

The SHE tradition also emphasizes that the political economy, including the institutions of governance, matter. Much of the STIRPAT and EIWB literature examines how structural factors shaping a political economy such as resource dependence, foreign direct investment and inequality moderate the effects of population, affluence and technology (Jorgenson et al., 2019). The SHE tradition has also considered the effects of political institutions but empirical work is just beginning to emerge (Dietz et al., 2001, 2015; Shwom, 2011). However, consistent

with the micro-theory that emphasizes the position and ultimately the agency of disadvantaged groups, evidence is accumulating about the importance of women's empowerment as a driver that reduces stress on the environment, human well-being and their ratio (EIWB) (Jorgenson et al., 2018; York & Bell, 2014).

## Other Species Matter

A fundamental aspect of the SHE approach is recognizing the continuity between humans and other species. Mostly broadly, this involves recognizing the central importance of biodiversity, in both an analytic and ethical sense, in our world and understanding how the well-being of human societies cannot be separated from that of other species (Besek & McGee, 2014). In a more specific sense, research in the SHE tradition looks at how biogeography—the distribution of various species across the globe—affects human social evolution and societal characteristics (Besek & York, 2018). For example, York and Mancus (2013) examine how the presence of domesticatable draft animals was a key factor allowing for the development of agriculture. Societies without large mammals that could be domesticated did not develop plows not because they failed to innovate or "discover" the idea of a plow, but because plows are only useful when they can be coupled with animal power (before the era of fossil fuel powered machines). This observation highlights how social evolution is not simply driven by societal propensities for technological development, but rather by ecological context including human relationships with other animals.

As with ecological approaches in general, incorporating a consideration of non-human species into the social sciences has both theoretical and methodological challenges. York and Longo (2017) note that to properly examine the role of non-humans requires a realist-materialist perspective, which is at odds with various sociological traditions that emphasize the centrality of human culture and symbolic interaction since these anthropocentric approaches focus on socially constructed human meaning. Further, our theories of labor, capital and agency have to be expanded to take account of the role of non-humans in production processes (Dietz & York, 2015). Beyond the theoretical and conceptual challenges of studying non-human species in the social sciences are basic methodological issues. In particular, many of the standard social science methods, particularly qualitative ones, such as interviewing, participant observation, and interpretation of texts, leave out direct analysis of other species, reducing all non-humans to the social meaning applied to them.[9] Thus, ecologically minded scholars aim to advance not only theoretical conceptualizations about also methodological approaches so that human and non-human animals can be analyzed. Such efforts include Malone, Selby and Longo's (Malone et al., 2014) political ethology and Irvine's (Irvine, 2004, 2008; Irvine & Cilia, 2017) approach to multispecies ethnography.

## Looking Forward

A central theme across this essay has been the importance of context. Eugene Rosa, a pioneer of the sociology of energy, risk and technology whose influence pervades this essay, sometimes defined the key finding of sociology, and certainly of the SHE program, as "context matters" (Dietz, 2013a). We have articulated six major themes that together constitute the SHE approach: evolutionary thinking, linking the micro and the macro, risk as a framework for thinking about environmental and sustainability issues, examining the tension between reform and transformation, thinking about all drivers of change in consort, and taking account of non-humans. Each of them can be thought of as a way to remind us that the core of our task is to understand variation over time, across nations, across communities, across species, and across households and individuals. SHE seeks to provide theoretical and methodological tools for

[9] There are ongoing debates about these issues in the animal studies literature (Kalof, 2017; Marvin, 2010).

understanding that variation. It is an approach that strongly empahsizes interaction effects, the statistical version of intersectionality, assuming not that variation we observe is the result of a monolithic cause but rather flows from the interplay of multiple factors whose relationships evolve over time. In this sense, SHE is a program that attempts to understand why context matters, and how the macro and the micro interact in a context to produce change. We can paraphrase G. Evely Hutchinson to suggest that with SHE we are examinging the cultural evolutionary play enacted in the human ecological theater (Hutchinson, 1965).

In addition to a focus on context, SHE embraces transdisciplinary breadth. The world itself is not divided into discrete fields that align with academic disciplines. Rather, the world—physical, biological, social, etc.—is an interconnected whole, and disciplines are social creations that structure human understanding of the world. This disciplinary structure is useful in many ways, in that it helps to guide and focus scholarly inquiry and organize our understanding of the world. However, disciplines also create artificial divides that can undermine our capacity to understand the diversity and complexity of the world. Understanding the global ecological system, including the human societies that are part of it, requires the type of transdisciplinary approach that SHE embraces. Therefore, SHE encourages us to not create artificial boundaries between the social and the ecological, but to draw on the full range of human knowledge, not limiting ourselves to the particularities of any one discipline. This approach does not make sociology or other disciplines obsolete, but it does call upon them to broaden their foci and eschew narrow-minded boundary keeping.

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# Environmental Science and Technology Studies

22

Scott Frickel and Florencia Arancibia

Thirty years ago Steven Yearley (1991) drew attention to the "uneasy alliance" existing between environmentalists, who claimed political authority in protecting nature, and environmental scientists, who claimed epistemic authority in knowing nature. A similar tension exists within the overlapping fields of environmental sociology and science and technology studies (STS). Both fields are proudly interdisciplinary and both claim jurisdiction over 'nature' as a central topic of research. Both fields gained legitimacy as academic social movements in the 1970s aimed at toppling central tenets of sociological inquiry. Environmental sociology's emergence challenged the discipline to recognize ecological limits and the "study of interactions between environment and society" (Catton & Dunlap, 1978: 41; Scott & Johnson, 2016). STS rose on the claim that the intellectual contents of science were not off-limits to sociological analysis as many, following Robert Merton (1973), assumed, but were best viewed as cultural and political objects that warranted close empirical study (Barnes, 1977; Bloor, 1976). From their inception, both academic social movements have held deep political commitments toward science and technology. Yet those political commitments have tended to run in different directions, often leading practitioners to ask different questions and nourish different theoretical traditions and methodological preferences.

To many observers in environmental sociology, these differences are evidence of a fundamental disconnect, often rendered in review articles as a "great divide" (Goldman & Schurman, 2000) or an enduring "realist-constructivist split" (Antonio & Clark, 2015). For some, relativist versions of STS represent nothing less than frontal assaults on environmental sociology's bedrock materialism (Murphy, 2006b). Others, looking for ways of mending the gap, offer critical realism as a philosophical band aid (e.g., Carolan, 2005; Lidskog, 2001; York & Clark, 2010). Still others, perhaps growing tired of the debate, agree to disagree and call for a discursive détente characterized by "agnosticism and pragmatism" (Dunlap, 2010).

Readers familiar with the work of sociologist of science Tom Gieryn (1999) will recognize these efforts as rhetorical skirmishes in an ongoing "credibility contest" aimed at, respectively, expelling STS, absorbing it, and protecting environmental sociology from it. As Gieryn argues, such "boundary work" is a normative institutional response from experts whose autonomy, resources, or status are, or seem to be, under threat (Gieryn, 1999; see also Abbott, 1988). Boundary work is an endemic feature of

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self-consciously interdisciplinary fields like environmental sociology, whose porous boundaries are both a point of pride and a structural vulnerability, one requiring continuous care and management (see Frickel, 2004).[1]

In this chapter we will not debate realism vs. constructivism or rehash environmental sociology's participation in the "science wars" of the 1990s (e.g., Vaillancourt, 2010). We will avoid engaging arguments about epistemology, ontology, postmodern theory, and Bruno Latour (e.g., van Koppen, 2017). We will not enumerate the ways in which environmental sociology and STS undeniably diverge. That is all well-trod ground.

Instead, our goal is to map some less familiar but mutually held territory. We will train our attention on bodies of empirical work where STS research engages questions about the material environment, environmental movements, and environmental knowledge. Our hope is that by paying less attention to philosophical differences among certain scholars, and more attention to empirical research and practice, we can help persuade readers that STS provides an important set of connections to—and has the potential to help advance—what we take to be one of environmental sociology's central projects: a deeper *materialist* understanding of nature-society interactions.[2]

Environmental sociology and STS are global fields. By necessity, this chapter covers much less ground. It focuses primarily on research from North and South America. Across the Americas, the two fields exhibit important differences in historical development, intellectual traditions and institutional configurations. In Latin America, for example, political ecology is the main academic discipline identified with social science research on nature-society interactions and includes contributions from sociologists, anthropologists, and economists (Alimonda, 2002; Alimonda et al., 2017a, 2017b; Pengue, 2017).[3] Latin American social scientists have also articulated a distinct and important body of social theory heavily weighted toward dependency theory, critical theory and kindred frameworks for studying neocolonial capitalism and global inequalities. Hence, in Latin America, STS research on nature-society interactions is often embedded within a politics of sustainable development in the context of unequal North-South relationships as well as South-South relationships that develop autonomously and seek independence from North America and Europe (Centellas, 2014).

Environmental sociology and STS are also topically diverse and there are a wide range of research areas where the two fields overlap. Rather than skim a large number of these topics, we have chosen to focus more in-depth on just three areas of research: resource extraction and sustainable development, epistemic inequality and the social production of environmental ignorance, and the political mobilization of environmental scientists and other experts. Natural resources and environmental movements are core areas of environmental sociology; questions about the social production of ignorance are informed by the field's recent focus on climate change denialism. All three topics have attracted significant interest in STS, especially over the past decade and thus offer multiple points of interconnection. We begin by situating "environmental" STS in relation to environmental sociology and political ecology.

## Situating Environmental STS

Our understanding of "environmental STS" is broad and more or less self-evident. We use the

[1] Studies of boundary work in the environmental sciences include Clark et al. (2016), Gaziano (1996), and Kinchy (2006).

[2] The centrality of materialism to environmental sociology's intellectual project remains firm, even as the field has moved with the rest of the social sciences through a "cultural turn", with some scholars lighting on hybrids, cyborgs, posthumans, and technonatures as tools for mapping material-cultural environments (White et al., 2015).

[3] On the history of political ecology and STS in Latin America see, respectively, Pengue (2017) and Kreimer and Vessuri (2018).

term to refer generally to research within STS and kindred fields[4] that examines the relationship between science and technology, society, and the natural world. STS as a whole studies the production, organization, dissemination, and impacts of science, technology and techno-scientific knowledge. *Environmental* STS studies techno-scientific institutions, practices, and knowledge production concerned with the dynamics of natural systems, with social intervention and impacts on the natural world and with the planet's capacity to sustain life. Environmental STS thus embodies two types of politics—a politics of knowledge and techno-scientific authority or "expertise" that it shares with all of STS, and a politics of nature and sustainability that it shares with environmental sociology and political ecology.

According to a recent study by Bohr and Dunlap (2017), environmental sciences and knowledge production are not among the major themes that occupy contemporary environmental sociology's intellectual space. Even so, environmental STS has become a burgeoning area of study (Lidskog & Sundqvist, 2018).[5] It is also the case that environmental sociologists have long recognized the importance of scientists, technologists and techno-scientific institutions for generating knowledge about nature, developing technologies that change nature, and for bringing attention to environmental problems and shaping environmental policy. Dietz and Rycroft's institutional study of *The Risk Professionals* (1987), Leff's critique of production-driven environmental science (Leff, 1986a), and Jamison and colleagues' national comparison of "knowledge interests" in Scandinavian environmental movements (1990), are illustrative examples from the US, Mexico, and Sweden, respectively.

An even earlier example of environmental sociology's engagement with environmental science institutions, experts and knowledge production is Allan Schnaiberg's essay, "Obstacles to environmental research by scientists and technologists," published in *Social Problems* in 1977. The essay is significant for the broad distinction the author draws between "technological-production sciences" that support industrial expansion, and "environmental-social impact sciences" that study the environmental and social consequences of production (p. 501). Building from the premise that environmental protection is locked in dialectical relationship with economic growth, Schnaiberg outlines a set of structural incentives and disincentives controlling researchers' training, problem choices, opportunities for funding and publication, and employment and advisory roles. This same system delivers professional sanctions to scientists who "stick their neck out" as advocates for environmental science and nature protection (p. 509). Schnaiberg suggests that, together, these constraints reinforce the dominance of production science over impact science and "obscure the negative consequences of high-technology production" for the environment and society.[6]

Rereading the essay, we were struck by the many useful insights it contains but also by how little those insights have impacted environmental sociological research in the decades since its publication (for an exception, see Gould, 2015). According to Google Scholar, the paper has been cited just 34 times as of January, 2019.

[4] Generally speaking, STS is articulated through its intellectual and institutional relationships with anthropology, history, geography, philosophy, and sociology. For recent reviews of the STS field, see Felt et al. (2017) and Kleinman and Moore (2014). Both handbooks contain multiple chapters dealing with environmental topics, including environmental justice, global environmental science, risk, and environmental ignorance.

[5] In conducting research for this review we were delighted to come across Lidskog and Sundqvist's new article, which sketches the connections between STS and environmental sociology, mapped through the concept of "expertise." We have taken a different, but complementary, approach here. We also note that the journal *Environmental Sociology*, established in 2015, has published a number of STS-related articles.

[6] Enrique Leff takes a broadly similar approach in his essay, "Environment and science articulation" (Leff, 1986b), in which he reflects on the close relationship between techno-scientific knowledge and capitalist production, and the associated epistemological limits of traditional "environmental sciences" to address environmental problems related to productive activities.

And while Schnaiberg repackaged the argument for his classic 1980 study *The Environment: From Surplus to Scarcity*, it was the 'treadmill of production' metaphor, not his arguments about the social structure of science and engineering that launched an academic cottage industry.

Reviewing an earlier draft of this chapter, Handbook Co-editor David Pellow wryly observed, "I imagine [Schnaiberg] would have a word or two to say about why that is—that perhaps few people want to engage with hard truths that hit so close to home?" (email correspondence with first author). We suspect he is right, especially given the legitimating function that environmental science and technology played in environmental sociology's early development in North America. Or the fact that, viewed from the present day, the framework lacks the capacity for conceptual nuance that current theoretical debates in the field often require (see Chaps. 3 and 23). Even so, shorn of its Marxist presuppositions, the essay shares many elements in common with lots of environmental STS research in which, for example:

- Science is understood as a form of power vested in institutions, practices, people, and ideas.
- Scientific expertise, resources, statuses and ideas are distributed unequally across the scientific system and circulate unevenly within society.
- The social system of science is entangled with dominant economic and political systems, and these relationships can reinforce power inequalities within science and have lasting consequences for nature and society.
- Cultural norms and practices governing scientists' behavior and organization also shape what is known and not known.
- Conflict is endemic within the system and politicized scientists represent a perennial source of environmental resistance, mobilization, and social change.

In short, Schnaiberg's essay, now more than 40 years old, bears a strong family resemblance to a rapidly growing body of environmental STS research closely associated with calls for a "political sociology of science and technology" (Hess et al., 2017)[7]—resemblances that include deep respect for and attention to the materiality of the empirical world and to human-nature interactions at different scales of organization. A central tenet of this body of work is that science is not self-contained but operates in specific socio-historical contexts and across interactional domains, fields, and settings. From a political sociological perspective, STS analyses of environmental science and technology should focus analytic attention on the institutional configurations in which science, nature, and politics converge.

While there is nothing inherently "environmental" or "ecological" about political sociological perspectives in STS, this and similar approaches have been developed and refined by scholars working in Asia, Europe, Latin America, and North America who collectively exhibit strong research interests in a diverse range of environmental topics. These now include studies of environmental risk (Cordner, 2016), environmental health sciences (Shostak, 2013), toxics and chemical regulation (Boudia & Jas, 2014), biodiversity loss (Suryanarayanan & Kleinman, 2017), GMO agriculture (Arancibia, 2013; Arancibia & Motta, 2018; Kinchy, 2012), environmental justice conflicts (Ottinger & Cohen, 2011), alternative technology (Hess, 2007), resource extraction and energy development (Jalbert et al., 2017), disasters (Kimura, 2016), and the social production of invisibility or environmental ignorance (Gross, 2010; Kuchinskaya, 2014). Together, these and other works offer environmental sociology a rich set of meso-level concepts and approaches that deepen understanding of environmental science, technological development pathways and knowledge production systems in mediating society-nature interactions. They promise important refinements to macro-level theorizing in environmental sociology such as Schnaiberg's provocative but

[7] Other programmatic statements in the political sociology of science and technology include Frickel and Moore (2006), Frickel and Hess (2014), Hess (2016), and Moore et al. (2011).

overly broad distinction between production and impact science and technology. And they offer avenues for developing socio-political strategies to resist and overcome incumbent production models that are now overwhelming planetary geochemical systems and regional ecosystems.

For example, in a recent analysis of nanotechnology that draws heavily on Schnaiberg's production/impact science distinction, Gould (2015: 150) concludes that "only an effective feedback loop between scientific data, public awareness, and a demand on policymakers for protection will slow and redirect the nanotechnology Treadmill." We agree that leveraging small "wins" in impact nanotech to generate incrementally larger "wins" seems like a promising strategy for gradually curbing environmental threats posed by production-side nanotech. But developing an effective strategy will require a far more nuanced understanding of nanotech agenda-setting, R&D, and policy formation than Schnaiberg's dichotomous framework could ever hope to provide. This is precisely where environmental STS can help move the needle, through careful institutional analyses of the dynamics of science-nature-society relations in ways that permit contextually meaningful interpretations of data and impactful interventions (Kimura & Kinchy, 2019).

We provide further evidence for this argument in the next three sections, which review three areas of recent environmental STS research that we believe are highly relevant to current environmental sociological/political ecological concerns: the sociotechnical regimes bound up with large-scale resource extraction projects driving Latin American development policy, the production and uses of environmental ignorance, and—returning to Yearley's path-setting observations about the political and cultural tensions between scientists and environmentalists—studies of "expert activism" and the political mobilization of scientific expertise in environmental conflicts.

## *Neo-extractivismo* and Sociotechnical Regimes

In Latin America, the term *extractivismo* has been long associated with extraction of both nonrenewable mineral and fossil fuel resources and renewable forest and agricultural resources, all destined for commodity export (Gudynas, 2013; Svampa, 2015a). More recently, the term "neo-extractivismo" has signaled the renewal and intensification of resource extraction as a model for Latin American development (Gudynas, 2009).[8] Neo-extractivismo references traditional extractive activities (e.g. mining, drilling, clear-cutting) as well as activities linked to the new industrial-scale food systems, such as monocrop agriculture and biofuels production, and energy production. These activities are organized by large (often transnational) enterprises and involve the expansion of capital's frontiers into territories previously considered nonproductive. It also includes projects whose main strategic objective is to transport raw materials to destination ports. These activities include massive infrastructure projects for commercially accessible waterways, ports, bi-oceanic corridors, and large hydroelectric dams that make bulk transport of raw materials economically and geopolitically possible (Bunker & Cicantell, 2005). Neoextractivismo has caused massive social and ecological dislocations through soil depletion, deforestation, loss of food sovereignty, declining biodiversity, contamination of freshwater, critical sanitary problems, and the spatial fragmentation of landscapes and populations (Burchardt & Dietz, 2014). Such dislocations, in turn, have triggered increasing public concern (Merlinsky, 2013, 2016) and a new wave of socio-

[8] While industrial-scale resource extraction is nothing new in Latin America, since the 2000s its intensification has been heavily promoted by international organizations and influential think-tanks (Burchardt & Dietz, 2014; Svampa, 2015b). These promotional efforts have run in parallel with a shift in Latin American economic development policy from what had been called the "Washington consensus" (arising in the 1980s and dominant through the 1990s), to a newer "commodities consensus" that continues today (Svampa, 2015b). In fact, primary goods in Latin America grew from constituting 27% of total exports in 2000 to 60.7% in 2011, clearly exceeding total industrial exports (CEPAL 2012). According to the UN, in 2011, raw materials represented 76% of total exports in Latin America, compared to only 34% for the world as a whole (UNCTAD 2014). Latin American manufacture of advanced technology, in comparison, represented 7% compared to 25% worldwide (Ibid.).

environmental conflict (Suárez & Ruggerio, 2018; Svampa & Viale, 2014).

The impacts of neo-extractivismo have also attracted increased scrutiny from Latin American political ecologists, who have studied a range of socio-ecological impacts (Cisneros, 2018; De la Vega Ciuffoli, 2018; Pengue, 2009; Primavesi et al., 2014; Souza Casadinho, 2018), governance of extractive systems and policies (Argento et al., 2017; Bravo, 2017; Lander, 2017; Svampa, 2017), dominant and alternative models of extraction-based development (Carrizosa Umaña, 2017; Eschenhagen & Maldonado, 2017; Leff, 1986a, 1995, Leff & Carabias, 1993; Pengue, 2017), as well as discourses of resistance to extractive activities (Riofrancos, 2017). Much of this work highlights the uneven socio-economic dynamics of North-South relationships and criticizes the political and cultural values underlying neo-extractivismo. It also expresses an urgent need for different—alternative—development models based on an indigenous social philosophy of "buen vivir" or "well living" (Gudynas, 2011a, 2011b; see also Escobar, 1992).

Political ecology's recovery of the indigenous concept of "buen vivir" emerged from activists' and academics' efforts to build cultural-political frameworks to guide an autonomous regional vision of socioecological change. The political relevance and social impact of the concept is reflected in its recent institutionalization as policy in the national constitutions of Ecuador and Bolivia. However, as Lawhon and Murphy (2011) argue, while political ecological studies of neo-extractivismo offer an important, if rough, macro-vision for socioecological change, the literature is wanting for meso-level, empirical studies designed to identify institutional possibilities and structural challenges for achieving buen vivir's strategic goal of moving away from neo-extractivismo and towards a more sustainable and just form of living.

In this context, STS offers an important set of conceptual tools for examining the techno-epistemic dimension of neo-extractivismo, in which "global flows of raw materials, pollution, and waste are intertwined with the uneven circulation of knowledge and expertise" (Ottinger et al., 2017: 1037). One STS framework that we believe holds promise for studies of extractive activities that increasingly rely on sociotechnical systems developed in the North and adopted in the South, often in the face of fierce local and transnational resistance (e.g., Arancibia, 2013; Graeter, 2017; Kinchy, 2010), is sociotechnical transition theory, and more specifically the concept of "sociotechnical regime."

Developed in Europe by Dutch STS scholars, the term captures the complex structure of mutually reinforcing and entrenching cognitive, social, economic, institutional and technological processes that sustain existing trajectories of development (Geels, 2002; Rip & Kemp, 1998; Smith, 2007).[9] These processes articulate and mutually strengthen one another, thereby structuring the way that societies become committed to certain, often path-dependent, developmental trajectories over others (Arza & van Zwanenberg, 2014; Dosi, 1982; Geels, 2002). For example, dislodging the horse and buggy from European roads was no simple technology substitution issue for automobile manufacturers and urban planners, but involved a complicated step-wise process of de-alignment and realignment of sociotechnical elements and relationships (Geels, 2005). Technological innovations that do not fit into incumbent sociotechnical regimes are encountered as major societal challenges (Rip & Kemp, 1998). Distributed solar power (Hess, 2013), eco-housing and organic food are three contemporary examples (Smith, 2007).

We believe the sociotechnical regimes framework would enhance and deepen political ecological perspectives on neo-extractivismo. In the first

[9] As one of our reviewer's noted, "academic dependency" and a critical adoption of theoretical frameworks and technologies from the North have been recurring topics in Latin American STS (Beigel, 2013; Connell et al., 2017; Díaz et al., 1983). Indeed, the sociotechnical regime framework we review here is in some ways consonant with studies of socio-technical systemic views pioneered in the 1960s and 1970s by members of the Latin America School of Thought on Science and Technology (e.g., Sábato & Botana, 1968; Varsavsky, 1974; see also Thomas, 2010).

place, this framework can help to explain concretely how neo-extractivismo has emerged and diffused through a set of large-scale sociotechnical regimes across the mining, forestry, and agricultural sectors. This perspective encourages historical-comparative analysis to tease apart the similarities and differences across these regimes and identify their points of interconnection and disarticulation. Second, and relatedly, the sociotechnical regime framework encourages a pragmatic and meso-level view of institutional change. Recognizing this, some STS scholars have worked to identify institutional barriers that are likely to curtail or disrupt change processes, while others seek out strategic opportunities for inducing socioecological transformation of existing regimes.

In an example of the former approach, Arza and van Zwanenberg (2013) studied how state and corporate actors negotiated the design and implementation of regulatory policies promoting GM agricultural technologies in Argentina—processes that have helped push neoextractivismo further into farming. Elsewhere, Barandiarán (2019) analyzed the role of "socio-technical imaginaries" in legitimating lithium extraction in Chile, Argentina and Bolivia. Other scholars have focused on new knowledge systems associated with neo-extractive exploitation of natural resources: the emergence of new scientific fields such as plant genetics, biotechnology, bioengineering, and fisheries science (Gargano, 2016; Kreimer & Ferpozzi, 2016; Porcelli, 2020; Stagnaro, 2016), the influence of extractivist interests in shaping research agendas within universities and other public research institutes, and the private appropriation of public (academic) knowledge (Gargano, 2013, 2018; Vessuri & Kreimer, 2016) as well as appropriation of indigenous and peasant knowledge (Caldas, 2004; Hayden, 2003; Ribeiro, 2001; Shiva, 2007).

Other STS scholars have focused on initiatives of "transformative change" as responses to developmental, social and ecological sustainability problems. Here, as Arza and Van Zwanenberg observe (Arza & van Zwanenberg, 2014: 58),

> [t]he challenge … for bottom-up innovation processes that seek to achieve wider technological and social change is not just to create artefacts and technological practices that are more appropriate for, say, marginalized farmers, but to create and support alternative production and consumption systems, or regimes, in which such practices and artefacts can perform well.[10]

A study describing three examples of successful "bottom-up innovation" from Brazil and Argentina highlights the important role of public policy in fostering more sustainable and inclusive sociotechnical configurations involving family farming, a rooftop rainwater collection system, and a "demand-pull" model for developing small-scale technologies that enhance social inclusion (Gordon et al., 2017). In all three cases, the public policy process engaged local actors such as social movement organizations, cooperatives and NGOs through "hybrid forms of linkages," (Ibid.: 6), akin to what Peter Evans has described as networks generating "state-society synergy" (Evans, 2002) or the synergies between Latin American universities, NGOs, the industry and the State identified by Hebe Vessuri (1987). Other "positive" steps toward transformative sociotechnical regime change among poor and underserved communities include case studies of successful solar and distributed energy systems (Garrido, 2018; Garrido et al., 2011), small-scale fish farming (Garrido & Moreira, 2017), and local-national networks promoted by public policy enhancing rural access to water for drinking, sanitation, and commercial use (Juarez et al., 2018).

A different way to study alternative development strategies is to examine how efforts to establish alternative sociotechnical regimes encounter challenges and obstacles. An important case in the Latin American context is agro-ecology. Arza and Van Zwarenberg (2013, 2014) analyzed how bottom-up efforts to develop new cotton production practices based on agro-ecological

[10] The authors credit this observation to Thomas and Fressoli (2011).

principles[11] in northeast Argentina were stymied by inadequate public policy support and by conflict with the incumbent chemical-intensive industrial mono-cropping regime arising from deterioration of soil quality, pesticide drift, and competition for scarce resources (Smith, 2007). Such studies help explain why achieving the goals embodied by the idea of *buen vivir* will usually encounter stiff resistance and require creative responses (see also Seoane & Marín, 2017; Thomas et al., 2017).

## Ignorance and the Politics of Undone Science

A key development in STS over the past decade has been a rising concern with epistemic inequality, or how scientific knowledge production is implicated in altering or reinforcing power imbalances and social hierarchies among different groups (Hess et al., 2017).[12] One way that scholars have begun to address this problem is by studying the absence of knowledge, or ignorance. Research in the newly christened field of "ignorance studies" (Gross & McGoey, 2015) asks, why do scientists know a lot about some topics and very little about others? Why does some knowledge circulate widely in society while other knowledge remains sequestered, available to only a few? What are the institutional and cultural mechanisms that structure the non-production of scientific knowledge? Underlying these questions is the basic assumption that the absence of knowledge is not—or not always—a 'natural' byproduct of scientific investigation, but rather a historically situated social production (Gross, 2007). As historian of science Robert Proctor (2008: 3) has observed, "there are many different ways to not know . . . . Ignorance can be made or unmade and science can be complicit in either process." And, ignoring ignorance can be counter-productive for science and society alike. In an article on dominant risk discourses around genetically modified organisms, Brian Wynne (2001: 447) problematized "the inability of scientists to recognize the limits of the knowledge which they advance as justification of policy commitments, including claims that the risks and consequences are (or will soon be) adequately known." For environmental sociologists, we would add, neglecting the various problems that ignorance poses for knowledge production and policy commitments constrains opportunities for theory building and comparative analysis and fails to capture the full range of social practices that shape what is known about society-nature interactions and what remains unknown.

The social production of ignorance has become a hot topic in STS-inflected environmental humanities (Elliott, 2015; Uekötter & Lübken, 2014) and environmental sociology is catching on too. Studies by McCright and Dunlap (2000, 2003, 2010), Jacques et al. (2008), and by Brulle (2014, 2018; Brulle & Roberts, 2017) on climate science skepticism and the climate change counter-movement have contributed an environmental sociological perspective on ignorance as the product of organized efforts by powerful social actors—corporations, industrial research labs, and conservative think tanks, foundations, and politicians—to manufacture public doubt, uncertainty and misinformation about claims put forward by climate scientists and to erode political momentum for policies that actively address the many complex challenges of a warming planet. This line of environmental sociological inquiry is consistent with one prominent strand of ignorance studies that sees ignorance as a strategic resource (McGoey, 2019) often leveraged in pursuit of explicit interest-driven goals and a reflection of the intentional exercise of power (Proctor & Schiebinger, 2008). In these accounts (to date, conducted mostly by historians of science and medicine), ignorance is described as an object of deliberate and organized political construction that can be generated through secrecy (Rappert, 2013), censorship (Galison, 2008),

[11] Agro-ecology is a holistic approach that applies ecological principles to agriculture, this means relying on ecological interactions and synergies between biological components within the farm rather than requiring external inputs (e.g., pesticides) (Altieri, 1995).

[12] The term epistemic inequality is malleable. See, for example, Go (2017) and Morgan et al. (2018) for very different examples of meanings and uses.

deceit and suppression (Markowitz & Rosner, 2002; Proctor, 1995), denial and neglect (McGoey, 2012; Wynne, 2001), and doubt (Michaels & Monforton, 2005; Oreskes & Conway, 2010). Theorized as something like a power grab, ignorance in this work operates relatively overtly and somewhat crassly to influence environmental politics and other domains as well, including public health, national security, and technology development.

There is no question that studies investigating climate change denial or obfuscation are doing valuable political work. Yet, as other studies in environmental STS makes clear, ignorance also operates through scientific disciplines and other knowledge cultures in ways that may be based less overtly on clear-cut political and economic interests and whose impacts have attracted considerably less media and legal attention. A growing number of empirical studies show environmental ignorance to be a product of the structural pressures, institutional arrangements and normative cultures that order everyday scientific practice and decision-making (Frickel & Vincent, 2007; Murphy, 2006a, 2006b).

A good example is Kleinman and Suryanarayanan's (2013) study of the controversy surrounding scientific and regulatory responses to colony collapse disorder (CCD) that is affecting US honey bee populations. At the center of this case is the question of whether a new class of agricultural pesticides is causing CCD, or whether the cause (or causes) lay elsewhere. While there is no shortage of political and economic interests at work in efforts by university and industry scientists, government regulators, commercial and small-scale beekeepers and hobbyists to address the problem, the authors argue that a deeper explanation of the controversy lies in the dynamic interplay of "epistemic forms", which they define as "the suite of concepts, methods, measures, and interpretations that shapes the ways in which actors produce knowledge and ignorance in their professional/intellectual fields of practice." Through historical analysis and interviews, Kleinman and Suryanarayanan show how dominant epistemic practices in honeybee toxicology produce three different but overlapping types of ignorance that together tip causal arguments in favor of agrichemical industry interests and help to justify regulatory *in*action (for the full study, see Suryanarayanan & Kleinman, 2017).

A closely related body of research, one that goes some ways toward integrating the political-economic and political-cultural approaches to environmental ignorance summarized above, are studies of "undone science." First developed by David Hess (2007, 2016), the concept refers to "areas of research identified by social movements and other civil society organizations as having potentially broad social benefit that are left unfunded, incomplete, or generally ignored" (Frickel et al., 2010: 445). In framing the social production of ignorance as a matter of undone science, scholars emphasize the politics of research agenda-setting as a way to explain why certain bodies of knowledge that could exist and perhaps should exist, in fact do not; the question, instead, is how and why the science remains "undone."

The undone science approach also examines the role of social movements and other social actors in bringing public attention to missing knowledge and the social, health, and environmental consequences of those absences. Thus, to use two earlier examples, honeybee toxicology and climate change skepticism both rise to public awareness as political problems in part because of efforts by social movements and other civil society actors to challenge dominant scientific understandings of the phenomena in question. In the first instance, commercial beekeepers and factions of the environmental movement challenged the dominant scientific view that the cause(s) of CCD was pathogenic rather than toxicological. In the second, better known case, various organizations and actors associated with the American conservative movement contested the dominant scientific claims that climate chance is (a) actually occurring and (b) originates from anthropogenic activities such as deforestation and burning of fossil fuels.

Kindred studies involving undone science include analyses of asbestos effects research and occupational health studies in a Parisian suburb

(Henry, 2017), regulatory testing and toxicology in New Orleans, Puerto Rico, and West Virginia (respectively, Frickel & Edwards, 2014; Hoffman, 2013; Bray, 2017), disclosure conflicts surrounding fracking fluids in the Marcellus Shale region of Pennsylvania (Kinchy & Schaffer, 2018), community health surveys in the industrial district of Marseille, France (Allen et al., 2017), environmental factors related to Tasmanian devil cancer (Warren, 2015), pesticide health effects research in Argentina and France (Arancibia & Motta, 2018; Cardon & Prete, 2018), environmental and health risks of nanotechnology (Hess, 2010), chemical flame retardants (Cordner, 2016) and the broader class of fluorinated compounds (Richter et al., 2018). These and other studies document how, across an ever-widening range of contexts and cases, epistemic inequalities resulting from the social production of ignorance and collective efforts to "get undone science done" are generated through institutionalized logics, expectations, and routines of scientific and regulatory cultures.

In our view, the undone science approach holds considerable value, for at least four reasons. First, it overcomes, without excluding, the narrow and therefore incomplete view that ignorance is driven only or mainly by ideology and necessarily involves stark abuses of power that distort scientific research and undermine science-based policy. These are sufficient conditions, but not necessary conditions; ignorance production can also occur in their absence. Second, the undone science approach treats the politics of ignorance production symmetrically. Ignorance is not tethered to the political right or left. While ignorance is always "political" as a social production, it does not come with a ready-made type of politics. Third, the approach draws explicit attention to the inter-field dynamics among scientific, government, industry and social movement fields. As existing research suggests, these relationships are relatively fluid and often not reducible to any one specific disciplinary culture, political goal or economic stake. Fourth, and most importantly in our view, the dual emphasis on agenda-setting processes and state-industry-social movement interactions has the effect of extending analytic focus from how ignorance is produced, to how that produced ignorance becomes institutionalized within different knowledge systems and communities, and what its broader socioenvironmental impacts are. This analytical extension is important because once different types of ignorance are institutionalized—whether as disciplinary expectations, industrial research protocols, or state policies—the effects of ignorance become measurable and can better form the basis of an empirical program of sociological and historical study (Frickel, 2014).

## Mobilizing Environmental Science

Throughout history, when conditions warrant, scientists have advocated for political and policy positions that accord with their specialized understandings of the world. Galileo did this. So did Einstein. And in more recent decades, so have many ecologists, environmental biologists, public health specialists and medical professionals, and earth and climate scientists (e.g., Bocking, 2004; Egan, 2007; Kroll-Smith et al., 2000). Since 2016, social scientists in the US representing environmental STS have been among the more prominent academic researchers to organize direct actions aimed at preserving environmental data and reporting on attacks to environmental research and policies by the Trump administration (See especially the work of the Environmental Data and Governance Initiative, or EDGI; e.g., Dillon et al., 2018).

This section considers environmental STS research on "expert activists" (Allen, 2003), a term that is not as self-contradictory as it may seem. As "[s]cience has become implicated in a wide array of social movements of the right and left, from large professionalized national networks to small under-resourced community groups" (Moore et al., 2011: 521), STS researchers have identified novel relationships and tensions emerging among these groups. The core issue motivating research on expert activism is not the normative question of whether scientists should become involved in politics (which is how scientists often frame the issue), but empirical and

strategic questions concerning how expert mobilization into environmental movements is organized, the conditions under which it is more or less likely to occur, and what effects it has on science, environmental conflict, and socioecological change more broadly.

We believe this body of research is directly consequential for environmental sociology and political ecology. Many researchers in these two fields are at least partially dependent on the natural sciences, engineering, and regulatory sciences for basic knowledge about the state of the world. Collective efforts by scientists to change the trajectory of environmental knowledge will shape the knowledge and data available to environmental sociologists to use for their own studies. Perhaps more importantly, as we noted in our Introduction, environmental sociology is an academic social movement that shares many goals with environmental social movements. For this reason, insights from environmental STS are best treated reflexively; that is, as having the potential to inform and advance environmental sociology's own political commitments to ecological sustainability and environmental justice.

Disciplinary and technical expertise is a cornerstone of environmental movements and activism (e.g., Hays, 1987; Woodhouse, 2018). As environmental movement organizations (EMOs) professionalize, is it not uncommon for these organizations to hire scientific and technical staff and even equip laboratories for collecting and analyzing environmental data in-house (Jamison, 2001). Smaller organizations also rely on scientific experts. They might recruit PhD-level scientists onto advisory boards or form partnerships with scientists at area universities to gain greater access to resources that would otherwise be out of reach. An early example is the storied partnership between West Harlem Environmental Action (WE ACT for Environmental Justice) and researchers at the Mailman School of Public Health at Columbia University (Shepard et al., 2002). Mobilizing environmental scientists can invite culture clash within EMOs (Cable et al., 2005) and provoke "backfire" (Martin, 2007) when scientists' research and advocacy threaten industry and state priorities (Delborne, 2008; Martin, 1999, 2007; Ottinger, 2013), but for local groups, working with scientists can also bring clear advantages. Dozens of studies have documented scientists working with social movements to develop, translate, and disseminate technical knowledge, engaging in political lobbying and petitioning, and providing expert testimony throughout legal proceedings and professional networking (e.g., Brown, 2007; Ottinger & Cohen, 2011). In these ways and more, expert activism can significantly shape EMO strategies, tactics, and outcomes.

Experts also mobilize closer to home, within their own professional communities. Sometimes, they create what Moore (1996) has called "public interest science organizations." During the 1960s, politicized scientists created organizations like Science for the People and Union of Concerned Scientists. These organizations provided ways for scientists to engage in the politics of social and environmental protest while preserving their scientific reputations. Sometimes scientists work to politicize professional societies. Kinchy and Kleinman (2003) have shown how Ecological Society of America members worked to preserve the discipline's credibility as apolitical natural science while providing cover for smaller groups of activist ecologists to engage in public affairs. And sometimes scientists mobilize to build entirely new disciplines and fields of study. Familiar with the harmful biological effects of the "chemical mutagens" they had studied for decades in their laboratories, geneticists influenced by Rachel Carson's *Silent Spring* and the growing visibility of environmentalism, organized a new science—genetic toxicology—to contribute basic and regulatory knowledge on the human health effects of environmental chemicals (Frickel, 2004). Three decades later a new generation of environmental health scientists working with new genomics technologies confronted the challenges of structural environmental inequalities in redefining contaminant exposure as a process of "gene-

environment interaction" occurring inside human bodies rather than where people live, work, and play (Shostak, 2013).

Yet another way that environmental scientists mobilize is through social networks that blur professional and political interests. These networks or "shadow mobilizations" (Frickel et al., 2015), connect professional scientists, engineers, and health and legal experts across disciplinary boundaries but also structure their interactions with local communities, patient advocacy groups, EMOs, government agencies and occasionally industry. As Eyal (2013) has argued, "expertise" is not a quality of particular individuals but a characteristic of social networks—relational structures that constitute and distribute "expert" knowledge. These ideas about the networked nature of expert activism come through clearly in the pesticide conflict in Argentina that began in 2001.

In the 1990s, Argentina was one of the first countries to pioneer the adoption of pesticide-resistant genetically modified (GM) soy, a biotechnology that is paired with what was then a new class of glyphosate-based pesticides and herbicides. Since then the country has developed into a major agro-industrial economy and today is the third largest world producer and exporter of GM soy. As the GM sociotechnical regime expanded and pesticide use grew exponentially, three interconnected social phenomena began to shape Argentinian society. In 2001 a small grassroots social movement organized in the outskirts of Cordoba city—la Madres de Ituzaingó—began targeting pesticides they believed were the main cause of a sharp increase in severe health problems in their village.[13] In 2005, this small movement allied with a group of scientists and intellectuals from the capital city of Buenos Aires—"Grupo de Reflexión Rural"—who opposed the adoption of agrarian biotechnology; together, the two groups launched a national campaign to restrict pesticide use, their protests garnering significant national and international media attention (Arancibia, 2013). Building on this momentum, professionals in rural health clinics and in regional cities of GM soy producing "provincias" such as Misiones, Cordoba, Chaco, and Santa Fe also established a network of physicians, lawyers, medical researchers, and a few scientists. Simultaneously, as more scientists from national universities and public research institutes began to study the biological effects of pesticides and a new field of pesticide effects research began to emerge in Argentina (Motta & Arancibia, 2015) that had not existed prior to the conflict. These three phenomena—the grassroots social movement, the expert network, and the scientific research field—are interconnected, each giving moral weight and political legitimacy to the other two.

To date, the movement has not been successful at forcing national-level changes to chemical regulation or agricultural policy, but it has affected changes at the local and regional levels. Beyond attention from media and NGOs, impacts of the pesticide conflict on civil society have included a series of municipal ordinances establishing "pesticide-free zones" around some populated areas in the soy-producing regions (Crow, 2004; Heath et al., 2009). In the courts, judges have ruled in favor of halting fumigation near some villages or punishing violators of the new ordinances, creating positive precedents for future litigation (Arancibia & Motta, 2018).

More consequential, thus far, has been the pesticide conflict's impact on science. When the conflict began, in 2001, only a few scientists in Argentina were actively assessing the health effects of pesticides and there were only a few published papers supporting their activities. As of this writing, just over 1000 studies on the topic have been published in scientific and medical journals by more than 1800 contributing Argentinian researchers. This growing bank of scientific knowledge became politically relevant when circulated, not only within the scientific community but also in public, legal and juridical domains, which required social mobilization as

[13] The movement documented increased occurrences of cancer, autoimmune diseases, diabetes and autism as well as a range of reproductive health ailments including miscarriages, birth defects, infertility, and delayed pregnancies.

well as the development of novel legal and juridical strategies.

Framing this story as a rare instance when impact science makes headway against the always-stronger forces of production science doesn't get us very far. Instead, this case demonstrates the value of an STS perspective in advancing environmental sociological work on sustainability and environmental justice. It does so by focusing analysis on the meso-level of networks and collective organization in which local villagers, doctors, lawyers, and scientists co-produced a movement against the widespread use of harmful chemical pesticides, a new Argentinian field of pesticide effects research, and a network of mobilized experts that continues to fuel both (Frickel & Arancibia, 2021; Arancibia & Motta, 2018).

## Conclusion

A disturbing work of speculative fiction written by historians of science Naomi Oreskes and Erik Conway, *The Collapse of Western Civilization* (2015), looks back from the year 2393 and offers a somber appraisal of contemporary science. The book is narrated by a pair of future historians who ponder the question of why scientists in our time failed to transform their hard-won "positive" knowledge into political action that would have curbed $CO_2$ emissions, slowed rising global temperatures and averted "The Great Collapse."[14] In their telling, the problem of "market fundamentalism" was matched by problems with "the epistemic structure of Western science" (p. 14). Partial blame falls to science's methodological reductionism and tendency to ignore complexity, a strict disciplinary hierarchy that discounts social science, and powerful norms of "intellectual self-denial" that insists on "an excessively stringent standard for accepting claims of any kind, even those involving immanent threats" (p. 16).

While Oreskes and Conway's account of the arrival of a second Dark Age is imagined,[15] their trenchant critique of scientific culture is quite real, grounded in decades of empirical scholarship. We have reviewed a sliver of that scholarship here in arguing that the complementarities between environmental STS and environmental sociology are too important to ignore, especially now. Studies of sociotechnical regimes, the social production of ignorance, and the dynamics of expert mobilization are just three areas of environmental STS that can advance environmental sociological understanding of nature-society relations through constructive[16] critique of science. The STS critique of science on offer in this chapter should concern environmental sociologists because virtually every environmental problem we confront contains something of science inside of it. Or, put more provocatively, science itself is an environmental problem. Allan Schnaiberg (1977) understood this all too well, even if the framework he proposed to study it was not fully up to the task.

STS needs environmental sociology too, of course. Deeper engagements with environmental sociological research and theory traditions could certainly broaden the scope and deepen the relevance of the knowledge that STS produces. Recent work by environmental sociologists on "cheapness" (Patel & Moore, 2018), urban-metabolic processes (Wachsmuth, 2012), and human-animal relationships (York & Longo, 2017), and by political ecologists on the productivity of environmental conflict and public deliberation arenas (Azuela & Mussetta, 2009; Melé, 2016; Merlinsky, 2017), ecological distribution conflicts and languages of valuation (Martinez-Alier et al., 2010), and the gendered dimension of resource extractivismo (Leguizamón, 2019)—again, to note just a few studies from scholars working in our respective hemispheres—seem to

[14] The book recounts The Great Collapse culminating in the rapid disintegration of the West Antarctica and Greenland Ice Sheets during 2073–2093.

[15] Speculative though it is, Oreskes and Conway's description of how The Great Collapse will unfold is based on current science and some of its most sophisticated predictive models.

[16] The critiques emerging from political sociological accounts of scientific institutions, organizations, and fields are not deconstructionist in the postmodern sense and do not require epistemological relativism as an underpinning.

us particularly relevant for better understanding why-we-know-what-we-know about the complex interactions shaping the natural and social worlds.

STS offers one additional lesson that we think environmental sociology and political ecology each would do well to adopt more fully than they often seem to do.[17] STS is deeply reflexive in its approach to the work it produces. Environmental sociology and political ecology should also strive to nurture a more reflexive awareness that environmental sociological knowledge—and ignorance!—are social productions subject to empirical analysis and vulnerable to the kinds of constructive critiques of science that we have highlighted above. Indeed, as the fields mature and more scholars are publishing work in general and specialty science journals such as *PNAS*, *Nature Climate Change*, and *Environmental Research Letters*, environmental sociology and political ecology are likely to become research topics in STS. And that is a good thing. If their shared intellectual project is as important as we all believe it to be, both fields deserve a turn under the microscope.

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[17] Enrique Leff's (1986b) epistemological work on environmental thinking is an important exception, one that exemplifies the power of a reflexive approach in political ecology.

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# Towards an Indigenous Environmental Sociology

23

Kari Marie Norgaard and James V. Fenelon

Indigenous peoples have long held intimate relationships with the species and places often called 'nature.' Across our present location in North America, Indigenous land management practices shaped ecological systems at the same time as they organized social, political, spiritual and epistemological systems. Although highly varied, Indigenous ethical systems and understandings of society center relationships with and responsibilities to both human and 'more than human' relatives (e.g., Coulthard, 2014; Grande, 2008; Whyte, 2013). Despite longstanding and general public awareness that Indigenous ecologies, epistemologies, values and social arrangements look quite different from those in so-called western societies, the potential for an Indigenous environmental sociology is only recently taking hold. Indigenous perspectives on society, nature, state power, health, justice and more hold the potential to powerfully reframe conversations integral to environmental sociology (Jacob et al., 2021). Indigenous perspectives on environmental justice expand understanding of the origins of the environmental and environmental justice movements, whether the state is conceived as a potential ally or explicit foe, and especially the desired goals and outcomes of social action. Taken together, Indigenous scholars and voices from Indigenous communities point to a deep reframing of "the other worlds that are possible" beyond either capitalism or colonialism (Fenelon & Hall, 2008; Grey & Patel, 2015; Norgaard, 2019; Simpson, 2017; Whyte, 2015).

Despite their importance, conceptions of Native peoples in popular discourse are subsumed by romanticized and essentialized notions of Noble Savages on the one hand, or simply ignored on the other. Within the field of sociology, scholarship by and about Indigenous peoples is dramatically under-represented. Instead, nearly all US sociology continues to be imagined and developed in the wake of unacknowledged Indigenous genocide and from a standpoint of a nearly silent colonial occupation (Jacob, 2018). Nearly all U.S. sociologists craft our theory within a space of colonial amnesia and willful ignorance. One result of the lack of appropriate structural analyses is the profound tendency towards pathologizing Native experiences (e.g., through emphasis on drug and alcohol use and domestic violence) documented in several recent content analyses of the relatively few sociological works engaging Indigenous experience (Bacon, 2017; Huyser, 2017).

We write at a particularly productive time. In just the past few years a number of theorists have argued for major theoretical insurrections within

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disciplines in the social sciences and humanities (Byrd, 2011; Champagne, 2015; Hall & Fenelon, 2015; Veracini, 2014). Roxanne Dunbar-Ortiz's *An Indigenous People's History of the United States* attempts to (re)frame history from Indigenous perspectives, even as other Native scholars try to fundamentally transform the organization and canon of U.S. history (Blackhawk, 2012; Cook-Lynn, 1997). These scholars are not seeking to merely integrate a few missing concepts. In contrast, their work shows how a range of modernist assumptions about Indigenous peoples, the nation-state and the so-called "natural" world fundamentally reorganize theories across the entirety of a given discipline.

Sociological theorizing on colonialism and from Indigenous perspectives is slowly but steadily gaining traction. Longstanding and recent works by Michelle Jacob (Jacob, 2016; Jacob, 2018; Jacob et al., 2018; Jacob et al., 2021), Dwanna McKay (2013, 2015, 2019; McKay et al., 2020), Kimberly Huyser (Huyser et al., 2014; Huyser et al., 2015), Julia Cantzler (Cantzler, 2011; Cantzler, 2015; Cantzler & Huynh, 2016), Erich Steinman (2012, 2019, 2020), Rima Wilkes (2006, Wilkes & Jacob, 2006), JM Bacon (2017, 2018, 2020; Bacon & Norton, 2019), Vanessa Watts (2013), CM Dhillon (2020), and others are contributing to the more frequent (although still minimal) representation of Indigenous epistemological approaches, perspectives on race, health, gender the animacy of the natural world, and use of settler-colonial constructs within U.S. environmental sociology.[1] ASA President Eduardo Bonilla-Silva's 2018 presidential address, attributed to one of this paper's authors (James V. Fenelon), reflects this well: "*Sociologists must recognize that settler colonialism, colonialism that is not past history, but a contemporary social force, is a racist project*."

Environmental sociologists have generated rich analyses of how capitalism, racism—and to a lesser extent patriarchy—organize state power, environmental damage and environmental movements (Bullard, 2008; Foster et al., 2011; Holleman, 2017, 2018; Pellow & Park, 2002; Pellow, 2017; Pellow, 2021; Taylor, 2016). Less detailed by environmental sociologists however are the ecological dynamics of what many call settler-colonialism, or how these forces constrain our epistemological systems as environmental sociologists. Perhaps most importantly given the state of the planet, many of us believe that Indigenous peoples have valuable social, ethical and political frameworks that are needed now in the face of critical global environmental challenges (see Fenelon, 2015a, 2015b; Simpson, 2017; Wildcat, 2010). Indigenous peoples hold real alternatives in the form of technologies, epistemologies, social structures, moral codes and ecologies themselves that are critically needed to respond to ecological crises today. Instead of engaging or acknowledging the value of those systems, our discipline has generally followed in the "modernist" pathologizing stance towards Native people.

Here we lay out a series of concepts from (primarily North American) Indigenous perspectives and Native Studies as they apply to environmental sociology and the associated fields of environmental justice, food justice and environmental health. We begin with a grounding in Indigenous traditional ecological management and the corresponding Indigenous ecologies and knowledge systems that emerge therefrom. From there we move to underscore the importance of sovereignty and bio-cultural sovereignty, as well as discussion of theories of colonialism, settler-colonialism, and the concepts of colonial ecological violence (Bacon, 2018) and environmental reproductive justice (Hoover, 2017). We close with a discussion of the importance of Indigenous knowledge, vision and resistance in light of the crisis of anthropogenic climate change. This list of topics relevant for an Indigenous

[1] Whereas U.S. environmental sociologists have been particularly slow in engaging settler-colonial theory, Canadian and Australian environmental sociologists are further along (e.g., the Canadian Sociological Association has had a research cluster on Indigenous-Settler Relations and Decolonization since 2014). Additionally, the related fields of Anthropology, Geography and Ethnic Studies—not to mention the rapidly growing field of Native Studies—con-tribute key perspectives upon which some environmental sociologists are be-ginning to draw.

environmental sociology is not meant to be exhaustive, but rather a starting point for expanding upon critical concepts from the recent literature.

## Indigenous Ecologies: Traditional Management and Traditional Knowledge

One key contribution to environmental sociology from Indigenous perspectives is attention to the presence of *Indigenous ecological systems.* Most western scientists and social scientists unconsciously follow in the tradition that, prior to European contact, North America was a relatively 'untouched' wilderness. Yet in fact, the Native peoples of this land have long been actively managing salmon, acorns, and thousands of species for food and cultural uses. For example, fire records in California clearly indicates that Native land management systems have significantly shaped the evolutionary course of plant species and communities for at least the twelve thousand years for which there are records (Agee, 1993). The abundance of these particular species is a product of Indigenous knowledge and management whereby quality seeds were selected, bulb production was enhanced through harvest techniques, and populations of desired oak species and understory shrubs as well as fish, mushrooms and huckleberries have been reinforced and carefully managed with prayer and fire. These surviving Indigenous ecologies are in addition to the great nations and even city empires that preceded European invasions and conquest.

What Indigenous peoples have described as 'traditional management' involves sophisticated non-western ecologies that include extensive knowledge of particular species and ecological conditions. Within Indigenous ecological systems humans and nature work together. Equally important, interactions with salmon, forest foods, rivers and rocks organize social activities, individual and group identities, gender constructions and more (Vinyeta et al., 2016). Embedded within this ecological management are the intimate social, moral and cultural structures that Karuk dipnet fisherman Ron Reed refers to as "Karuk social management" (see Norgaard, 2019). In other words, the ongoing ability of Indigenous peoples to engage in what is known as traditional management is important for political–cultural sovereignty, subsistence activities, and the mental and physical health of individuals (see also work by Elizabeth Hoover, 2018; Kyle Whyte, 2013 and many others).

Through traditional Indigenous management flourishing salmon runs, huckleberry patches, acorn groves and more are manifestations of partnerships across species. Within species' are enhanced through human activities including enhancement by fire, the use of particular harvest techniques and prayer, and in return—according to Indigenous worldviews—they offer themselves to be consumed. Both humans and other species work in a sacred partnership in which each has obligations to the other. Director of the Karuk Department of Natural Resources, Leaf Hillman, described Karuk responsibilities to tend and care for the natural world through traditional management as follows:

> We believe that we were put here in the beginning of time, and we have an obligation, a responsibility, to take care of our relations because hopefully, they'll take care of us. And it's an obligation, so we have to fish. They say, "Well, there aren't that many fish this year, so I don't think you should be fishing." That is a violation of our law because it's failure on our part to uphold our end of the responsibility. If we don't fish, we don't catch fish, consume fish, if we don't do those things, then the salmon have no reason to return. They'll die of a broken heart because they're not fulfilling their obligation that they have to us (Quoted in Norgaard and Reed 2018).

Thus participation in fishing, burning, gathering and other aspects of traditional land tenure and management hold immense cultural, political, personal and spiritual significance for many Indigenous peoples and communities in North America and are central to their identity, political struggles, social movements and everyday life (Norgaard, 2019; Whyte, 2013, 2018).

When it comes to fire, for example, Indigenous knowledge and management generated the

abundance in the land that partly formed the basis of capitalist wealth across North America. Recent scholarship has identified that Indigenous use of fire was so extensive across the Americas that it's interruption through the genocide of the late 1500s and early 1600 is visible in the historic atmospheric carbon balance (Koch et al., 2019).[2] That Indigenous management and its interruption are visible in atmospheric processes supports Indigenous critiques of the term Antropocene which is seen as erasing colonial processes and inappropriately universalizing human experiences (Todd, 2015; Whyte, 2017).

Another powerful example of Indigenous understanding of this interactive environment is northern plains peoples' holistic relationship with the American bison, including their self-sacrifice to feed the people (Defender-Wilson & Fenelon, 1987) and a subsequent near extermination by the invading dominant society both to erode Indigenous resistance and for more profitable introduction of European cattle.

Potowatami scholar Kyle Whyte et al. (2018) describe how since European invasion, settlers have sought to impose their own ecological systems onto Indigenous ecologies, as well as how the struggle over these different ecological, cultural, political and economic systems is the central dynamic of colonialism:

> "Ecologies" are systematic arrangements of humans, nonhuman beings (animals, plants, etc.) and entities (spiritual, inanimate, etc.), and landscapes (climate regions, boreal zones, etc.) that are conceptualized and operate purposefully to facilitate a society's capacity to survive and flourish in a particular landscape and watershed. Waves of settlement seek to incise their own ecologies required for their societies to survive and flourish in the landscapes they seek to occupy permanently (p. 159).

Another example of how these systems can be disrupted and even destroyed, was the introduction of the for-profit fur trade—replete with guns and competitive markets—by Europeans in the great northeastern forests, causing intertribal warfare, breakdown in traditional authority, and elimination of animal, plant and human ecological co-existence that had prospered for thousands of years. Norgaard (2014, 2019) details many of these "ecological mechanics of settler-colonial domination" as they manifest for Karuk people through fire policy in California. Fire suppression was mandated by the very first session of the California Legislature in 1850 during the apex of genocide in the northern part of the state.[3] Within the territory of Karuk People the establishment of the Klamath National Forest in 1905 began an era of fire suppression. This policy was an attempt to protect commercially valuable conifer species from being "wasted" in fires (Show & Kotok, 1923). For Karuk people this "exclusion" of fire from the landscape has resulted in changes in species composition through wholescale conversions of tree species throughout Karuk homelands. Forest species composition has shifted from acorn producing tanoaks to commercially valuable Douglas firs. The transformation of what for thousands of years been productive food generating oak woodlands into single-aged

[2] More specifically, the authors found that Indigenous cultural burning and agricultural practices across the Americas were so extensive that their interruption through the genocide of the late 1500s and early 1600 caused a 7–10 ppm decline in the global atmospheric carbon dioxide concentration and a global lowering of surface air temperature by 0.15 °C. Note that this does not mean that Indigenous management practices had a negative impact on the cli-mate. Rather, as plants and trees grow they take up carbon, as they die it is re-leased. Within this context, fires are natural parts of ecological systems and they too play a role in carbon storage and cycling since when fires occur stored carbon is temporarily released. Indigenous burning, like all fire, releases carbon. Indigenous use of fire is a key component of mixed severity fire regimes, which release less carbon than under a suppression/high severity fire regime scenario. The near total interruption of Indigenous land management practices including agriculture, traditional burning and more resulted in a temporary increase in terrestrial carbon storage across the Americas.

[3] Note that fire suppression was mandated as well by the first Spanish governors- an event that was especially important in the southern part of the state. See Timbrook et al. 1993: 129 Veg. Burning by the Chumash "Arrillaga's Proclimation May 31, 1793 in Before the Wilderness Blackburn and Anderson eds and Dr. Frank K Lake (2007). *Traditional ecological knowledge to develop and maintain fire regimes in northwestern California, Klamath-Siskiyou bioregion: management and restoration of culturally significant habitats*. Oregon State University.

conifer-dominant forests not only reduced ecological complexity and diversity, and reduced the habitability for Karuk people, it has increased both the risk of stand-replacing wildfires and pathogenic disease. Without fire, smaller patches of grasslands and meadows within forests that were once prime harvesting areas for "Indian potatoes" have become invaded by conifers and have all but disappeared.

At the same time, the exclusion of fire has created an overabundance of so-called "ladder-fuels" and dense underbrush, which can lead to the larger, higher intensity and severity fires that many people experience as "catastrophic." In contrast to the highly productive forests of decades past, today these "fire excluded" forests hold few foods, making them the rural equivalent of food deserts in the inner city (Sowerwine et al., 2019). There has been a shift from what Karuk Department of Natural Resources Founder and Director Leaf Hillman describes as "a forest that is productive for people, to a forest that is productive for timber." The exclusion of fire from the Karuk landscape negatively impacts spiritual practices, gender relations, threatens cultural identities, and infringed upon political sovereignty (Norgaard, 2019).

While the work of noted historians on the process of land transformation in the Northeastern U.S. via colonization includes erasure of Indigenous ecological management (for example, see Cronon, 1995) is widely recognized, *the implications of this research have failed to conceptually impact the field of environmental sociology.* Instead most environmental sociologists continue to use generic and static notions of "nature." From a practical standpoint, this knowledge makes clear that rather than the concept of an "untouched" wilderness, as European settlers professed, much of what we now recognize as the United States was analogous to carefully tended gardens. What natural scientists have described as "nature" and "natural history" is in fact a human-natural history. Yet few environmental sociologists account for Indigenous ecological management in either our historical or present day understanding of environmental dynamics, leaving the broader implications of Indigenous management and presence ignored.

Indigenous knowledges of landscapes are inseparable from Indigenous cultural management practices. Indigenous knowledges and ethics are embedded in and emerge from the practices of traditional management (see e.g., Coulthard, 2014; Whyte, 2018). Over the past 20 years, but especially in the last 10 years, Western ecologists have recognized and acknowledged many benefits of traditional ecological knowledge and management. For example, within the field of forestry, there is a recognition of Native management practices that allow for multi-species management, landscape patchiness, and the abundance of important species (see e.g., Hessburg & Agee, 2003; McGregor, 2009; Smith & Sharp, 2012; Whyte, 2013; Williams & Hardison, 2013). Similar innovations and integrations are also occurring within fisheries science (David et al., 2018). Now in the face of the ecological threat of climate change, there has been a heightened understanding of the value of Indigenous "traditional ecological knowledge" by Western science practitioners, academic institutions and Federal and State land management agencies (see e.g., Leonetti, 2010; Ross et al., 2010; Whyte, 2013). Although the notion that Indigenous people have traditional ecological knowledge is exploding across the ecological and conservation biology literature—especially now in the face of climate change—the full implications of these "alternative" epistemological systems is still waiting for environmental sociologists to engage (see Hoover, 2013; Norgaard, 2019; Watts, 2013). Collaborative work between academics and tribal communities in the area of environmental health has been on the forefront of this trend, providing a hopeful way forward for other areas within the social sciences. Scholars from Katsi Cook, Elizabeth Hoover, to Bonnie Duran, Vanessa Watts Simonds and Kelly Gonzales are doing important work illustrating how powerful and transformative such collaborations can be, but the incorporation of Indigenous perspectives within environmental health is in its infancy. Not only do Indigenous communities have specific knowledge

and unique perspectives to offer the research process, incorporation of Indigenous environmental knowledge into social science research can bring the added benefits of additional epistemological frameworks, as well as Indigenous values and ethics (Hoover, 2017; Simonds et al., 2013). Within any such collaborations it is essential that non-Native scholars follow the desires and guidelines of Indigenous partners, as essentializing and appropriating Indigenous knowledge are ongoing risks. It is critical for non-Native scholars to educate themselves about the very significant ways that academic research has been complicit in colonialism. Anyone considering doing work in this area should also become fluent with the issues and writing on appropriate protocols by Indigenous peoples. Writings by Denzin et al. (2008), Smith (2013), and Wilson (2004) are great starting places.[4]

## Sovereignty

A key aspect of Indigenous people's relationships with the State, internal social and community dynamics, ecological and natural resource policies and individual identities is the fact that Native peoples have political, economic and social power that has never been relinquished. For federally recognized tribes, political sovereignty means that tribes' ability to govern their lands, resources and members is recognized by the United States. Of course not all tribes are Federally recognized, but even for those who are, notions of legal political sovereignty in the U.S. are, however, limited by tribes' status as "domestic dependent nations (see Tsosie, 2013). Indigenous scholars include what are called non-recognized Tribes by rejecting that term and noting Inherent Sovereignty which all Nations/Tribes/Peoples have, conditioned by federal and state laws that are in constant contention, where most states try to impose dominance over even federally recognized Tribes or Nations (Fenelon, 2002).

Indigenous perspectives of sovereignty that are inclusive of cultural materials, language, knowledge systems, ecological relationships to land, animals and human and tribal interactions. Similarly, Tom Goldtooth (1995) of the Indigenous Environmental Network writes, "Before colonization, Indigenous nations possessed complete sovereignty. Many Indigenous people today argue that Indigenous sovereignty remains in force and regard all federal laws limiting tribal sovereignty as illegal" (p. 142). Yaqui descended legal theorist Rebecca Tsosie (2013) writes:

> The political sovereignty of Indigenous peoples under U.S. federal Indian law is grounded in a more ancient sovereignty, which is an "internal, culture-and-community-based model of sovereignty" that reflects the identity of Native peoples as the first Nations of this land. The concept of cultural sovereignty is a valuable basis for the construction of an Indigenous right to self-determination because it is constructed from within Native societies, rather than from the outside by the federal courts of Congress, who struggle to determine the limits on inherent sovereignty (pp. 243–244).

Indigenous peoples themselves repeatedly emphasized deeper and more generative sources of power through their relationships with the earth. The importance of the natural world for this richer source of power is underscored by the term "bio-cultural sovereignty" as described by Cutcha Risling Baldy (2013) who draws upon. Whether one considers traditional political or "bio-cultural" conceptions of sovereignty, relationships with the land are the basis of political power. Indigenous notions of sovereignty draw upon rich morally grounded ecological relationships across species that have co-created the abundance needed for human survival and flourishing. For many Indigenous communities, the legitimacy of sovereignty and management jurisdiction is based in the fact that people have continued to carry out cultural and spiritual practices since time immemorial. For many

[4] Indigenous perspectives are under-represented in academia and very necessary to advance accurate understandings of Indigenous experiences and the processes of colonialism. Online see Guidelines for Considering Traditional Knowledge in Climate Change Initiatives: https://climatetkw.wordpress.com/ and NIEHS Resources on TEK: https://www.niehs.nih.gov/research/supported/translational/peph/webinars/tribal/index.cfm

communities in California such notions of sovereignty and land management authority rest as well upon the fact that because treaties were never ratified, land title has never been ceded. The fact that different Indigenous communities have different legal relationships with Federal and State governments via particular treaties, Federal recognition (or lack thereof), and specific histories and legacies of genocide complicate the relationships of Native peoples' to one another, not to mention the differences in their abilities to maintain relationships and responsibilities to the natural world at any given point in time.

Indigenous conceptions of power entailed in tribal sovereignty are illuminating for sociology, and one fruitful place for possible sociological engagement (Champagne, 2008; Middleton, 2015). Attending to Indigenous sovereignty can inform social movement scholars and theories in political sociology and social movements alike, making visible much broader configurations of social resistance than sociologists have otherwise described. For example, in his work on Indigenous social movements, James Fenelon (2014) points out the multitude of organizational configurations including "broad pan-Indian social movements, like AIM, and particular struggles for social independence and cultural integrity based on traditional world views, such as on Pine Ridge or the other Teton-Sioux reservations" (p. 328). Indigenous perspectives on sovereignty contribute not only to an illustration of the ongoing process of colonialism, but also the relevance of the natural environment for sociological understandings of the nature of power. As Steinman (2012) notes, sociological blind spots regarding the many organizational forms of Indigenous resistance relate to the discipline's limited conceptualizations of state power and state violence, to which it is responding.

Indigenous communities have long histories of exploitation and abuse by academic researchers. Unfortunately, serious forms of academic abuse continue into the present in the form of the extraction of knowledge and cultural materials, misrepresentation of views and voices, lack of informed consent and other actions that can be deeply harmful to Indigenous communities (Marley, 2018). Many federally recognized tribes have their own internal review boards in an attempt to enforce knowledge and data sovereignty. Environmental sociologists working with Indigenous communities need to be aware of Indigenous research protocols, ethics and methodologies (Denzin et al., 2008; Smith, 2013).

Another result of the general public ignorance of Native sovereignty has been a superficial or metaphorical usage of the term within social movements and food justice literatures (see Milhesuah & Hoover, 2019; Grey & Patel, 2015; Whyte, 2018). Initially, Indigenous perspectives on food sovereignty played vital roles in formations of environmental justice and food sovereignty movements, but these perspectives have become subsumed by non-Indigenous outlooks and experiences. The term food sovereignty is widely used with minimal understanding of larger political meanings, or what Native food sovereignty movements fight for or against. This development is particularly troubling because not only does it further settler colonial dominance, it also weakens the potential of these movements (see e.g., Grey & Patel, 2015; we further discuss this challenging issue below in the section titled "Visions Moving Forward").

## Colonialism and Settler-Colonialism

Amongst the concepts Indigenous peoples and perspectives bring to environmental sociology is the relationship between colonial states and organizing forces of human-ecological dynamics and history in North America and beyond (Fenelon, 2014). Indigenous peoples have experienced genocide and violent colonialism across a long time period in North and South America. Violent colonization in the Spanish conquest of the Caribbean and the English colonization of the east coast occurred hundreds of years before the emergence of the United States. Fenelon and Hall (2008) describe how:

> Many of these peoples and countries devolved under pressure into colonies and smaller nation-states, what social scientists call "tribes" even as other peoples, already smaller in scope, simply

> survived … Essentially newly created social groupings began to emerge as European nations took over the Americas, later termed Indians as racially defined, as "tribes" and sometimes nations, and much later as hunter-gatherers, terms which clearly put Indigenous peoples surviving four centuries of increasingly violent onslaught of European and then Euro-American societies, into categories of the "under-developed." However, what is less studied is what was lost or submerged with development of the modern world system over "less developed" regions and how that produced structured inequality (p. 144).

In contrast to the racial formation framework that emphasizes the movement of resources and shifting power relations between groups within a given society, or Marxist frameworks that attend so adeptly to human exploitation via labor, the notions of colonialism and settler-colonialism emphasize the fact that the social, economic, ecological and political systems of one group of people are imposed upon and—to the extent they are successful—supersede those with another, with the goal of elimination and replacement of existing systems and whole societies.

An emphasis on colonial and/or settler-colonial structures is not meant to replace the importance of addressing other forces shaping Indigenous communities such as capitalism or racism, although Indigenous and Marxist critiques of capitalism do vary. Rather, there are complex relationships among the operation of genocide, racism, capitalism and colonialism. Indeed, as Fenelon and Trafzer (2014) emphasize: "Indigenous peoples represent the most complex social analytical issues in the world today, including invasion by foreign groups, outright genocide, culturicide and multiple forms of coercive assimilation, and ranging over half a millennium of modern colonization histories covering the Americas and globally" (3). For many Native Studies scholars and environmental sociologists engaging Indigenous perspectives, settler colonialism is a primary force shaping eco-social relations (Bacon, 2018; Grande, 2008; Klopotek, 2011; Sabzalian, 2019).[5] Settler-colonial theory stressing an emphasis on contestation over land and territory makes it particularly relevant for environmental sociology. Settler-colonial and other theories emphasize at least three key dynamics of power that are highly relevant for environmental sociologists, but as yet underdeveloped in the field's body of theory: the notion that North American colonialism is, like race and racism, an ongoing structure rather than a past event; the centrality of land to the operation of Indigenous, settler and state power; and the structuring of state and settler relationships with Indigenous peoples in terms of elimination and replacement (Veracini, 2013; Wolfe, 2006). Settler-colonial theory is relatively recent, rapidly developing, contested, and the subject of much scholarly attention. Many Native Studies scholars call for greater nuance in the use of the concept. We contend that at minimum, settler colonialism, as a subset of the Colonizer invasion by colonialism, remains useful with its focus on what some have called 'settler mentality.' This settler mentality consists of the thinking and ideologies arising in the general population toward a conquest dominating frame that separates human society from the natural world environment in which we are in fact embedded. This is also the frame in which the economic institutions view as resources to be extracted or harvested in tightly controlled political economic structures that maximize profits over people.

[5] See also Coulthard (2014), as well as Fenelon (2016), Dunbar-Ortiz (2014) and Simpson (2017) for further discussion of how capitalism, colonialism and patriarchy intersect and reinforce one another.

## Colonial Ecological Violence

Another concept recently appearing in the environmental sociology literature is that of colonial ecological violence, coined by JM Bacon (2018). Bacon observes that settler colonialism as a structure "disrupts Indigenous eco-social relations, and in so doing produces what I call colonial ecological violence, which results in particular risks and harms experienced by Native peoples and communities" (p. 59). Colonial ecological violence has transpired in different ways across an extended time period and a large geographic area in the Americas. This includes, for example, the attempted extermination of the American bison during the conquest colonizing era over

the Great Plains of the northern U.S.?, and the vast animal and species destruction from the fur trade in both north-eastern and south-eastern forested lands, demonstrating ecological violence toward lands and peoples manifested by intentions to maximize economic profiteering during the capitalist phase of development of the modern world. Indigenous peoples surviving in these regions restored forests and bison herds in lands under their supervision. Similarly, across California, Indigenous peoples experienced ecological devastation during the Mission period, such as the introduction of cattle, agricultural crops for export, and destruction of tended species with replacement of different kinds of trees and plants, with deeper destruction during the state genocide period, which included gold and mineral mining, initial urbanization of seaport regions, and damming of rivers and lakes, followed by massive water diversion and management projects. These forms of colonial ecological violence are what Kyle Whyte also calls the "ecological dynamics of settler-colonialism" (Norgaard, 2019).

Colonial ecological violence describes both "the ferocious and spectacular assaults on Native people through environmental damage" (Bacon, 2018, 6) as well as the more incremental, pervasive and structurally produced forms of violence that occur as settlers attempt to eliminate Indigenous ecologies and replace them with new ecological practices (e.g., small family farms, commercial agriculture and forestry practices, mining, urban centers etc.).

Similar invasion effects have targeted Indigenous peoples globally, in closely documented struggles over forests for timber exploitation in India (Bijoy, 2008), Mapuche resistance in southern Chile and central America, and now within the last vestiges of the Amazon forests by peoples like the Guajajara who are fighting illegal loggers with armed patrols (Wallace & Fagan, 2018). Like the Warli forces in India that are re-growing teak forests, or the Zapotecs in the southern Mexican highlands, these Indigenous peoples are resisting ongoing ecological violence and revitalizing their traditional environments as a key dimension of their cultural and spiritual survival.

## Environmental Reproduction and Reproductive Justice

The intimate connections between social and ecological systems that Indigenous peoples consistently articulate embody moral conceptions that move beyond notions of equality, towards deeper conceptions of justice and 'right action' that involve responsibilities to other species and the ability to generate life (Baldy, 2018; Hoover, 2018; Hoover et al., 2012; Simpson, 2017; Willette et al., 2016). Here we also highlight concepts related to social and ecological reproduction and Elizabeth Hoover's (2018) notion of *environmental reproductive justice*.

Fenelon and Hall (2008) describe how many Indigenous peoples resist environmental and local economic pressures, to see how each of four arenas of social behavior—decision-making, land tenure, economic, community—are connected in holistic paradigms that stress revitalization of traditional society's environmental orientation (see Fig. 23.1).

Fenelon and Hall (2008) found the above spheres of Indigenous social interaction in the four societies they describe in their work—Gond *penjayat* in central Indian, Lakota council in the Dakotas, Tarahumara *ejido* in northern Mexico, and a Maori *marae* in Aotearoa New Zealand. In other shortened words—Indigenous peoples have decision-making leadership structures that reflect and reinforce traditional land tenure values, including sacred and sustaining relationships, economic values with a focus on equitable distribution, with a strong guiding vision of an inclusive community harmonious with the environment.

These notions of responsibility and relationships inform deep criteria for justice. Together with a series of colleagues, Elizabeth Hoover details the experiences of Akwesasne, a Mohawk American Indian community confronting legacies of industrial pollution

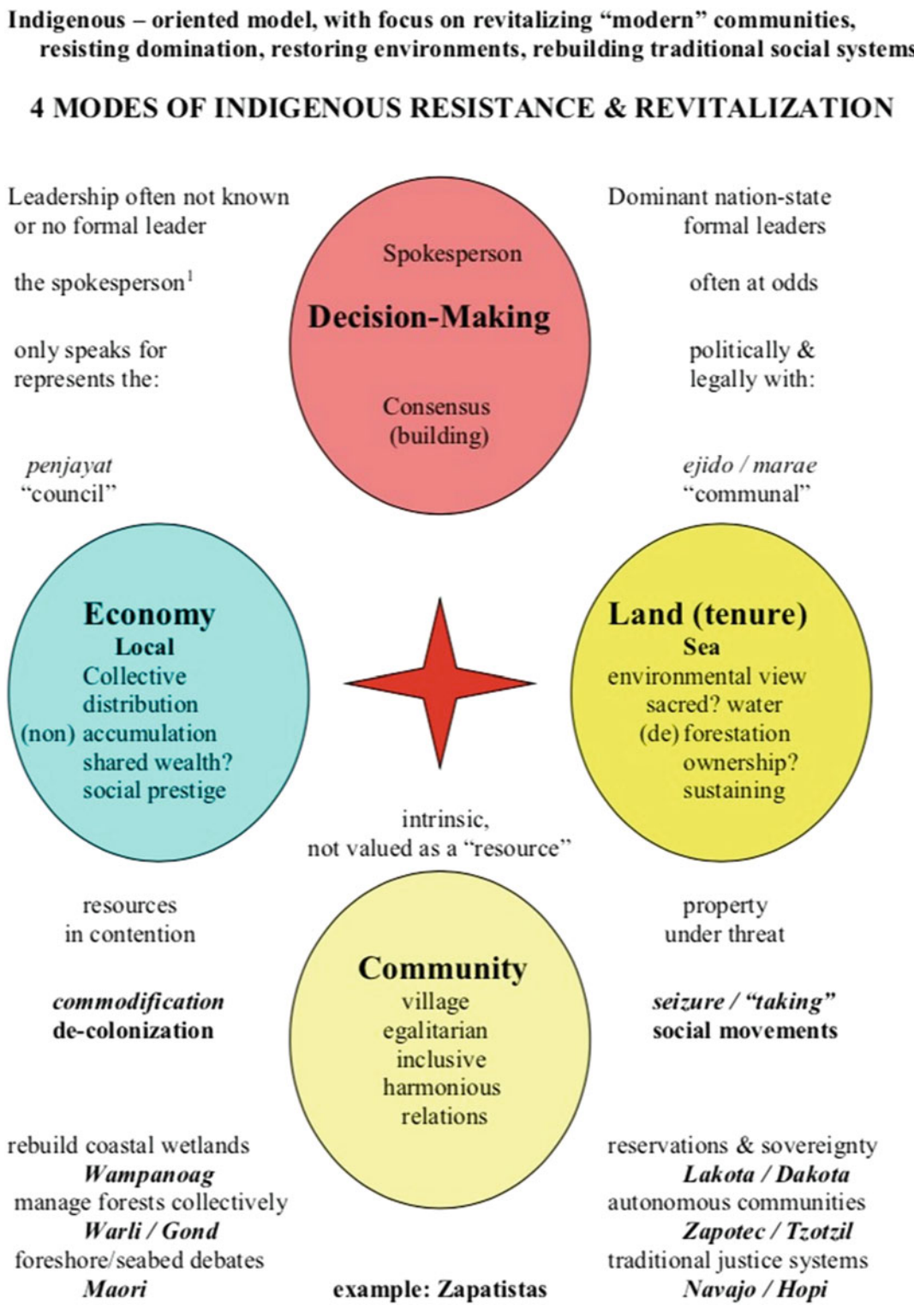


**Fig. 23.1** Four modes of Indigenous resistance and revitalization. (Reproduced from Fenelon & Hall, 2008)

(Hoover, 2018; Hoover et al., 2012). Hoover (2018) articulates the notion of *environmental reproductive justice,* which centers the notion of justice in the processes that generate life, and injustice as activities that interfere with life. Because life-producing activities are carried out by coordinated actions between humans and other beings in the natural world, the phrase environmental reproductive justice encompasses the need to ensure "that environmental issues do not interfere with physical or cultural reproduction" (p. 8). Hoover emphasizes that environmental reproductive justice "involves expanding reproductive justice to include a deeper focus on the environment, and to include the reproduction of language and culture as concerns" (ibid). This term highlights how Indigenous frameworks attend not only to justice in the present time, but "expand[s] the framework of environmental justice to more closely consider the impact of environmental contaminants on physical and cultural reproduction" (ibid). Ron Reed's notion of *Karuk social management* and the environmental justice dimensions of *denied access to traditional management* is closely related to Hoover's notion of environmental reproductive justice because Reed too is emphasizing how in the absence of ongoing ecological management the reproduction of gender relations, identity and physical and mental health and more are on the line. Many Indigenous peoples articulate similar frameworks.

## Visions Moving Forward

> The countries with large and influential Indigenous populations are well in the lead in seeking to preserve the planet. The countries that have driven Indigenous populations to extinction or extreme marginalization are racing toward destruction… (Noam Chomsky, 2013)

Indigenous peoples hold real technological, epistemological, social structural, moral and ecological alternatives to dominant capitalist and colonial systems that are critically needed to respond to ecological crises today (Fenelon, 2015a, 2015b). Amongst the most important messages for the developing Indigenous environmental sociology is the extent to which the crises of capitalism, environmental decline, and now climate change are a product of five hundred years of colonialism. While the crisis of climate change is "new" to many who have long benefitted from capitalism, Indigenous peoples (along with others in communities of color) have been trying to bring attention to the severity of these problems for a very long time. Indigenous scholars center the role of Euro-American countries in contributing to these growing crises through the development of global industrial capitalist economies whose centralized political economies further the growth of predatory systems. These capitalist systems are forever altering the world with their immense trading systems that ship products and people to different parts of the earth. Furthermore, these very large systems subordinate smaller systems, maximizing displacement and creating a vortex of social problems that destroy community cohesion, distributive economies and the land tenure relations of Indigenous societies that have been practicing reciprocity and holistic interaction. The intertwined forces of colonialism, capitalism, racism and sexism have colluded to obstruct reception of Indigenous voices. To that end, attention to and theorizing of the existing *Indigenous alternatives to global crises* forms a central element of the needed directions for environmental sociology broadly. For non-Native sociologists, now would be a good time to listen.

The global crises include devolution of the environment, probably to the point of chaos, or what some scientists are calling a global "tipping point" of no-return in Nature (Barnosky et al., 2012) where we are "approaching a state shift in Earth's biosphere" because of the burning of fossil fuels, greenhouse gas emissions, global warming, rising sea levels, and altered climates causing perturbations in the agricultural and industrial sectors of all societies, notably negative and possibly irreparable (Fenelon, 2015a, 2015b). World-systems analysts are drawing attention to these models as potentially causing socio-political unrest and resource wars across regions, over water and food, and survival itself. Grow-or-die has been the mantra of capitalist

"development" for the last two centuries, and since then has been based on industrialism, fueled by the power sources of oil and coal, while much larger effects, including whole-scale destruction of the environment upon which all countries depend, are ignored in the pursuit of growth and profits.

The great anomaly is that those peoples thought to be "left behind," deemed "underdeveloped" or those that are simply surviving centuries of predation, suppression and destruction by the large-scale "civilized" societies, may well hold the keys to future survival. Indeed many of us believe that Indigenous alternatives in the form of specific technologies, epistemologies, social structures, moral codes and ecologies themselves are critically needed to respond to ecological crises today (Fenelon & Hall, 2008; Norgaard, 2019; Whyte et al., 2018). As Noam Chomsky has observed, rich, capitalist countries profiting from corporations support status quo operations, even as the only "effort to preserve conditions in which our immediate descendants might have a decent life are the so-called "primitive" societies: First Nations, tribal, Indigenous, aboriginal... Throughout the world, Indigenous societies are struggling to protect what they sometimes call "the rights of nature," while the civilized and sophisticated scoff at this..." (Chomsky, 2013).[6]

Strong Indigenous resistance movements to environmental decline and now climate change emerge from relationships between human and other species as kin, from Indigenous value systems centered in respect and responsibilities to humans and the earth, and modes of social organization rooted in local governance and place. Drawing from cases around the world, we highlight examples of each element of these alternatives to global crisis.

A starting point of Indigenous alternatives to global crisis concerns widespread values of respect and responsibility to human community and the natural world as kin (Simpson, 2017; Whyte, 2017). Indigenous ethical systems, natural resource management practices, knowledge systems, and more are incredibly diverse across the thousands of Indigenous cultures. The very existence of such communities who have co-evolved in specific places over very long time periods is testament to the sustainability of these systems. In these closing pages we offer a few specific examples of the many and various ways that Indigenous peoples have retained alternatives to the global system in crisis.

Arguably the most basic difference between Indigenous peoples and the dominant societies of the modern world system are what are called "Mother Earth" philosophies of relationships to the earth, environmental consciousness, and humans as an interconnected whole with strong basis in community. As Turtle Mountain Band of Chippewa sociologist Duane Champagne articulates, "Land is given as a sacred gift and a sacred stewardship. People do not own land, but must care for the land as part of their sacred task within the purpose and direction of the cosmic order" (Champagne, 2005: 7). Fenelon identifies societal ("tribal") connections of the Lakota as being linked to similar constructs of the Warli, Maori, Tzotzil, and Mapuche among other Indigenous peoples, to illustrate this universality as a social construct.

The basis of Lakota relationships of people and the environment uses "Ina Maka" (Mother Earth) as key. For instance, Lakota greet relatives with "*Hau Mitakuyepi*" for all that is related, first being the "*tiwaye*" family (ti-pi, household); "*tiyospaye*" as extended relatives (community); "*Unci Maka*" as grandmother earth and "*Tunkashila*" as grandfather in spiritual language (ancestors), "*Oyate*" as a nation or those belonging together (*wanbli* eagle, *pte* buffalo nations), and outsiders "*unma oyate*" those (people) outside the group, or others; with "Ikce Wicasa" meaning just a common (red) human; ending

[6] However, Chomsky credits countries with large Indigenous populations, such as Ecuador or Bolivia, rather than the Indigenous societies themselves creating alternative social patterns. This perspective runs the risk of ignoring the anti-ecological and anti-Indigenous policies of those nation-states. For example, Ecuador tried to auction Amazonian oil reserves to China, while Bolivia sought to build highways in "undeveloped" regions without consulting Indigenous governance.

with "Omidakuye oyasin" meaning we are all related (global), including animals and living things in the environment. The Lakota have kinship relationships, encompassing an environment of all life.

Tanya Casas (2014) captured these dynamics in her work on Indigenous peoples in Central America and the new (revised as of September 2008), Ecuadorian constitution "that granted rights to living things and their environment." Ecuador's Constituent Assembly declared that "nature has the right to exist, persist, maintain and regenerate its vital cycles, structure, functions and its processes in evolution." Importantly, they acknowledge a "Kichwa Indigenous concept and project of *sumak kawsay*, or 'living well' for all natural systems." *Sumak Kawsay*, has a "critique of traditional development strategies focused on growth and exploitation of resources rather than seeking to live and co-exist within dynamic systems of interdependence and relations. This practice and concept integrates (and unites) peoples and communities with *Pachamama* (Mother Earth)" (Casas, 2014).

Clearly, then, concepts of a living relationship with the earth and community as collective responsibility are operative among Indigenous peoples in Latin America, and indeed around the world. This is clear in the nation of Bolivia, where the government passed "The Law of Mother Earth" (*Ley de Derechos de la Madre Tierra*) in 2011, defined as "the living dynamic system comprised of the indivisible community of all living systems and all living beings that are interrelated, interdependent, and complementary, and that share a common destiny… Mother Earth is considered sacred" (Casas, 2014).

These relationships with other species as kin relate to important conversations within environmental sociology. For example, interest in food studies has generated an explosion of attention to "food," including a new lexicon of *slow food, local food, food security, food deserts, food sovereignty,* and *food justice* (Alkon, 2012; Alkon & Guthman, 2017; Sbicca, 2012). While 'food' no doubt holds significant individual and cultural meanings for all peoples, the profound connection that Indigenous peoples draw between "food" and identity, community and spiritualty are of another order.

Karuk and other Indigenous people speak of the foods they eat as relations. They speak of a longstanding and sacred responsibility to tend to their relations in the forest and in the rivers through ceremonies, prayers, songs, formulas and specific stewardship practices they call "management." Such concepts are in stark contrast to the generally commodified understandings of "food" where there are concerns about inequalities in the 'production' and 'consumption of 'food." For example, in Northern California, the visions of "food sovereignty" that Karuk people have articulated are about restoring relationships and the ability to carry out one's responsibilities to the earth and to the human community—in particular the ability to carry out one's responsibilities to one's kin that are not in human form, but in the form of other species.

What some analysts are calling "food sovereignty" is really an interactive, holistic set of relationships of food, land, and more, not fully understood. These relationships are the basis of production, consumption, and life itself. Furthermore, colonialism and its resistance remain almost entirely invisible within this new field of food studies. We contend that if activists and scholars listen to what Native people are saying here, and take food justice and food sovereignty to be about fixing relationships between people, society and across species, any understanding of what is wrong with those relationships would do well to look to the long arc of tribal knowledge and achievement with the natural world on this continent for the last 10,000 plus years (Trosper, 1995, 2003; Whyte, 2018).

The orientation to land as sacred gift is in direct opposition to how modern, capitalist society approaches "private property" with economic values and private title (Kimmerer, 2013; Simpson, 2017). This creates a conflict—"The larger problem for the Indians was the struggle against breaking up the communal lands. The Liberals made private property sacred … the communal ownership of land in Indian communities became an obstacle to be removed" (Bonfil Batalla, 1996: 100). Thus, communal land

tenure relationships, compounded by the less destructive and symbiotic interactions with the environment, became a central point of conflict with capitalist neoliberalism and globalization processes, even as alternatives are viewed as threats by modern states. The very real challenge to communities from extractive interests—such as oil in the Amazon, hydroelectric dams in the Americas, and deforestation in Asia, results in clashes of paradigms of development, progress, and of what is valued. Global interests pit "economic calculus" against "ecological calculus" and dismiss most Indigenous claims as primitive or less progressive, rather than viewing these as different paradigms of social life on earth.

Taken together and noting that there is great diversity among Indigenous Peoples, we acknowledge that Indigenous peoples on the whole express deep-set philosophies of maintaining organic complementary environments, that view human life as only one set of animal relationships—often noted in such statements as "the two and four-legged, those with wings that fly, that which swims, crawls or burrows…" Indigenous peoples usually refer to all life-forms and the earth itself in traditional language and often in ceremonial practices, that obligate leaders to continue the relationships of rights and responsibilities toward earth, land and water—see use of *mni wiconi* in recent social movements such as at Standing Rock, where life is connected to water, land, and the elements as the basis of health and social reproduction. Indigenous peoples critique dominant settler-colonial frameworks and capitalism as intrinsically un-healthy and destructive to their holistic environments, and based in individual and institutional greed that lifts particular groups above all others, including animals and the earth itself. And Indigenous peoples resist, not always successfully, developmental ideologies of modern society that view the built environment as superior to and therefore dominant over a natural environment that values size over society, and divorces non-human life from all humans and inanimate existence as put on earth for humans to exploit.

Of course, the socio-political domination of states, previously those of colonizers, inhibits and inherently suppresses Indigenous practices that run counter to developmental economies and western philosophies that divorce humans from "natural" environments. These general observations about Indigenous Peoples must also be understood in the context of multiple centuries of contact, interaction and resistance by colonial structures. The characteristics of any given community today are further qualified by level and type of adaptation (or assimilation) that communities have made into the modern structures of a global society, built upon neoliberal philosophies and over capitalist economies that reject or suppress Indigenous thought.

Drawing from these observations we therefore propose that an Indigenous Environmental Sociology would include most of the following qualities: *It would always begin with a specific and then generic Land Acknowledgement*,[7] usually followed by recognizing particular Indigenous Peoples or Native Nations, named or placed in specific geographies, including mention of how historical socio-political circumstances or settler-colonial struggles have influenced or reduced the geographical and topological (much less the political) relations and boundaries to those lands and environments. Secondly, an Indigenous environmental sociology would *center on examples of orientation toward Land and Environment,* such as above with Lakota perspectives (as noted in the Four Directions, multiple sources, see Fenelon, 2006) that definitively include respect for all living and inanimate forms of existence, often exemplified in prayer or ceremony. This approach should further bring *attention to the sociological relationships within Indigenous societies* attending to how community and or society have symbiotic and interactive components, such as sharing of food sources, rarely if ever destroying forests or landscapes, but rather giving recognition to how these are shared, often in a spiritual way, and a general sense of how all life forms regenerate themselves

[7] Guide to Indigenous Land and Territorial Acknowledgements for Cultural Institutions, http://landacknowledgements.org/

in the broader environment.[8] Lastly, we suggest that an Indigenous environmental sociology should not view any part of the living environment or the earth itself as a resource, but rather *as an integral source of life-giving sustenance, including humans themselves*, and therefore less of an orientation of management for profit or productivity and more of a cycle of giving and taking.

In closing we call on environmental sociologists and all peoples to affirm and support Communities (Indigenous Peoples) to determine their own futures—over use of non-renewable and sustainable resources. Indigenous communities must decide on their own food and resources policies, and their own environmental practices and resource distribution strategies. And leadership with decision-making needs to be responsive to communities, and not centralized power sources and political parties that corrupt representatives no longer directly linked to home groups. The rights of collective human groups, whether community, village, or tribe, need to be understood in the context of the United Nations Declaration on the Rights of Indigenous Peoples, similar to the Mother Earth platforms in the Ecuador and Bolivian constitutional improvements. Finally, and here perhaps is the most difficult challenge for non-Indigenous peoples to learn: more of the world must embrace and understand concepts like "mother earth" and spiritual-social-biological relationships with land, air, sea and all life that walks, flies, swims or crawls upon it. Rather than view these alternative philosophies as "primitive," we need to see them as essential, sophisticated, time-tested and holistic approaches better suited to the powerful and potentially lethal changes we will see as a result of anthropogenic climate change and global warming.

Native Nations, Indian Tribes, First and Indigenous Peoples of the Americas, have long continued to engage in resistance to land takings and practice revitalization of the natural environment, as *survivance* or "renunciations of dominance, tragedy and victimry" and "the continuance of native stories" (Vizenor, 2008) against colonization and Empire in the twenty-first Century (Estes, 2019; Fenelon). Historical struggle and movements against dominant states, includes a colonized settler-based United States and transnational oil corporations participating in the denial of global anthropogenic climate change and disruption, threatening our entire world, with suppression of Indigenous communities that redress global issues of survivance. Many Indigenous leaders are now saying: "The time is now, the actors are us (Indigenous peoples), (our) vision perseveres."

[8] While there are some moments in time and space where this success with sustainable adaptation may have been otherwise (e.g. the potential relationship of human hunting to megafaunal extinction in North America), such instances if true are notable for their rarity. Instead, it is clear from the high human population levels that the profoundly abundant ecological systems in North America supported very large human populations until Euro-invasion.

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# Environmental Movements in the United States

24

Erik W. Johnson and Jordan Burke

## Introduction

Environmental movements have always been a core subject of research within environmental sociology (Dunlap & Catton, 1979). Once largely the near sole purview of environmental sociologists, organized and collective efforts at social change in the name of the environment are now a central object of inquiry among scholars interested in social movements, business organizations, civic participation, resource governance and other topics. The result has been a marked increase in sociological research on environmental movements over the past couple of decades.

This review attempts to summarize the broad array of sociological research on the United States environmental movement, as well as major developments within the movement itself. We highlight two trends in particular. First, the increased diversification of the movement. The white, middle-class environmental movement that emerged in the 1970s and relied primarily upon lawsuits and lobbying increasingly includes participants across broader demographic groups, integrates a wide diversity of tactics, and aims beyond the world of politics to advance its goals. The second is institutionalization of the movement and especially concerted efforts to work with government and industrial producers to develop new markets for environmentally (more) friendly products. In what follows, we review the historical roots of the modern US environmental movement and burgeoning literatures on the movement's organizational infrastructure, the diversity of tactics exhibited and the variety of outcomes the movement has affected. We conclude with a discussion of likely and potentially promising research trajectories.

## Building National Organizational Infrastructures

The modern environmental movement in the United States emerged at the tail end of the long protest wave of the 1960s and grew rapidly during a period of tremendous legislative advance, often referred to as the Golden Age in federal environmental policy making. The rate of establishing new environmental movement organizations (EMOs) peaked shortly after the first Earth Day in 1970 and remained high through the 1980s (Johnson & Frickel, 2011; McLaughlin & Khawaja, 2000) when there were also large spikes in memberships and budgets of the largest national EMOs (Mitchell et al., 1991). That growth served to highlight a prominent feature of this early movement infrastructure that endures today, the embrace of a *professional*

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organizational model (Dunlap & Mertig, 1991; Gottlieb, 2005).

Professional social movement organizations (SMOs) (McCarthy & Zald, 1977) rely heavily on donations or "checkbook" memberships, rather than active members, and are staffed and run by professional scientists, lawyers and fundraisers. Groups like the Environmental Defense Fund (EDF) and Natural Resources Defense Council (NRDC), founded in 1967 and 1970 respectively, are exemplary. Each consists of professional lawyers, scientists and lobbyists sustained primarily through membership dues, individual donations and a combination of corporate and foundation funding, rather than relying on members' active and involved participation (Bosso, 2005). Professional EMOs play a prominent role in the environmental movement and tend to dominate movement efforts, especially at the national and international levels.

The extent and implications of the shift from "membership to management" (Skocpol, 2003) has been a common theme of research on social change organizations in general (Putnam, 1995; Walker et al., 2011) and environmental organizations in particular (Andrews & Edwards, 2005; Carmin, 1999; Fisher et al., 2012; Salazar, 1996). Professionalized, relative to volunteer, EMOs tend to be larger, to have more bureaucratic structures and decision-making processes, are more likely to adopt a nonprofit tax status, to receive funding from other organizations, and to engage in advocacy coalitions. Professionalized groups are also considerably more likely to employ conventional tactics of political insiders like lobbying, while eschewing both radical direct actions and philosophical orientations that may be seen as off-putting to potential allies and large donors (individuals, foundations, and corporations). Volunteer EMOs, while smaller on average, are more likely to engage individuals in ways that build civic capacity and represent more diverse membership, tactics, and philosophical orientations.

There is strong evidence that a mixture of professional and volunteer organizational types offer significant potential synergies. Organizations relying on a mix of volunteers and professionals tend to be the most successful at maintaining resource flows and mobilizing people (Andrews & Edwards, 2005). And, whereas voluntary organizations are more likely to identify emergent environmental harms, it is professionalized EMOs who are typically better able to build sustained relationships that undergird much public policy making (Carmin, 1999).

As the largest national EMOs expanded during the 1980s, federal legislative progress on environmental issues stalled, leading many to question the ability of these organizations to affect change. By the early 1990s, two emergent grassroots strands of environmental movements (which we explore below), more reliant on active participation of members than professional staffs, had largely come to view mainstream national EMOs as ineffectual relics, beholden to corporate donors, more focused on mass-marketing techniques and fundraising than protecting the environment, and too willing to compromise.

## Environmental Justice

Sociological research on the US environmental movement has been shaped by attention to two closely related strands of this grassroots mobilization: a white-working class anti-toxics movement tracing back to Love Canal (Szasz, 1994) and an anti-environmental racism movement rooted in communities of color (Bullard, 1993, 2008; Edwards, 1995), catalyzed by the First National People of Color Environmental Leadership Summit in 1991. Often referenced collectively as the environmental justice movement, both strands saw, and largely continue to see, the mainstream national organizations as more concerned with protecting endangered species than the health and welfare of people (Dowie, 1996; Gould et al., 1993), and its members often emphatically reject the "environmentalist" identity due to this association (Allen et al., 2007). The anti-toxics movement rapidly developed its own organizational infrastructures, highlighted by groups like the Lois Gibbs-led Citizens Clearinghouse for Hazardous Waste and the National Toxics Campaign. Environmental justice in

communities of color, meanwhile, has primarily been nurtured within the broader civil rights community (Edwards, 1995). Stretesky et al. (2011), for example, demonstrate that the establishment of racially focused environmental justice groups in a county is facilitated by the presence of civil rights, but not environmental, groups in that county.

One staple of the literature on toxics and justice movements has been (comparative) case studies of emergent mobilization in reaction to the discovery of toxic contamination (Brown & Mikkelsen, 1997; Gould, 1993; Levine, 1982) or in response to the attempted citing of a Locally Unwanted Land Use (LULU) such as a waste disposal facility or energy infrastructure project (Bullard, 1993, 2008; McAdam & Boudet, 2012; Walsh & Warland, 1997; Walsh et al., 1993). By and large, this literature confirms the importance of traditional movement factors (e.g., political context, community resources and activist framing efforts) in explaining where opposition emerges and is successful. More uniquely, it has highlighted the leading role of women in discovering and organizing around environmental threats to health (Bell, 2013; Brown & Ferguson, 1995; Freudenberg & Steinsapir, 1991; Gottlieb, 2005; Krauss, 1993), as well as developing alternative models to professional science.

Mobilizations in response to specific instances of disease clusters or attempted LULU sitings have sometimes resulted in sustained campaigns for equality, justice and resiliency; what some activists have called the move from NIMBY (Not in My Back Yard) to NOPE (Not On Planet Earth). Today, the blending of environmental and social justice issues and framing can be seen most prominently in the way that climate justice has become a rallying point for a broad range of organizing, including campaigns for food justice, energy justice and indigenous justice, from local to international levels (Agyeman et al., 2016). A focus on environmental campaigns, such as climate justice or the long-running campaign opposed to waste infrastructure projects in the US, draws attention to the broad constellation of actors involved in environmental disputes (Porta & Rucht, 2002). In the case of climate, this includes social and economic justice movements with which environmentalism is increasingly linked, as well as unions, countermovements and industry opponents and supporters.

Environmental justice movements based in racial-ethnic communities often emphasize the importance of heritage, culture, and legacies of oppression and colonialism in shaping the way these groups approach environmental issues (López, 2018; Sze, 2011; Whyte, 2017). In his first-person account of the Dakota Access Pipeline (DAPL) protests at Standing Rock, Nick Estes (2019) emphasizes how those events fit into a much larger and multi-general American Indian Movement (AIM) where issues of Indigenous sovereignty take center stage. Research on Indigenous justice movements also highlights the uniqueness of traditional Indigenous governance institutions and understandings of the reciprocal relationships between humans, non-humans, and nature (Estes 2019; Whyte, 2016). Humans, animals, land and water are conceived as relatives in many indigenous cultures, necessitating a sense of obligation, rather than being delineated and separated as in typical Western thought. Likewise, Asian American Immigrant and Refugee Environmental Justice (AAIREJ) activism and movements expand what is viewed as the environment to include such things as the effects of gentrification and the lack of translation services (Sze, 2011). These perspectives promote holistic approaches to addressing environmental degradation, ones that may not only better incorporate issues of inequality but also provide a foundation for more effective governance and institutional arrangements.

Other research has focused on applying a global perspective to environmental justice efforts. López (2018) argues that the Dakota Access Pipeline (DAPL), rather than being "a pipeline by and for America," is in fact a product of racialized global neoliberalism (146; see also Estes, 2019). As such, movement efforts should address this transnational system of oppression. Similarly, Anguelovski and Martinez-Alier (2014) argue that peasant and indigenous environmental efforts around the world are part of a global environmental justice movement that

recognizes how poor and indigenous individuals worldwide are exposed to exploitative practices that are inherent to global, capitalistic processes, of which wealthy nation-states benefit, even (or especially) at the expense of their own indigenous peoples.

The development of a robust environmental justice movement also highlights the extent to which issues of diversity and social justice have been taken-up within the mainstream environmental movement. In short, the US environmental movement remains highly segmented (Bosso, 2005; Hoffman & Bertels, 2009; Olzak & Johnson, 2019; Stretesky et al., 2011) and, while environmental justice organizations engage in extensive coalition building, attempts to span class and racial boundaries have been marked by acute challenges (Mix, 2011; Mix & Cable, 2006). One reason is that mainstream environmental organizations have traditionally had fairly dismal diversity records. In an examination of 1053 mainstream environmental organizations, for example, Dorceta Taylor finds (1999) that 83% of organizational presidents are male. By contrast, among 331 environmental justice organizations there is a nearly even split between male and female leadership. Moreover, whereas mainstream environmental groups are dominated by wealthy, educated and white members, a predominance of environmental justice groups are composed of and serve primarily people of color and/or low-income (Taylor, 1999).

EMOs have made some modest progress in terms of increased diversity since the 1990s, but considerable room for growth remains. In an influential report, Taylor (2014) found that although national EMOs had made substantial strides in terms of the gender diversity of their workforce, with women comprising the majority of new hires in conservation and preservation organizations, men continue to disproportionately occupy the most powerful positions. Moreover, the increase in gender diversity is largely due to the increased participation of white women. When looking at diversity in terms of ethnic/racial composition, minorities only comprise, at most, 16% of general staff positions and 12% of leadership positions. A follow-up report (Johnson, 2019) emphasizes the ways in which increased diversity among leadership positions is hindered by very high turn-over among staff of color, as well as suggesting best practices that organizations may adopt. Judging by membership in the ASA section on the environment, professional environmental sociologists aren't doing much better in promoting an inclusive environment for racial and ethnic minorities (ASA, 2018, 2019).[1]

## Radical Ecology

Radical ecologists, embodied in groups like Earth First! and more recently the Earth Liberation Front, have been influential culturally, developing and articulating a philosophy that envisions an end to human exceptionalism and the radical restructuring of human ideals, values and societal structures. Like environmental justice activism, many radical ecologists see the relationships between such things as the exploitation of nature and issues of power, inequality and prejudice as being interrelated, often resulting in efforts that are multi-issue in nature (Pellow, 2014). Radical ecology largely emerged from ideologies and perspectives that sought to question and change the manner in which humankind views and treats human/environment relationships and the inherent exploitative nature of these relations. For instance, Deep Ecology's emphasis on biocentrism, or the belief that human needs are not above the needs of other living things, and the promotion of action not merely on the basis of protecting "resources" but based on the moral imperative that all living things have value (Manes, 1990).

Radical environmental groups have adopted a range of movement strategies and tactics that have been previously used by other social movement groups. Pellow (2014), through a combination of interviews, archival and field research on

[1] In 2018 the ASA section on the Environment established a Committee on Racial Equity, both recognizing the lack of and seeking to increase racial diversity within the section.

the radical ecology and animal rights movements in the US, traces the way in which activists have borrowed across multiple movements to develop their ideological framing. By transforming and combining elements of pre-existing frames around social justice (applied to the ecological rather than social world), anarchism, and anti-capitalism, activists have developed a new "total liberation" frame that challenges the dominant social order, unifies the movement, and helps to motivate and structure the work of activists. Similar to the mainstream movement, however, radical ecological organizations tend to be dominated by white males. Earth First!, for instance, has been found to be exclusionary to women and people of color, often stemming from the intersections of race, sex and/or class-based differences in acceptance and opportunities for participation (Meyler, 2003; Pellow, 2014).One prominent characteristic of radical ecologists has been the willingness to adopt direct action protests, including sometimes even violent actions, in the name of eco-defense. Common tactics employed include trespassing, blocking roadways, sit-ins, tree-sitting, equipment and property damage, or what can collectively be referred to as "monkey-wrenching" or ecotage (Smith, 2008). Radical ecologists use these tactics to cause financial harm intended to coerce businesses to change environmentally destructive practices. The decentralized and cell-like organizational structures favored by radical ecologists both fit within their ideological perspective and are conducive to this type of radical direct action (Gerlach, 2001). The experience of Rick Scarce, an early sociologist to the study of radical *Eco-Warriors* (Scarce, 1990) is, however, illustrative of how authorities have typically viewed this radical segment of the environmental movement. Scarce spent more than 5 months in jail in 1993 for refusing to testify after a break-in at an animal research facility at the university where he was doing his dissertation research. In 2002, the Domestic Terrorism Section Chief of the FBI Counterterrorism Division, James F. Jarboe, referred to the Earth Liberation Front and the Animal Liberation Front jointly as the "top priority in domestic terrorism" (Smith, 2008). In the post 9–11 world, even academic accounts of radical ecologist activities are more often conducted under the lens of terrorism (Ackerman, 2003; Beck, 2007; Gray, 2013; Joosse, 2007; Michalski, 2019; Taylor, 2003) than social movements. It has been argued that this terrorism label and rhetoric largely emerged from pro-industry countermovement efforts (Smith, 2008). In fact, Ron Arnold, the former leader of the Center for the Defense of Free Enterprise (CDFE) and promulgator of the Wise Use movement (discussed further below) has been credited as the first person to use the term "ecoterrorism" (Arnold, 1983; Smith, 2008). It has also been argued that the "ecoterrorism" label is due in part to the structure of these organizations, particularly that of leaderless resistance, of which ELF is a prime example, whereby it is not activists themselves but spokespeople who publicly discuss the organization's actions (Joosse, 2012). Joosse (2012) argues that these spokespeople have less public credibility than those on the frontlines, so the media and government institutions can more easily discredit the "counter-hegemonic ideologies" and actions exhibited by these organizations.

## Putting Cases in Context

One longstanding emphasis within social movement studies has been studying populations of organizations, or social movement industries, rather than individual organizations or mobilization events (McCarthy & Zald, 1977; Minkoff & McCarthy, 2005). Research adopting this approach has contributed to our understanding of population growth dynamics within the US environmental movement. It also suggests that there is a bit of a disjuncture between sociologists' focus on pollution, human health, and social inequality and a movement that often remains focused on issues of wildlife and resource conservation. Wildlife and wildland conservation groups are considerably more numerous than those focused on issues of pollution (Andrews & Edwards, 2004; Johnson & Frickel, 2011) and they control significantly

more resources (Jenkins et al., 2017; Johnson, 2008). Many of these groups are also politically conservative, including "rod and gun" clubs that played crucial roles in passing 1970s era environmental legislation (Bosso, 2005).

While environmental justice is prominent in sociological literatures, groups focused on these issues are relatively rare within the environmental movement. In one of the earliest attempts to create a census of environmental groups, in the Delmarva Penninsula and State of North Carolina, Kempton et al. (2001) note that even after re-checking their sample and conducting a second search for relevant organizations, they find no environmental justice groups. Andrews and Edwards (2005) (in a census of groups within North Carolina) and Johnson and Frickel (2011) (looking at national EMOs) both find that environmental justice organizations comprise less than 5% of their samples. Given that efforts to achieve environmental justice are primarily undertaken by SMOs that would typically be classified as belonging to various civil rights movements, each of these studies underestimates mobilization around issues of environmental justice. If they had incorporated The People of Color Environmental Groups Directory (Bullard, 2000) as part of their sampling frame, they may have found a somewhat greater number of EJ groups. In the 2000 edition, the directory included over 400 people of color environmental organizations located in 45 states and Puerto Rico. This also serves as a reminder, however, of the extent to which environmental justice and mainstream environmentalism co-exist as part of a highly segmented social movement. Where wildlife and resource conservation issues predominate among mainstream environmental groups, only a distinct minority of environmental justice-oriented groups attend to such issues (Taylor, 1999).

To understand this gap between a mainstream movement dominated by wildlife and natural resource issues and sociological research emphasizing issues of social justice, it is helpful to revisit the origins of the sub-discipline. Early environmental sociologists developed a strong critique of the larger discipline's reliance on theories emphasizing "social facts" and which promoted a "human exceptionalist paradigm" that positioned human and natural systems as distinct rather than inter-related (Catton & Dunlap, 1978, 1980; Dunlap & Catton, 1979). This critique helped to position early environmental sociologists outside of the disciplinary mainstream and its practitioners operated on its relative fringes for more than a decade. A key to opening doors to the core of the sociological discipline was the increased focus on racial, class and gender based social inequalities that have been sociology's customary focus (Pellow & Nyseth-Brehm, 2013; Scott & Johnson, 2017).

The population-level approach has also lent itself to assessing both inter and intra population dynamics within the large, but highly segmented, environmental movement. Coalitions of EMOs have become increasingly common at the national and international levels alike (Murphy, 2005; Walker et al., 2011). While professionalized EMOs are more likely to join formal coalitions than volunteer organizations, coalition building is common among local movement actors as well. Networking is a particularly conscious political strategy within the environmental justice movement, where it is seen as a potential antidote to perceived problems associated with centralized organizations (Schlosberg, 1999). While coalitions are common among environmental justice groups and may be efficacious (Mix, 2011), environmental coalitions that cross class-boundaries remain rare (Mix & Cable, 2006).

Blue-green coalitions attempt to bridge this gap by establishing alliances between EMOs and labor organizations. The class divide between national EMOs that remain disproportionately middle class in membership, and labor unions, is one reason that blue-green coalition building is more likely to occur at the local rather than national levels (Mayer, 2009). Where successful blue-green collaborations occur, human health is often key to bridging the ideological framing of labor and environmental groups. That is the central thesis of Brian Mayer's analysis of three blue-green coalitions (in New Jersey, Massachusetts and Silicon Valley, California), for each of which health served as a central element of frame bridging. The logic of the precautionary

principle, for instance, played a key role in linking (or "frame bridging") environmental concerns with health and safety concerns of labor unionists to promote "green cleaners" in Boston public schools (Senier et al., 2007). One implication of the reliance on environmental health framing is that, while the environmental justice and health factions of the environmental movement are well-poised to make coalitions with labor, the resource-rich habitat and wildlife branches of the movement have considerably larger interest gaps (Gould et al., 2004). This, combined with the retreat of labor in recent decades in the face of anti-unionization trends within corporate and government policy making, likely puts limits on the efficacy and reach of blue-green coalitions.

## Environmental Countermovements

Environmental countermovements, or those that oppose environmental movement objectives, have a long history in the United States. Many early countermovements were related to issues of public land use and control. The Sagebrush Rebellion in the late 1970s and early 80s (Cawley, 1993) was rooted in the rural West, where federal public landholdings are extensive. The Wise Use movement of the late 1980s and 1990s was similarly rooted in rural Western landowners' fight for individual property rights and local control of public lands management. McCarthy (2002) describes how these movements are cultural in nature, with real grassroots support by those opposing decision making about resources from distant elites. Neither of these early countermovements, however, received extensive attention from sociologists.

As climate change has taken an increasingly central place in environmental and scientific discourse, at the same time that public support has splintered and legislative accomplishments lagged, a wave of high quality research has examined the well-resourced and organized climate denial movement (e.g., Farrell, 2016; Jacques et al., 2008; McCright & Dunlap, 2000, 2003; Oreskes & Conway, 2010). Focusing especially on the foundation and corporate funding networks that undergird the movement, this research has made a compelling argument for both the large political and public influence of this countermovement and its ties to a small core of conservative funders. These funding networks are partly extensions of the Wise Use movement, and the association with partisan politics, rurality, and identity all echo to a countermovement with historical roots that are as deep as environmentalism and deserving of more examination. See Chap. 10 to read more about the climate change counter-movement.

## Activities

The environmental movement of the 1960s and 1970s relied heavily on institutionally approved tactics (e.g., letter writing and public education campaigns, direct lobbying of policy-makers, working with government officials and/or using litigation to hold them accountable) for advancing political goals. This approach made sense given both the middle-class demographics of movement participants, and the very open political opportunity structure of the period. That tactical profile also helps to explain why movement scholars, for whom demonstrations in the street have traditionally been a defining feature of social movements (Piven & Cloward, 1979; Tarrow, 2011), were slow to the study of environmentalism. That profile was also the object of intense critique by analysts who suggest it as a major cause for the national movement's relative political impotence during the 1980s and 1990s (Dowie, 1996; Gould et al., 1993; Shellenberger & Nordhaus, 2004).

Today the environmental movement is a prominent object of inquiry within social movement literature, both because prevailing resource mobilization (McCarthy & Zald, 1977; McCarthy et al., 2001) and political opportunity (McAdam, 1982; Tilly, 1978) perspectives emphasize the wide array of activities in which movements engage beyond social protest, and because at least some elements of the movement have embraced more confrontational tactics. In this section, we review two countervailing

developments within the movement. First, the increasingly diverse protest strategies employed by elements of the US movement, including mass civil protest. Second, we examine how the institutionalization of environmentalism has resulted in extensive efforts at sustained cooperation with private industry and government.

## Protest

As is often the case (Soule & Roggeband, 2019), interactions across movement boundaries have spurred the adoption and development of new tactics in the environmental movement. Environmental justice activists, in particular, have been at the forefront of incorporating mass protest into the movement's tactical repertoire (Edwards, 1995). To successfully implement new tactics requires physical resources and human skills, as well as the construction of ideologies that support and align with tactical choices (Dalton et al., 2003). EJ activists have relied heavily on the organizational structure of the civil rights movement, as opposed to traditional environmental organizations, for physical and human resource support (Bullard, 1993; Stretesky et al., 2011; Taylor, 2000). Ideologically, an environmental justice approach anchored in concepts of autonomy, self-determination and the emphasis on fairness that people of color bring to environmental issues, as well as historical legacies of contention, is particularly amenable to protest tactics (Taylor, 2000).

It is only recently, however, as campaigns for environmental protection and social justice have increasingly merged, that significant and sustained environmental protests have moved beyond the local level. This scale shift (Tilly et al., 2001) is highlighted by large and multi-site demonstrations tied to issues of climate justice. The People's Climate March of 2014 and subsequent march in 2017, for example, drew tens of thousands of protesters and were joined by sister protests around the world. While scholarship on these large national environmental protests is only beginning to emerge, there is much to be learned from studying how and why this scale shift occurred, and to what extent it represents a change within the environmental movement writ large or is part of a larger backlash related to issues of environmental harm and deregulation associated with the Trump Presidency.

When it comes to large-scale events, environmentalists seem often to be members of protest coalitions where labor and social justice organizations take the lead. Levi and Murphy (2006), for instance, describe how in the leadup to the 1999 World Trade Organization Protests in Seattle, there was significant tension in regard to protest planning among coalition members. Those representing environmental organizations largely stood outside these tensions, with other coalitions taking control of protest planning.

## Scientific Activism

Scientists have always been central participants in the environmental movement, both individually, as in the cases of Rachel Carson and Barry Commoner, and as a collective enterprise building entire fields of activist-science (Frickel, 2004). The often-blurry boundary between the scientific enterprise and environmental movements continues to result in a host of innovative tactical developments. Scientists have engaged in large-scale public protests highlighting concerns about the role of science, often environmental science, in government decision-making (MacKendrick, 2017). Scholars and activists are working together to create archives of public documents threatened by the Trump Administration (Climate Mirror, 2016; Dillon et al., 2017). Others have called on universities in developed countries to become locations of "climate change capacity building" for developing nations (Khan et al., 2018).

The interchange between environmental movements and science has been a particular focus of scholars interested in movements that grapple with the often-contested and complex nature of environmental illness. Movements concerned with cancer clusters caused by toxic pollution (Brown & Mikkelsen, 1997), breast cancer (McCormick, 2009; McCormick et al.,

2003), Bisphenal-A (BPA) (Lubitow, 2013), flame retardant chemicals (Cordner, 2016) and gulf war illness (Zavestoski et al., 2004) have questioned traditional paradigms in science about how environmental illnesses are understood and studied. Of particular note is the way in which collaborations between environmental movements and scientists have pushed scientists to study the often overlooked realms of "undone" science (Frickel et al., 2010; Hess, 2009). In the process, movement-scientist collaborations are developing new ways of doing research, such as popular epidemiology (Brown et al., 2011). Collaborative citizen science, whether in the guise of popular epidemiology, monitoring water and air-quality in areas prone to fracking, or community based participatory research around issues of environmental justice, offers potentials for both empowering activists and building community social capital, or disempowering social change agents and demotivating participants (Kimura & Kinchy, 2019; Kinchy, 2017; Minkler et al., 2008; Pellow, 1997).

## Working with the State

While the adoption of increasingly diverse protest activities is one trend in the past 50 years of research on the environmental movement, the vast preponderance of the movement remains focused on advancing environmental protection through conventional means of public education, direct conservation efforts and working within the political system. In a survey of EMOs in North Carolina, for example, Andrews and Edwards (2005) find that the majority of EMOs engage in citizen education and monitoring public policy, while more than a third lobby policy makers. Only 11% of groups, primarily small and local organizations without tax-exempt status, engage in expressly partisan activities and only 5% actively participate in social protest or consumer boycotts. By far the most common activity was engagement with government agencies, with nearly 90% of surveyed groups indicating that they do so. These more conventional strategies are likely easier to promote and implement due to the inherent lack of contention present, but organizations may also have a larger impact on influencing public opinion, and hence policy agenda setting, using these tactics. In a subsequent study of EMOs in North Carolina, Andrew and Caren (Andrews & Caren, 2010: 841) found that groups that focus on more widespread and conventional issues and engage in routine tactics, as opposed to groups who were "confrontational, volunteer-led, or advocate on behalf of novel issues" garnered more media attention. This both suggests that EMOs are particularly concerned with the implementation of public policy, a stage of the policy process that has been largely overlooked in studies of social movement outcomes (Andrews & Edwards, 2004; Johnson et al., 2010), and hints at the overwhelming participation in institutionalized activities which continue to define the movement writ large.

One way in which the environmental movement increasingly intervenes in the policy process is participation in a variety of "participatory" or "collaborative" governance processes that are widely promoted as offering great potential for civic participation and local democratic governance. Place-based collaborative management of natural resources (e.g., forests, watersheds, fisheries) are particularly well-established and a major focus in the governance literature (Emerson & Nabatchi, 2015; Weber, 2000). For environmental movement scholars, perhaps the primary question about collaborative governance arrangements has been the extent to which acceptance in the policy arena has resulted in new advantages versus cooptation of movement goals. Collaborative governance requires that movement actors engage simultaneously in sustained collaboration, and confrontation, with government and industry (Pellow, 1999). In the process, movement actors are simultaneously exposed to opportunities to advance their agenda and threats of cooptation.

For environmental justice groups, at least, such collaborations are fraught with difficulty. State and industry actors regularly reframe environmental justice in ways that co-opt the concept to justify ongoing activities (Eady, 2003;

Liévanos, 2012). Jill Harrison (2015) argues that this reframing has contributed to the establishment of an environmental justice grant apparatus in the US that largely funds activities at odds with the stated priorities of the environmental justice movement, and that this is facilitated in important ways by cleavages within the environmental justice movement itself. Furthermore, Harrison's (2019) recent research suggests that both the culture and bureaucratical structure of regulatory agencies creates an environment that impedes any significant environmental justice reform. For organizations primarily concerned with direct conservation efforts, and whose goals are more likely to closely align with government and corporate partners, participation in collaborative management is likely less problematic. Fisher et al. (2012), for example, studying community tree-planting in New York City, focus on the ways in which such projects may enhance civic engagement, with little of the concern about cooptation that is so prominent in studies of movement-government collaboration within the environmental justice realm. There remains considerable space for research into the ways in which environmental movement actors actively collaborate with government, and the effectiveness of various strategies.

## Corporations as Target and as Partner

As the role of the state has retreated, and the strength of capital and corporate power expanded, activists from a wide variety of social movements have increasingly come to target corporate entities, rather than government agencies or policy makers, and studies of social change have followed suit (Walker & Rea, 2014; Walker et al., 2008). The trend towards engaging with corporations, both as antagonists and cooperatively, is heightened within an environmental movement concerned with issues that are inextricably linked with the economy (Jorgenson & Clark, 2012; Schnaiberg & Gould, 2000; York et al., 2003). Industry is both a primary threat to environmental quality, and a source of change and activism in the name of environmental protection.

Scholars have studied activist efforts directed at influencing corporate behavior (King & Pearce, 2010; King & Soule, 2007; Walker et al., 2008), efforts at mobilization within a corporate structure (Davis et al., 2005; Hoffman, 2001), or even the ways in which corporations themselves may act as social change agents (McCright & Dunlap, 2000; Walker & Rea, 2014). The flourishing of research on environmental movement-corporate interactions has focused less on confrontation, and more on how movement activists may work *with* producers and other relevant stakeholders to construct new institutions and markets with potential ecological benefits.

Recent research looking at the extent to which corporate actors join social movement sponsored boycotts is illustrative of the trend to merging the study of corporate contestation and cooperation. Corporate boycotts are typically employed as part of more coordinated campaigns to alter corporate behavior and are a long-standing common tactic within the environmental movement. In Mary Hunter-McDonnell's (2015) sample of boycotts targeting 300 large companies between 1993 and 2007, she finds that those convened by EMOs are the most common (constituting 22% of the sample) and that corporations are more likely to join in movement sponsored boycotts of other corporate actors when they themselves have been the chronic targets of activist challenges. Corporate contestation, in other words, can lead to overt attempts by corporations to cooperate with movements in an effort to defend against future threats by creating activist allies. In the next section, we will look more at efforts by activists to both challenge and work with corporate partners.

# Outcomes

In this section, we first review studies of the environmental movement and public policy outcomes, a primary emphasis in the field. We then discuss two additional outcomes of interest: cultural change and corporate behavior. We conclude with a call for more research on the ultimate

aim of environmental movements, improved ecological outcomes.

## Environmental Policy

The environmental movement has achieved broad *acceptance* in policy making. Environmental issues receive an increasing amount of Congressional attention (Baumgartner, 2006). Analyses suggest that national EMOs are readily able to influence the Congressional agenda by pushing for the convening of legislative hearings and bill introductions (Johnson, 2008; Johnson et al., 2010; Olzak & Soule, 2009). Environmental activists have also carved out a seat at the table in local resource conservation districts as well as international conference and treaty negotiations.

Studies assessing movement outcomes in terms of *new advantages*, like the actual passage of laws, however, typically produce fairly weak and inconsistent results in social movements literature (Burstein & Linton, 2002). This has been true for the environmental movement as well. Some quantitative research has found the national environmental movement somewhat more likely to experience legislative success when it is able to muster larger and more diverse organizational structures and tactical repertoires in support of environmental policy (Johnson, 2008; Johnson et al., 2010), or when mobilization occurs in concert with heightened public support (Agnone, 2007). Qualitative-historical analyses support the notion that many of the environmental movement's greatest legislative successes have depended on mobilizing not just liberal elites, but also conservative "hook and bullet" or "rod and gun" sectors of the movement (Bosso, 2005; Gottlieb, 2005). The direct effects of movement efforts on law passage have not been highly reproducible in statistical models (Olzak & Soule, 2009), however, and when they have been found, the relationship is generally fairly weak. The main path of movement influence on law passage seems to be indirect, primarily operating through agenda setting (Johnson, 2008; Olzak & Soule, 2009; see King et al., 2007 for more on social movements other than the environment). Overall, the pattern of research on environmental movement political outcomes fits a larger emergent narrative within social movement studies emphasizing the need to, as McAdam and Boudet (2012) describe it, "put movements in their place." That is, environmental movements matter, but they are just one small piece of the policy making process (see also Amenta, 2014).

Qualitative work has highlighted the role of elected official and civil service "issue entrepreneurs" working within the system and with access to important agenda setting and gate-keeping roles within government. Such issue entrepreneurs play crucial and largely hidden roles in developing or blocking new environmental initiatives (e.g., Huitema & Meijerink, 2010). Along these same lines, Olzak et al. (2016) find the passage of environmental laws more likely when legislation is sponsored by more moderate and influential Congressional members.

A long-standing methodological problem for scholars of social movement outcomes has been the tendency to sample on the dependent variable; to study protests and movements where they exist, not the absence of them. There is, however, a rich tradition of work within environmental movement literatures that avoids this problem of sampling on the dependent variable. That is, it puts movements in their place by investigating factors that both inhibit and facilitate movement action. In his study of six Great Lakes communities, Gould (Gould, 1991, 1993) finds that, despite the high visibility of pollution in each of his cases, movement mobilization and even the very interpretation of emissions themselves varied tremendously from community to community. According to Gould, the key factor in determining whether visible pollutants were identified as problematic versus a net economic benefit (e.g., many industrialists have referred to pollution as "the sweet smell of money,") is the strength of industry and their ability to leverage *control capacity*; their social, political and economic resources to suppress mobilization. This control capacity, ultimately the control of industry over jobs, is heightened in more peripheral and resource dependent communities. In addition

to resource dependence, this research highlights active attempts by industry to "minimize the primary social visibility of local pollutants through various methods of concealment, diffusion, and transport" (Gould, 1993: 175). Shannon Elizabeth Bell (2016) and Bell and York (2010) have shown how this industrial control capacity can be asserted even in the absence of economic dependency. In a study of coal mining towns in West Virginia, where economic dependency has rapidly dissipated, they show how industry has actively worked to build themselves as part of the "economic identity" of communities, and how they use "astroturf" groups, or citizen groups they create and fund to further their agenda and facilitate this cultural project.

Active campaigns to hide pollution, promote identity with industry, as well as suppress counter-mobilizations, are also a theme of research in highly threatened communities around the Oak Ridge Nuclear Reservation (Cable et al., 2008; Mix et al., 2009). Despite significant health concerns, and high publicity, local environmental health movements have been sporadic and weak. This research stream has found that the ability of authorities to draw on institutional and organizational resources to build community identity, promote ambiguous discourse around environmental health, and actively suppress mobilization is key to explaining the relative absence of movement activity. The importance of community identity, and industrial opposition, is also implicated in the work by Fedor Dokshin (2016) on the passage of municipal ordinances prohibiting hydraulic fracturing in New York State. He finds that communities located above the most economically viable shale gas resources were unlikely to pass such ordinances due to significant local support for development. Instead, bans were most likely to proceed in areas located just outside the most economically viable areas of development and, over time, that passage became increasingly tied to politics, occurring primarily in Democratic-leaning communities. Relatedly, Auyero and Swistun (2009) found when studying a highly polluted shantytown community in Argentina, that even though residents experienced detrimental living conditions and health effects as a consequence, they did not provide much resistance and in fact largely supported industry due to the perceived benefits it provided to the community.

## Building Markets

Beyond directly influencing policy, a major way in which the environmental movement matters is influencing cultural change. The modern environmental movement has fundamentally changed the very language we use to talk about the environment, and thus how we think about and conceive of the natural world (Wright, 1992). Cultural change, of course, can have important implications for mobilization and success. Vasi et al. (2015) demonstrate how the diffusion of a cultural product (the documentary movie *Gasland*) was associated with anti-fracking mobilizations and of local fracking moratoria in Marcellus Shale states. Moreover, as protection of the environment has become a core responsibility of states, ties to global culture have become an important driver of environmental movements, and federal policies for protecting the environment, across nation states (Longhofer & Schofer, 2010; Longhofer et al., 2016).

A primary line of research on cultural impacts of environmentalism, anchored especially in business schools, has emphasized the process of building new markets by promulgating new cultural categories of understanding among multiple stakeholders: activists, producers, customers, and government regulators. Lounsbury et al. (2003) demonstrate the important role the environmental movement played in building non-profit recycling organizational infrastructures and "field frames" that enabled the rise of a for-profit recycling industry. Environmental activists have worked together with ranchers and consumers to establish a grass-fed beef market that turned what was once seen as an inferior product into one for which consumers willingly pay a premium (Weber et al., 2008). The creation of environmental sustainability certifications in forest products (Bartley, 2007) and seafood (Konefal, 2013; Oosterveer & Spaargaren, 2011) require close

cooperation between social movements and industry. Similarly, expansion in the wind industry has received critical assistance from alternative energy advocates (Pacheco et al., 2014; Sine & Lee, 2009; Vasi, 2011).

The extent to which movement-corporate alliances are beneficial is, however, contested. Though seldom explicitly framed in these terms, much of this literature is aimed towards showing how social movements can act as ecologically modernizing (Mol, 2000; Sonnenfeld, 2002) agents of the economy. According to ecological modernization theory, altered business practices and adoption of technological innovations allows economic growth to be compatible with increased environmental sustainability (i.e., sustainable development). For critics, attempts at ecological modernization are often perceived as greenwashing that may be a deterrent to more sustainable business practices and, even where successful, likely to be undercut by economic dynamics underlying the Jevon's paradox[2] (see Clement, 2011; York & McGee, 2016 on Jevon's paradox). In the case of new markets for recyclables, for instance, Pellow et al. (2000) highlight substantial negative externalities like the elimination of waste reuse programs and increasing worker exposure to biohazards. In a careful analysis of nearly 50 years of data, MacBride (2012: 8) concludes that despite the economic vitality of the recycling industry it "has next to zero impact on resource conservation... and delivers only weak results in terms of pollution reduction or energy savings." As long as economies are built on models of continual growth, contradictions with finite nature are seemingly inescapable. Moreover, market dynamics that underlie social inequality in the United States and globally are likely to reproduce the asymmetric distribution of resources of all kinds, including the costs and benefits of environmental disruptions. Changing the larger context within which industries operate is fundamentally a socio-political problem as much as it an economic challenge.

Activists, of course, also target corporations in more confrontational ways in hopes of changing behavior, and are sometimes successful. Protests of corporations may negatively impact stock prices, for instance (King & Soule, 2007), potentially encouraging changes in corporate behavior. In their analysis of U.S. oil and gas firms from 1982 to 2010, Hiatt et al. (2015) take an approach that attends to the variable responses resulting from different types of movement activities. Specifically, they find that activist participation in congressional hearings, because it is perceived as increasing the risk of regulation, evokes changes in internal firm practice, such as the adoption of more environmentally friendly technologies. Direct protests of corporate activity like boycotts, on the other hand, are perceived primarily as a challenge to legitimacy and firm reputation (see also McDonnell & King, 2013) and tend to evoke more externally focused framing changes (i.e., public relations rather than operational change). Externally-oriented strategic management devices, such as corporate social responsibility boards, may also make firms potentially more receptive to future movement demands, however. The boycotting of firms, including for environmental reasons, also negatively affects politicians' willingness to associate with a targeted firm (McDonnell & Werner, 2016), a potentially significant outcome given the importance of agenda-setting in the making and enacting of public policy.

## Future

The environmental movement is a large and influential force for social change in America today. It is notable for the diversity it exhibits in terms of central organizing issues of concern, membership, organizational structure, ideology, and tactics, as well as for the extent to which it has become embedded within American culture and a wide variety of social institutions. We have focused this review on interactions US environmental movements have with state and industry

[2] The Jevons' Paradox suggests that increased efficiency, rather than leading to less consumption of a resource, increases consumption due to the increases in accessibility of that resource that efficiency also provides (Alcott, 2005).

actors in particular. In this closing we suggest some topics of research that we think are likely to be, or that should be, areas of particular emphasis in coming years.

A fundamental insight of environmental sociology is that ecological and social systems are intrinsically connected. The large and wide-ranging ecological disruptions posed by the reality of a changing global climate, which are only beginning to manifest, and the social responses they will necessarily engender, seem sure to be a defining feature of the coming century. Threats from climate change have promoted activity that can be conceptualized in social movement terms across a wide variety of institutions. Collective, organized efforts demanding institutional change in the face of climate change are occurring in food and agricultural systems, the production and distribution of electricity, urban planning in resiliency and disaster preparedness, and transportation, to name just a few, while climate justice has become a rallying cry for those focused on ties between social inequality and ecological change, both domestically and internationally.

The social and economic change that a rising global temperature will require seem to assure that environmental movements will be a major area of study in coming years. Even if humans fail to keep a changing climate in check, or perhaps especially if we fail to do so, the social response necessary to effectively mitigate and adapt to the physical realities associated with those changes will require large-scale mobilizations that span a broad range of social systems and the diverse issues that the environmental movement represents. A critical question for our day is how advocates can promulgate effective framing strategies, mobilize human and physical resources for action, and develop and exploit political opportunities to successfully push for meaningful action on climate change.

Given the strong segmentation within the US environmental movement, one potentially productive area of scholarship might examine the extent to which the issue of climate change operates as a boundary spanning issue with unique potential to unite the highly disparate movement. At present, however, we know more about the tightly networked climate-denial movement than the diffuse movement for action on climate change and organizations like 350.org that are leveraging modern communications technologies to drive participation. Research on the climate change movement in the US and elsewhere has focused on identity formation, the managing of emotions, framing arguments for change, and building internal belief systems (e.g., McAdam, 2017; Norgaard, 2011; Roser-Renouf et al., 2014). We know much less about the organizational infrastructures that support climate action, the resources they manage, and the networks between them and benefactors (individuals, foundations, corporations) than we do the corporate backed climate denial movement, which has been the focus of so much excellent research.

Much of the most vibrant action for environmentally driven social change is now happening within allied movements focused on social justice, within a scientific community concerned with both growing public skepticism of science and the massive stress modern industrial societies are placing on ecological systems, and within realms of the for-profit sector struggling to move towards a more sustainable future. Despite the unifying potential of climate issues, a central tension it seems to us is reconciling across various segments of the US environmental movement with fundamentally different ideological orientations to environmental problems. Environmental issues and movements have increasingly come to overlap with traditional movements of the left, including unionism, social justice, and human rights. These elements of the environmental movement are often the focus within the sociological profession where issues of inequality and social stratification take center stage. At the same time, there are strong roots to more conservative politics and ideologies whose activation has often been critical to policy success. Frame-alignment across diverse sectors of the environmental movement will likely be critical to future policy success and there is a strong need for more research like that of David J. Hess and Kate Pride Brown (2017) who examine the development of

"clean-energy conservatism" as a counter-countermovement to climate denialism.

A key insight of both modern social movement literature and examinations of the climate denial movement is the importance of industrial actors as participants in environmental movements. It may well be that the building of green industries is a key to the success of civil-society efforts aimed at protecting the environment (Meckling et al., 2015). The recent emphasis within environmental movement literatures on interactions with industry actors and participation in economic markets is, in our view, an essential and proper focus given the strong connections between environment and economy (see Chap. 6). Within the subfield of social movements, where many leading scholars are employed as faculty within schools of business, this work has typically adopted an implicit theory of ecological modernization and focused especially on how businesses can be cajoled into moderating their behavior and/or how movement actors working with producers, consumers and other vested parties can help to create new markets for environmentally friendly products. The focus on altering existing business practices and creating new markets has also necessarily focused on change within single industries or even individual industrial producers. One area in which research from environmental sociology, often undertaken with a more critical focus, and movement studies could profitably inform one another would be the analysis of intentional alternative communities that attempt to develop more holistic alternative models for development that span across numerous markets (Boyer, 2018; Ergas & Clement, 2016). This allows for framing that is simultaneously both within and outside mainstream ideals regarding issues of sustainability and consumption (Boyer, 2018).

There is also a need for more research on the political outcomes of environmental movements beyond establishing new policies. As environmental policy has devolved from the federal level, state and local actors are increasingly central to the implementation of environmental policies (Berkes, 2010). Collaborative attempts (often at the level of municipalities) to build resiliency in the face of continued global warming, in particular, offers multiple opportunities for research on the effectiveness of various collaborative governance structures. The Under2 Coalition, for example, consists of various government entities around the world, including regional, state, and national governments, who have committed to the goal of reducing GHG emissions to under 2 metric tons per capita by 2050 and limiting global temperature rises to below 2 °C by the end of the Century (i.e., endorsers and signatories of the Under2 MOU) (Under2 Coalition, 2019). Movement scholars might have much to contribute to literatures on collaborative governance currently housed in public administration, public policy, political science and environmental policy domains.

Environmental sociologists are interested in the interaction between social and ecological conditions. The ultimate goal of analysis, then, is determining how and when social movement activity affects actual ecological conditions and/or human health. Early work in this vein suggests that, at least at the level of US states, pro-environmental protests may be associated with reduced $CO_2$ emissions (Muñoz et al., 2018). Advances in assembling large datasets with geo-coded information on demographics, human health and neighborhood conditions are allowing researchers to assess health disparities resulting from chronic exposure to air pollutants (Kranjac et al., 2021) and has the potential to facilitate eventual study, for example, of the success of pollution mitigation policies. It has been nearly 50 years since the first Earth Day and, far from being a fad, the US environmental movement has not only persisted but continues to grow and diversify. How environmental activists organize and agitate for institutional change and how societal responses to a changing climate will advance, or impede, social justice will continue to be critical areas of inquiry in coming decades.

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# Socio-Ecological Systems

25

Beth Schaefer Caniglia and Brian Mayer

## Introduction

Environmental sociology aims to overcome longstanding sociological thought that humans and nature are independent entities (Dunlap & Catton, 1994; Freudenberg, 1988; Kroll-Smith et al., 2000). Environmental sociologists have played key roles in advancing several strands of analysis that specifically articulate interactions between humans and their environments empirically and theoretically, including in the areas of human ecology (Borden, 2017; Dyball, 2017; Kroll-Smith et al., 2000), structural human ecology (Dietz & Jorgenson, 2013; Jorgenson & Dietz 2015), and coupled human and natural systems (Folke et al., 2002; Kramer et al., 2017; Walker & Salt, 2006). However, environmental sociology has failed to fully integrate the interdisciplinary literature on socio-ecological systems and their characteristics into the central lexicon of the subdiscipline. In addition, the central toolset for characterizing and modeling socio-ecological systems—systems thinking, has been largely overlooked as a framework to advance environmental sociology. In part, the challenge to environmental sociology is the highly interdisciplinary provenance and developmental trajectory of scholarship related to socio-ecological systems. At another level, the target audience of scholarship on socio-ecological systems includes not only academics, but an array of practitioners and policy actors. This diversity poses challenges to academics and practitioners alike, as each community evolves theory and practice often in isolation from each other.

For example, both the concepts of sustainable development and resilience inform contemporary scholarship in environmental sociology. Yet little work has been done in environmental sociology to articulate clear boundaries between these concepts and to ensure that they are in conversation with one another. These are decidedly interdisciplinary concepts that have taken on important meaning in practice yet remain inconsistently defined and applied in environmental sociology as well as in other disciplines. Similarly, while sophisticated methods have been developed in environmental sociology for measuring and explaining human and environment interactions, our work has not taken full advantage of findings from the interdisciplinary field of socio-ecological systems, nor have we explicitly integrated the toolkit of systems thinking into our teaching and research.

With these gaps in mind, we offer in this chapter an overview of the interdisciplinary field of socio-ecological systems as a body of literature, an overview of systems thinking as a general

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approach and a tool in the field of socio-ecological systems, and a review of the primary outcomes of concern to this interdisciplinary field: sustainable development and resilience. We expand this discussion to include a concept that is of emerging importance and related to resilience and sustainable development: regenerative development. This is a concept used widely in the practice of community development, design, and architecture that has yet to find traction in the social sciences (Caniglia et al., 2019b). Because the concept of regenerative development as it is used in practice overlaps considerably with sustainable development, we review the literature on regenerative development so that environmental sociologists can assess and critique its usefulness in future research. Our goal is to articulate these concepts as they are currently used so they can be further assessed for their utility and more readily integrated into environmental sociology.

## Socio-Ecological Systems: Conceptual Provenance

The scholarship on socio-ecological systems has been built from several lines of scholarly literature dedicated to advancing our understanding of how humans and nature interact. Examples of this work can be found in environmental sociology, such as contributions from human ecology, structural human ecology, and the sociology of disasters (e.g., Chase-Dunn & Jorgenson, 2003; Givens et al., 2016; Laska, 2005; Tierney, 2019; Chaps. 11 and Dietz & York, 2021; Peek, Watchendorf, & Meyer 2021). Over the past 30 years, however, as explicit attempts have been made to create a unified interdisciplinary field focused on the ways human values, behaviors and institutions influence the natural world and in turn how changes in biophysical variables (e.g., drought, wildfire, biodiversity, etc.) impact human livelihoods, beliefs, and policy decisions, environmental sociology has been a peripheral contributor, along with scholars in ecology, geography, hydrology, economics, psychology, agriculture to name but a few. For purposes of this chapter, the field of study that best characterizes these efforts to build an integrated interdisciplinary approach to understanding interactions among human and natural systems is socio-ecological systems (SES) research, although at various times it is also referred to as coupled human and natural systems (CHANS), biocomplexity, human ecology, and the human dimensions of global environmental change.

Despite the diverse disciplinary backgrounds of contributors to socio-ecological systems research, there is strong agreement that humans and nature are not separate. Indeed, in order to understand the behavior of either human societies or ecosystems, we have to account for important interactions that occur between them. In fact, most scholars in this line of study argue that human and natural systems are not independent at all; rather they are entwined (Adger, 2000; Alessa et al., 2009; Chase-Dunn & Jorgenson, 2003; Costanza & Kubiszewski, 2016; Cote & Nightingale, 2012; Folke, 2006; Holland, 2006; Kramer et al., 2017; Liu et al., 2007; Meadows et al., 1992; Ostrom, 1990; Walker & Salt, 2006).

At a variety of scales, the actions of humans and social institutions have profound impacts on ecological systems, shaping countless outcomes of interest to scientists and policy makers. For example, the long running Baltimore Ecosystem Study has shown that as areas urbanize, shallow streams no longer act as Nitrogen sinks, because their flow rates are increased due to urban water runoff (Pickett et al., 2008). In this case, they show that human decisions regarding urban development influence ecological functioning in urban settings, as increased paving and decreasing urban forestry impacts stormwater runoff rates in ways that hinder Nitrogen fixation in streambeds. In sociology, a robust body of research highlights that a country's ecological footprint is impacted by economic, political, and demographic characteristics (Chap. 21; Dietz et al., 2007; Jorgenson & Burns, 2007; Jorgenson & Clark, 2011; Marquart-Pyatt, 2010, 2015). Scholarship on the treadmill of production, ecologically unequal exchange, and metabolic rift have clearly highlighted the impacts that world system advantages, consumption and

production patterns, and other economic drivers have on patterns of environmental degradation (Foster et al., 2010; Givens et al., 2019; Gould et al., 2008; Jorgenson, 2016; Schnaiberg, 1980).

Likewise, biological diversity, climate variability, storms, and other characteristics of the natural environment place limits on human activities, affect human value systems, and, sometimes, threaten human livelihoods. The Millennial Ecosystem Assessment (2005) accounts in detail the direct health impacts ecosystem impairment can have on human communities, including heatwaves, floods, landslides, radiation exposure, and water shortages. Numerous studies have illustrated the disproportionate impact climate change has brought to Native and Tribal communities. For example, rising sea levels, land erosion, and permafrost thaw have forced migration of tribes in Northern Alaska and coastal Louisiana (Laska, 2005; Maldonado et al., 2013; Whyte, 2013). While studies in the sociology of disasters have found that when poorer environmental conditions existed prior to the onset of storms, the impacts on socio-cultural outcomes are more severe (Roberts & Parks, 2007).

Despite their clear and important interconnections, efforts to integrate social and ecological models have been slow and uneven. In sociology, one hindrance to doing so has been marked by debates regarding actual biophysical environmental causes and consequences of environmental challenges and the symbolic/ideological dimensions of human construction of environmental problems (Dunlap & Catton, 1994; Freudenberg, 1988; Kroll-Smith et al., 2000). An additional challenge to integration is that constructed places, such as nation-states, cities, towns, and neighborhoods are difficult to match up with clearly defined natural contexts. Indeed, finding the right scale at which to measure coupled human and natural systems is difficult (Burns & Rudel, 2015; Folke et al., 2007; Mang & Haggard, 2016; Ostrom, 1990). Rivers and waterways often cross geo-political boundaries (Young, 2017); pollution in one country or city can flow over to other countries or cities through rivers or acid rain (Kiss & Shelton, 2007). It is also difficult to find or collect data that allows comparison of socio-cultural features with similar natural outcomes in ways that advance generalizable claims (Alberti et al., 2003; Rudel, 2005, 2019). Sophistication in both modeling and data availability have improved drastically (Alessa et al., 2009; Dietz & Jorgenson, 2013; Liu et al., 2007; Motesharrei et al., 2016), but artifacts of available data still limit our understanding of the complex dimensions of socio-ecological systems, such as time lags, reciprocal effects, and the ways these relationships change at different scales (An et al., 2014; Burns & Rudel, 2015; Cote & Nightengale, 2012).

The primary tool used to conceptualize and model interconnections between human and natural systems in the interdisciplinary field of socio-ecological systems (SES) research is systems thinking. In the discipline of sociology, systems thinking is generally linked to the structural-functionalist tradition and the work of Talcott Parsons (Caniglia & Frank, 2017; Ritzer & Stepnisky, 2018). This approach has been largely abandoned by contemporary sociologists, in large part due to its failure to account for differential distribution of power and resources in human systems (Mayer, 2017; Pellow, 2017). Instead, sociology turned toward conflict theories for explanations of social stratification and the unequal distribution of goods, services, social capital, education, and other factors associated with inequality and human wellbeing (Ritzer & Stepnisky, 2018). Several underpinning assumptions of systems theory as elaborated by structural-functionalism are problematic for sociologists when adopting a systems orientation. For example, Durkheim (2014) and Parsons (1960) argue that stability and social cohesion are required for social systems to survive over time. Existing institutions and patterns of social relations are seen as functional in producing a cohesive and stable society (e.g., inequality in Davis & Moore, 1945). And Parsons argues in several of his works that elements in functional societies, such as economic and educational institutions, are adapted to their external environments, both biophysical and socio-cultural (Caniglia & Frank, 2017; Holland, 2006; Parsons, 1966).

Further, socio-ecological systems (SES) approaches to resilience, in particular, emphasize that returning to the pre-shock state of a system is desirable, while more conflict oriented sociologists reject outright the belief that the contemporary human system is either functional or desirable (Caniglia & Frank, 2017; Mayer, 2017; Pellow, 2017). For this reason, scholars focused on environmental justice have worked to introduce conflict perspectives into socio-ecological systems approaches that are designed to achieve sustainable development, resilience and regenerative development (Caniglia et al., 2017, 2019a; Pellow, 2019), and these efforts need to be expanded to increase the effectiveness socio-ecological systems research.

Even in light of these critiques and limitations, it is important that environmental sociologists and other social scientists engage with socio-ecological systems approaches, because the design of truly sustainable, resilient, and regenerative places will likely fail without our input. The integrated field of socio-ecological systems is advancing conceptualizations and models for sustainable development and resilience, and an infusion of insights from environmental sociology, especially from the subfields of environmental justice, disasters research, and structural human ecology, would significantly advance this work, particularly the SES approach toward equity, justice, power, and other socio-cultural components of SES models. Therefore, we provide here a very basic review of some of the central socio-ecological systems dynamics that feature prominently in this interdisciplinary field. While there is a vast literature relevant to this review, we focus on two articles in particular that articulate the central socio-ecological systems dynamics of concern and provide a useful introduction to the systems thinking literature for general environmental sociologists: "Complexity of coupled human and natural systems" (Liu et al., 2007) and "Top 40 questions in coupled human and natural systems (CHANS) research" (Kramer et al., 2017).

Liu et al. (2007) draws our attention to six insights that derive from examining socio-ecological systems in interdisciplinary ways. First, they highlight the feedback loops and reciprocal effects that take place between human and natural systems—feedback loops that occur across space and time. Second, they draw our attention to the non-linear relationships that exist in socio-ecological systems, which can cause changes to occur suddenly when thresholds in either human or ecological systems are crossed. The third feature is that research in socio-ecological systems produces surprising findings that might not be explicable without interdisciplinary collaboration. A fourth insight refers to the time lags and legacy dimensions of cause and effect relationships in socio-ecological systems. The fifth insight pertains specifically to resilience in socio-ecological systems, and they argue that social and ecological resilience are coupled. And, finally, the sixth insight refers to the role of heterogeneity across socio-ecological systems and draws our attention to the ways "human-nature couplings vary over space, time, and organizational units" (p. 1515).

Ten years after the publication of Liu et al. (2007), Kramer et al. (2017) conducted a survey of members of CHANS–Net members to determine the primary questions that require further research in the field. We list here only a selection of the questions that pertain to the systems dynamics mentioned in Liu et al. (2007) or those that highlight the ways sociologists can help to advance future research in CHANS:

- How can we incorporate behavior, tipping points, emergent properties, and regime shifts, especially for ecosystem function and social organizations in CHANS models?
- How can we better represent human decisions, behavior, and human-built elements of natural systems in coupled process models?
- How can we design social-ecological research that is relevant to communities affected by ecosystem processes?
- What are the linkages between ecosystem services and human well-being?
- How can we measure and account for ecosystem services in decisions and connect this to policy-making agendas?

- How do economic and institutional factors interact at multiple scales to influence local conditions?
- What characterizes and can we predict tipping points or thresholds in CHANS?
- How can resource management practices better integrate ecological resiliency and anticipated disturbance?
- What are the social drivers at multiple scales of complex CHANS?
- How can scientists best integrate data, methods, and research designs across multiple spatial and temporal scales?
- What alternative pathways of development are available that have lesser impact on ecosystems and the biosphere?
- How do we couple environmental sustainability with social and economic sustainability?

These questions point to a number of ways environmental sociologists can help to advance the interdisciplinary field of socio-ecological systems drawing on our own disciplinary insights and expertise. However, the tools of systems thinking will need to be more broadly integrated into our approach to provide the tools needed to accelerate our collaboration with socio-ecological systems scholars. Therefore, we summarize systems thinking below.

## Systems Thinking Versus Traditional Thinking

Arnold and Wade (2015) provide a thorough review of definitions of systems in which they ultimately define *systems* as: "[g]roups or combinations of interrelated, interdependent, or interacting elements forming collective entities" (p. 7). They further define *systems thinking* as: "...a set of synergistic analytic skills used to improve the capability of identifying and understanding systems, predicting their behavior, and devising modifications to them in order to produce desired effects" (p. 7). To further clarify this definition, we point to Arnold and Wade's (2015) discernment of eight essential components of systems thinking, which we illustrate in Table 25.1. This set of systems thinking dimensions is consistent with the writings of numerous systems scholars (for example, Arnold & Wade, 2015; Meadows, 2008; Motesharrei et al., 2016; Seibert, 2018; Walker & Salt, 2006). Thus, we restrict our discussion to these for brevity.

Traditional thinking emphasizes stochastic events more often than patterns of behavior repeated through time. It focuses most often on individual elements within systems, rather than on the relationships and feedback loops among those elements. It is better at listing factors that combine to produce an effect at a given point in time, rather than examining feedback loops and interaction effects that impact patterns over periods of time. Traditional perspectives look at stocks of current resources, rather than the flow of those resources over space and time. And it stops short of examining the nested nature of subsystems, multiple scales of interactions, and the nonlinear cause-effect patterns needed to intervene with impactful results, which are the perspectives we need to advance our understanding of socio-ecological systems, as highlighted above.

Systems thinking is designed to account for the complexity of cause and effect. Causes and their effects are often separated by time and space, and identifying causes involves examining more processes, feedback loops, delays, inputs and outputs than scholars traditionally include in mental and empirical models (Arnold & Wade, 2015; Meadows, 2008; Motesharrei et al., 2016; Seibert, 2018). Simply put, systems thinking is a holistic way of examining human and environment interactions that require one to consider the interconnections between various elements as they work together, in opposition, and sometimes in unanticipated ways to influence particular goals or functions within the system (Arnold & Wade, 2015).

**Table 25.1** Basic components of systems thinking. (Adapted from Arnold & Wade, 2015)

| Systems thinking requirement | Definition |
|---|---|
| Recognizing interconnections | The ability to identify key connections between parts of a system |
| Identifying and understanding feedback | Some interconnections combine to form cause-effect feedback loops. Systems thinking requires identifying those feedback loops and understanding how they impact system behavior |
| Understanding system structure | System structure consists of elements and interconnections between these elements |
| Differentiating stocks, flows, and variables | Stocks refer to pools of resources in the system. Flows are changes in stock levels. Variables are changeable parts of the system that impact stocks and flows, such as a flow rate or limits to growth |
| Identifying and understanding non-linear relationships | Limits to growth, flow rates, inputs, and outflows often impact system behavior in non-linear ways |
| Understanding dynamic behavior | The behavior of systems varies in surprising and unanticipated ways. Delayed responses, exponential responses, as well as hard limits result in emergent behavior or the disappearance of behaviors |
| Reducing complexity through conceptual modeling of systems | Systems are often too complex to model fully. Thus, we have to discern the primary drivers of system behaviors and understand their component parts in order to predict behavior or leverage the components in ways that produce desired outcomes |
| Understanding systems at different scales | In truth, most systems don't have clear boundaries. It is necessary to consider the subsystems within systems and the ways our system of interest may be influenced by even larger, more complex systems |

It is important to note that we are not arguing that environmental sociologists fail to incorporate dimensions of systems thinking in our own models of socio-cultural systems. For example, questions about the influence of global, regional, local, and personal factors in guiding individual decisions are central to our work. Rather, we argue that environmental sociologists can have a significant impact in advancing important social and environmental goals by more actively joining efforts to understand human and environment interactions in the context of socio-ecological systems. To illustrate, we focus next on three goals that scholars and practitioners pursue through socio-ecological systems research: sustainable development, socio-ecological resilience, and regenerative development—goals that overlap with those of environmental sociology and can be advanced through more integrated interdisciplinary collaboration.

## Understanding the End Game: Sustainable Development, Regenerative Development, and Socio-Ecological Resilience

There is shared recognition that the study of socio-ecological systems has the potential to produce knowledge that points to interventions that increase the sustainability, resilience, and regeneration of threatened environments (Dyball, 2017; Lubchenco, 2017). Each of these concepts refers to one potential "end state" that scholars and practitioners want to achieve through the application of the science of socio-ecological systems. Unfortunately, due to the interdisciplinary nature of most socio-ecological research endeavors, there has been a failure among scholars in the field to congeal around consensus concepts and methodologies, and the ways practitioners should apply them. Indeed, there remains a tendency to conflate sustainable development, resilience, and regenerative development and to define the achievement of one with the existence of the other (Alessa et al., 2009; Caniglia, 2019). Given their importance to the advancement of the study of socio-ecological

systems, the next section of this paper will provide an examination of definitions of these end states, drawing from the diverse literatures that have contributed to their articulation.

## Sustainable Development

Underpinning most definitions of sustainable development is the desire to harmonize what practitioners in the international environmental policy realm often refer to as the three Ps: People, Prosperity, and Planet or the three Es: Environment, Economy, and Equity. The assumption, in both cases, is that these three domains are interdependent—three legs of a common stool. This interdependence is most commonly represented graphically by three intersecting circles, each representing distinct 'fields' or universal goals pursued by modern societies (see Fig. 25.1). At the center exists sustainability, or the practice of sustainable development that in theory can achieve of balance between economic, social, and environmental outcomes.

Most academic definitions of sustainable development incorporate a systems orientation and the need to attend to system sustainability. For example, Costanza and Patten (1995: 195) present a definition of sustainability conceptualized as a system: "[a] system is sustainable if and only if it persists in nominal behavioral states as long as or longer than its expected natural longevity or existence time." They also argued that "[w]ithin the socioeconomic subsystem, a social consensus on *desired* characteristics . . . must be arrived at. These characteristics also function as predictors of what kind of system will actually be sustainable" (p. 196). Equity and human wellbeing have been at the core of sustainability definitions from the beginning, but they were not always prioritized or carefully articulated in early definitions of sustainable development. By contrast, in a recent conceptualization of a sustainable wellbeing economy, Costanza (2020) states:

> . . .[S]ustainable wellbeing should be the real goal of our increasingly interlinked and interdependent economic, social, and natural systems. The headlong pursuit of GDP growth at all costs has blinded many countries to the other factors that contribute to sustainable wellbeing and the hidden costs of GDP addiction. . . A wellbeing economy . . . is embedded in society and the rest of nature. It must be understood and managed as an integrated, interdependent system of social relations that pursues balance and prosperity, rather than the maximization of production and consumption. It is an economy that values both social and natural dimensions as fundamental components of national wealth and as critical factors in determining wellbeing.

Conceptualized through the lens of systems thinking, sustainable development is about striking a medium-term balance (of approximately one generation or about 50 years) between desirable human and economic outcomes and environmental limits. The goal is to meet current needs without compromising the ability of the next generation to pursue their own goals. This requires a change from linear and single point in time focus to a reflexive and more adaptive orientation that considers ecological cycles, feedback loops, and interdependence between human and natural systems.

The sustainable development paradigm was designed to address trade-offs between the desire to foster continued growth in the global economy and the need to protect the ecological resources needed to support that growth (Bernstein, 2001; Caniglia, 2019; Mensah, 2019). The word "sustainable" became a moderator to the primary concept of "development," which is considered the best solution to existing inequality. Holden et al. argue, in contrast, that the concept of sustainability implies ". . .a set of constraints on human behavior, including constraints on economic activity" (Holden et al., 2016: 1). In fact, they argue that "economic growth cannot be one of the sustainable development goals." Similarly, Clement et al. (2020: 98) highlights that "as inequality rises, social cohesion and public confidence deteriorate, undermining the organizational foundation for environmentally responsible behavior. Efforts to clarify the role of equity, power, and conflict in the achievement of sustainable development is one area environmental sociologists are uniquely poised to contribute.

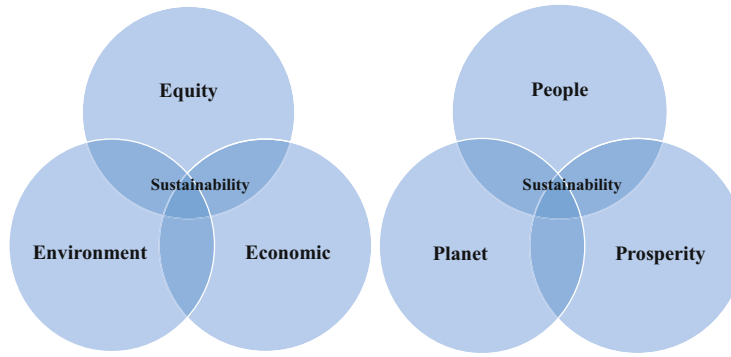


**Fig. 25.1** The Three Ps and the Three Es of sustainability

The goal of sustainable development has become institutionalized within global frameworks advanced through the United Nations (UN) and championed by the organizations and leaders associated with decades of international environmental policymaking. These groups have had a powerful influence over the definitions of sustainability and sustainable development and their application in the field by practitioners (Mensah, 2019). Branches of the United Nations, such as the UN General Assembly, the UN Environment Programme (UNEP), the UN Development Programme (UNDP), and the High Level Forum on Sustainable Development promulgate guidelines and measurement tools that member governments use to gage and report their compliance with international sustainability principles. Nongovernmental organizations, social movement groups, industry leaders, and a range of practitioners adopt UN language related to sustainable development to increase their efficacy in fundraising, policy influence, brand recognition, and measuring and reporting their contributions to the cause. In these contexts, the most commonly used definition of sustainable development was put forth by the United Nation's World Commission on Environment and Development (UN WCED) in *Our Common Future* (1987) and states that sustainable development is: "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 8).

Multiple extensions of this definition were offered by academics in the decade following *Our Common Future* (Gladwin et al., 1995). For example, Barbier (1987:10) defined sustainable development as: "To maximize simultaneously the biological system goals (genetic diversity, resilience, biological productivity), economic system goals (satisfaction of basic needs, enhancement of equity, increasing useful goods and services), and social system goals (cultural diversity, institutional sustainability, social justice, participation)." Costanza, Daly and Bartholomew (Costanza et al., 1991: 8) wrote that "Sustainability is a relationship between dynamic human economic systems and larger dynamic, but normally slower-changing ecological systems, in which (a) human cultures can develop; but in which effects of human activities remain within bounds, so as not to destroy the diversity, complexity, and function of the ecological life support system." Meadows, Meadows, and Randers (1992: 209) defined a sustainable society as "one that can persist over generations, one that is far-seeing enough, flexible enough, and wise enough not to undermine either its physical or social systems of support."

Similarly, UN agencies and other national and international regulating bodies focused on sustainability offered their own extended definitions of sustainable development, spurred by the desire to measure and advance sustainability in practice (Gladwin et al., 1995). The U.S. President's Council on Sustainable Development (1994: as cited in Gladwin et al., 1995) articulated a definition of sustainable development in their vision statement: "We believe a sustainable United States will have an economy that equitably provides opportunities

for satisfying livelihoods and a safe, healthy, high quality of life for current and future generations. Our nation will protect its environment, its natural resource base, and the functions and viability of natural systems on which all life depends." The World Conservation Union (1991: 10) defines sustainability as "Improving the quality of human life while living within the carrying capacity of supporting ecosystems." Such high level goals are measured and their achievement advanced though the scholarship on socio-ecological systems (Mensah, 2019).

Aside from definitions per se, there are several ideas related to the concept of sustainability and sustainable development that influence how it might be interpreted and applied by academics and practitioners. For example, the precautionary principle is considered an important piece of the sustainable development framework. Some interpret the precautionary principle as an approach designed to identify potential thresholds where development practices cross into unsustainable terrain, allowing for business-as-usual techniques to remain mostly unchallenged (O'riordan & Jordan, 1995). Considerable scholarly and practical analyses focus on identifying such thresholds and designing environmental management systems that protect against crossing those thresholds defined as most critical (Allen et al., 2009). Insights from environmental sociology could considerably advance our understanding of such thresholds.

Another central component of the sustainable development concept is "non-declining capital" (Pearce et al., 1989). This dimension of sustainability is interpreted through the lens of either "weak sustainability" or "strong sustainability," where a strong sustainability lens assumes limited substitutability of various forms of capital (human, natural, or economic), and weak sustainability assumes quite a bit of flexibility and substitutability across forms of capital. The weaker model of sustainability is predicated on a global economic model where trade around the world provides access to the materials needed to sustain production processes. When taken together, non-declining capital, substitutability, increased efficiency, and the ability of technology to address scarcity point to a concept environmental sociologists call dematerialization (Buttel, 2003; Herman et al., 1989).

Important questions remain to be asked of the sustainability model; for example, exactly what should be sustainable? And who gets to define what is sustainable and benefit from its application? Other remaining questions challenge the scale at which sustainability occurs and over what timeframe should we consider the processes and outcomes associated with sustainability.

Those advocating for sustainability in international policy arenas were hoping to offer a compromise for those who prioritized expansion of the economy and those concerned about rapid environmental depletion in an unequal world (Ciplet et al., 2015; Roberts & Parks, 2007). Best known as *common but differentiated responsibility*, a framework emerged that emphasized sustainability as "a participatory process that creates and pursues a vision of community that respects and makes prudent use of all its resources—natural, human, human-created, social, cultural, scientific, etc." (Viederman, 1994: 4; also see Gladwin et al., 1995). In practice, however, the integrated perspective of sustainability as an approach that recognizes the interdependence of economic, environmental, and human prosperity devolved into a practice of indicators and measurements that allowed policy makers, practitioners, local authorities, and business professionals to choose the dimensions of "sustainability" they were most able or committed to implement (e.g., LEED Certification, see Cole, 2012; du Plessis, 2012; Mang & Reed, 2012). Decoupling the pillars of sustainability in this way has severely undermined the potential to scale systems-level changes that support shared prosperity on a healthy planet.

## Resilience

The complications of the international policy arena and the difficulty adapting an expanding barrage of indicators to local contexts led many practitioners and local authorities to turn to the

resilience framework as an alternative to sustainable development and sustainability as end goals (Caniglia et al., 2014, 2017; Davidson, 2010; Frank et al., 2017). In much of the contemporary scholarship on the challenges of meeting sustainable development goals, resilience thinking is often promoted as a boundary concept that can help practitioners integrate the social and natural dimensions of sustainability (Olsson et al., 2015). While many feel resilience is a simpler concept to grasp, conceptual confusion still surrounds this idea, particularly when contrasting ecological resilience, social resilience, and socio-ecological resilience (Myers-Smith et al., 2012).

The origins of the resilience concept can be traced to the work of 1970s ecologists, who introduced it as a way to assess the capacity of ecosystems to persist in the face of adversity (Folke, 2006; Folke et al., 2010; Holling, 1973; Lake, 2013; Walker & Salt, 2006). Research conducted by Myers-Smith et al. (2012) has highlighted the most commonly cited definitions of resilience referring to ecology, 1970–2012. We report those here.[1] The most highly cited definition of resilience was published by Holling (1973) and describes resilience as "a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables." Gunderson (2000) defines the concept as a "property of an ecosystem that describes the change in stability (or return time) and resilience (the width of the stability domain). Another popular definition of resilience comes from Walker et al. (2004) and states: "Resilience (the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks)." Carpenter et al. (1992) defines resilience as "The rate at which a system returns to equilibrium after disturbance." And, finally, Pimm adds to this literature in Pimm, 1991: "How fast a variable that has been displaced from equilibrium returns to it. Resilience could be estimated by return time: the amount of time taken for the displacement to decay to some specified fraction of its initial value." In its most basic usage, the term ecological resilience refers to the ability of a system to return to an equilibrium state after an external shock without altering the existing relationships between species populations and other ecosystem characteristics (Barr & Devine-Wright, 2012; Brand & Jax, 2007; Caniglia et al., 2014; Holling, 1973; Lopez et al., 2013; Webb, 2007).

There is less consensus across the literature on socio-cultural resilience. In general, scholars and practitioners apply the ecologically focused definitions above to human societies. For example, social resilience stresses the importance of humans to reply to or cope with "external shocks," whether economic, geo-political, ecological, etc. (Caniglia et al., 2014). The ability to respond to a shock enables societies to recover from natural hazard events and technological disasters (Adger, 2000; Barr & Devine-Wright, 2012). Others have extended this more generally to focus on the ability of the public and/or individuals to survive and function in the face of change, uncertainty, unpredictability and surprise (Barr & Devine-Wright, 2012; Berkes & Ross, 2012; Magis, 2010). Fiksel (2006) argues that the resilience of social systems depends upon social diversity, efficiency, adaptability, and cohesion—characteristics often attributed to resilient ecologies. Social resilience is often contrasted with social vulnerability, which is a concept that captures the sensitivity, coping capacity, and recovery trajectories of people, groups, organizations, communities, and so that have been exposed to external shocks and stressors (Kasperson et al., 2005).

Some of the clearest definitions of social resilience come from scholars who study disasters. For example, Bruneau et al. (2003: 738) propose four dimensions of community resilience—technological, organizational, social, and economic. When addressing community resilience in the face of earthquakes, they define these dimensions of resilience as follows:

[1] Page numbers where quoted definitions can be found were not included in Myers-Smith et al. and will not be reported here.

> The *technical* dimension of resilience refers to the ability of physical systems . . . to perform to acceptable/desired levels when subject to earthquake forces. The *organizational* dimension of resilience refers to the capacity of organizations that manage critical facilities and have the responsibility for carrying out critical disaster-related functions to make decisions and take actions to . . . achieve greater robustness, redundancy, resourcefulness, and rapidity. The *social* dimension of resilience consists of measures specifically designed to lessen the extent to which earthquake-stricken communities and governmental jurisdictions suffer negative consequences due to the loss of critical services as a result of earthquakes. Similarly, the *economic* dimension of resilience refers to the capacity to reduce both direct and indirect economic losses resulting from earthquakes.

Further, they argue that "At the community level, *social* and *economic* performance measures can be defined that refer to the ability of the community to withstand and recover quickly from disaster" (Bruneau et al., 2003: 738).

Dovers and Handmer (1992) contrast proactive and reactive resilience in social systems, highlighting that, unlike ecological systems, human systems have the ability to learn and plan ahead in the face of predictable external shocks. Caniglia et al. (2014, 2017) make a similar argument regarding the environmental justice dimensions of social resilience, calling upon practitioners in the emergency management field to incorporate insights from vulnerabilities, human security, and coupled human and natural systems to anticipate the unequal impacts of external shocks and abate those impacts before disasters strike. Focused on urban resilience to climate change, Leichenko (2011: 165) draws from the disasters literature to describe resilience as ". . .enhancing the capacity of cities, infrastructure systems, and urban populations and communities to quickly and effectively recover from both natural and human-made disasters." The article also highlights the importance of governance, institutions, and economics as conditioning factors impacting community resilience.

Ambitious attempts have made to elaborate socio-ecological resilience, which is a concept designed to account for the ways ecological and human systems share vulnerabilities and capacities (Kasperson et al., 2005). Like sustainability, socio-ecological resilience is fundamentally focused on the interdependence of people and their surrounding ecosystems. Observations that natural resource dependent communities are linked to ecological and social systems helped shift the initial applications of resilience thinking from purely ecological or socio-cultural models towards the synergistic and coevolutionary relationships between society and the environment (Alessa et al., 2009; Norgaard, 1994). For example, Folke (2006) and Folke et al. (2010) connect ecological and social resilience with the concepts of persistence, adaptability, and transformability. In this conceptualization, persistence refers to the ability of socio-ecological systems to remain within critical thresholds during periods of change. Adaptability enables socio-ecological systems to learn or adapt through experience and knowledge and to build persistence through collective and adaptive action (Berkes et al., 2008; Walker et al., 2004). While transformability drives the system to new regimes "when ecological, economic, or social structures make the existing system untenable" (Walker et al., 2004: 5). Complex feedback loops are clearly at work in this definition, and modeling these draws heavily on systems thinking.

One of the most elaborate frameworks for defining and measuring socio-ecological resilience was published by Renschler et al. (2010). This framework examines seven interdependent levels of resilience: population, environmental, organization, physical, lifestyle, economic, and social/cultural (PEOPLES). This report, published by the National Institute of Standards and Technology (NIST), provides an extensive and highly useful literature review of dozens of definitions of ecological and social resilience. It also disentangles factors related to the PEOPLES model. There, population and demographics ("P") includes factors related to the distribution and density of human and natural populations; the age, gender, and racial composition of human populations; and the socio-economic status of citizens. The Environmental/Ecosystems ("E") dimension includes "the ability of the ecological system to return to or near its pre-event state"

(16) as predicted by water, air, and soil quality, biodiversity, and other measures of ecosystem health. The "O" refers to organized government services focused on health, emergency response, judicial, and legal/security organizations. Physical infrastructure (the second "P") encompasses a broad area of measurement and includes diverse indicators, such as housing units, health care facilities, utility services, food supply, and communications infrastructure. Lifestyle (L) and Community Competence refers to collective organization, self-efficacy, and overall quality of life. The Economics dimension (the second "E") is also quite broad and includes indicators such as savings account balances, characteristics of the local economy (e.g., economic diversity), and the availability of overall financial services. And, finally, the Social/Cultural dimension (S) refers to social support, a sense of community identity, and trust as measured by the presence of nonprofit organizations, educational and cultural services, and active community engagement. This report goes on to present indicators and formula for integrating these dimensions into quantitative models that can parse out comparable measures of socio-ecological resilience across geophysical spaces and specific units of time.

In socio-ecological systems research, the application of resilience to questions of predicting or modeling environmental change is fundamentally about applying a systems thinking approach to human-environmental interactions. However, as Cote and Nightingale (2012) have argued, the conceptual integration of relevant systems in resilience thinking has largely been unidirectional, where the applications of ecological concepts to social systems has become normative. Even still, resilience thinking continues to grow in prominence and can be found in fields ranging from the social sciences, the natural sciences, engineering, law, public health, and others.

Many of the unanswered questions in the sustainability literature equally apply to resilience thinking. For example, the question of 'resilient for whom' remains one of the most challenging aspects of putting resilience in practice. Findings from the evaluations of development projects embracing resilience thinking already suggest that the scholarship and practice of resilience tends to overlook existing social inequalities, while they emphasize the conditions under which existing institutions (e.g., government and economic activities) and infrastructure (e.g., roads, bridges, dams, etc.) are vulnerable during external shocks, such as floods, heatwaves, riots, etc. From this point of view, city planners and emergency managers often conclude that a city can be classified as resilient, even when large groups of their residents never recover from a hurricane or financial crisis (Caniglia & Frank, 2017). As these and other programs continue to emerge and evolve, input and assessments from the social science community will be critical for their implementation and evaluation.

## Regenerative Development

Regenerative development is a paradigm designed to push beyond sustainability and resilience. The concept of regenerative development builds on sustainable development's emphasis on living within ecological limits and goes further by emphasizing the need to invest resources that build the capacity of socio-ecological systems to coevolve in increasingly positive ways. The priority of regenerative development is to heal existing damages in communities and ecosystems in ways that create abundance for people, the economy, and the planet (Caniglia, 2019). In contrast, sustainability focuses on actions today that protect the ability of future generations to develop, and resilience is focused on recovering system functions after external shocks. Significant conceptual confusion surrounds the emerging approach of regenerative development. Advocates claim that the regenerative development framework integrates fully the priority to build mutual supportive feedback loops between physical, natural, economic, and social capitals. They argue that sustainable development emphasizes maintaining the status quo and business-as-usual, rather than advancing the important interactive dimensions of human and natural systems in bio-regional contexts. They argue that the regenerative development approach is a

marked improvement over sustainable development, in that in practice designers, planners, and architects who place themselves in the regenerative practice community actively attend to the relationships among people, prosperity, and planet, rather than focusing upon multiple indicators of individual dimensions of each of these pillars of sustainability (the Three Es or Three Ps). This field of practice is growing rapidly, and their influence is considerable, particularly in US cities like Denver, Portland, Atlanta, and Pittsburgh, where the regenerative development lexicon is being adopted by a wide array of community groups, policy makers, and businesses (Caniglia et al., 2019a, 2019b).

The social science literature in the field of regenerative development has been slower to evolve than the application of the regenerative framework in communities of practice (Caniglia et al., 2019a, 2019b), because regenerative development has gained considerable traction among practitioners in the planning, architecture, and design communities who first advocated for this conceptualization (Cole, 2012). During the push to apply a growing set of sustainable development indicators in local, bio-regional urban contexts (Cole, 2012; du Plessis, 2012), practitioners found frustrating gaps that were difficult to overcome. Many argued that the sustainable development framework was decidedly mechanistic—focused on replacing parts of the system and tinkering with business-as-usual, while those advocating a regenerative development approach wanted to prioritize the interdependent dimensions and feedback loops that linked the fate of the entire system to human behavior and systems design (Cole, 2012; du Plessis, 2012). Although, as we have highlighted, socio-ecological systems and multiple capital solutions were part of the sustainable development approach from the beginning, advocates for the regenerative development framework argue that the systems approach is missing in the implementation of sustainable community design. Without attention to systems dynamics, they argue that an inferior, mechanistic approach to human-environment interactions will remain the inevitable outcome. In essence, regenerative development practitioners want to redefine the endgame more systemically, and they perceive sustainable development practitioners as losing focus on interdependence and feedback loops in socio-ecological systems in preference for measurement of disjointed indicators.

In the published literature, there are two distinct approaches to the regenerative framework: *regenerative development* and *regenerative economics*. Regenerative development is the focus on architecture, design, agriculture, and emerging scholarship in the social sciences. Caniglia et al. (2019a, 2019b) brought together contributors across sectors and to advance collaboration between academics and practitioners and to develop shared understanding of how to define and achieve regenerative development. Their consensus regarding the concept is:

> The priority of regenerative development is to heal existing damages in communities and ecosystems, which are connected in bioregional contexts, in ways that create abundance for people, the economy, and the planet. The framework advocates applying holistic processes to create feedback loops between physical, natural, economic, and social capital that are mutually supportive and contain the capacity to restore healthy and prosperous relationships among these forms of capital (p. 262).

Tom Dietz characterizes the core ideas of regenerative development in the same volume as (Dietz, 2019: 95):

- Catalyzing increased prosperity and health of human and natural environments through holistic design and meaningful human participation
- Fostering positive feedback loops where excess human and natural resources are reabsorbed by the system to create mutually beneficial relationships that self-replicate to build inclusive resilience
- Having respect and deep consideration to local contexts, whether economic, cultural, or ecological, so that development is properly adapted to local ecosystem and cultural and economic circumstances.

John L. Knott, Jr., founder and CEO of CityCraft Ventures and a thought leader in the

field of regenerative development wrote (2018: 161):

> If we are to achieve a regenerative future, we must understand that as humans, we are both a biological organism and a social being with a spiritual dimension. As a biological organism, we need adequate clean air and water, healthy soils to provide healthy food, and resilient shelter based on our unique bioregions. As a social being we require a network of others organized and connected to us supporting a healthy and thriving community each with access to the above three resources. A decision that threatens the capacity or health of these required resources is not regenerative.

Mang and Haggard (2016: XXXII) have argued elsewhere that "[r]egenerative development works on growing the capacity of the natural, cultural, and economic systems in a place. What makes this possible is the power of co-creative relationships between humans and nature. . .A regenerative development project leaves behind more than physical structures; it does more than benefit the surrounding natural and social communities. It also grows new capability and capacity in the people that it affects." Summarizing a variety of contributions to the regenerative building and design literature, Clegg (2012: 366) argues that "regenerative development has the capacity not only to reverse the negative ecological impacts created by human development, but also should have the capacity to increase social and natural capital. . .".

Regenerative economics is largely represented by the collective work of Hunter Lovins et al. (2018) and John Fullerton (2015). Both contributors have adopted Fullerton's eight principles of a regenerative economy as the primary characteristics and/or drivers of regenerative outcomes in the economy. These are illustrated in Fig. 25.2. Principle one argues that a regenerative system relies upon putting the economy, human prosperity, and the ecological system into "right relationship" with one another. While our contemporary system puts natural capital and human resources in service to the economic system, Fullerton argues that we must put the economy into service of humans and the natural system upon which they depend for survival—an argument central to the discipline of ecological economics (Lovins et al., 2018). Fullerton, Lovins, and their colleagues argue that a multiple-capital solution can move us toward "right relationship" by explicitly targeting the constant improvement of human, physical, ecological, and economic capital in all actions by government, educational institutions, businesses, and community organizations (e.g., Costanza & Kubiszewski, 2016). The principle of "right relationship" also recognizes that the economy is embedded in society, which in turn in embedded in nature. A regenerative economy is one in service to life (Lovins et al., 2018).

The second principle, "adaptability, innovation, and responsive" states that economic systems also need to build in resilience at multiple scales though a commitment to constantly learning, increasing their flexibility, and thereby finding innovative responses that increase adaptability. Principle three "views wealth holistically" focuses on the difference between wealth and value, emphasizes the wellbeing of the entire socio-ecological system, which is only as strong as its weakest link. Principle four, "empowered participation," acknowledges the need for shared abundance, rather than an economic system where wealth accumulates to only the rich.

The last four principles draw from ecosystem theories to advance ideas regarding resilient economic systems. Principle five, "robust circulatory flow," compares a circular economy to a circular ecosystem: both require resources to enrich all species, which in turn creates overall system health. Principle six, "edge effect" abundance, draws from ecology to recommend designing socio-ecological systems that increase value through "a diversity of relationships, exchanges, and resiliency" (Lovins et al., 2018: 63). Principle seven, "seeks balance," argues that the economy, like nature, needs to operate within planetary boundaries and develop equilibriums "that mirror those found in healthy, resilient natural systems" (Lovins et al., 2018: 63). And, finally, principle eight, "honors community and place," underscores the unique needs of different geological and the human-ecological interactions that characterize those places, combined with the

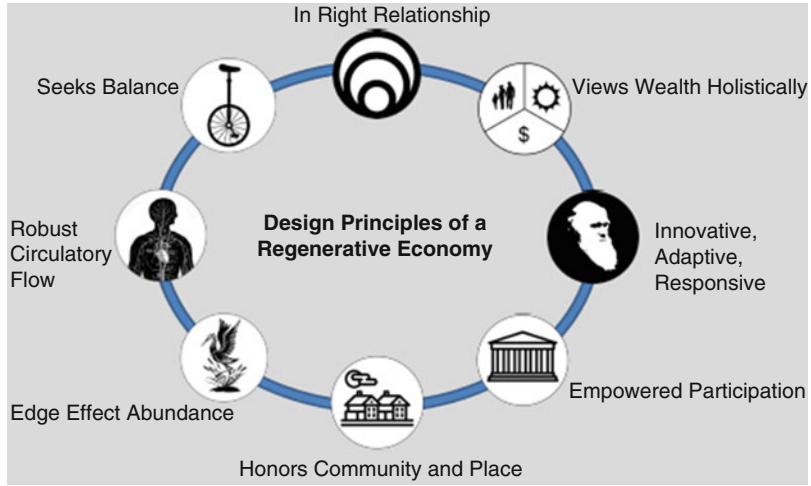


**Fig. 25.2** Eight principles of the regenerative economy. (Reproduced from Fullerton, 2015)

desire to build a patchwork of healthy and stable place-centered economies.

Efforts to differentiate regenerative development from sustainable development are still weak in their operationalization. However, more clarity is developing as a wider array of scholars grapple theoretically with regenerative development. For example, du Plessis (2012: 17) argues that regenerative development departs from sustainable development in four ways:

- Humans and their artefacts and cultural constructs are inherent parts of ecosystems;
- Their actions should contribute positively to the functioning and evolution of ecosystems and biogeological cycles, enabling the self-healing processes of nature;
- Their endeavours should be rooted in the aspirations of the context; and
- Development and design is an ongoing participatory and reflexive process.

Others have questioned whether these comparisons are either accurate or complete (Caniglia, 2019). More examination is required to tease out whether these are, in fact, operationalizable points of departure from the original conceptualization of sustainable development and resilience—efforts that environmental sociologists are poised to advance.

Through a systems lens, the regenerative development approach requires practices that restore the capacity of systems to regenerate multiple forms of capital in a co-evolutionary process (Wahl, 2016). In this way, it is the most holistic approach—looking backward at dysfunctional patterns, examining the current balance of natural, physical, human, and economic capitals, and focusing development activities in ways that replace dysfunctional patterns with institutions that create surpluses in all four capital categories within a given bio-regional system. Indeed, the central purpose of regenerative development is to put socio-ecological systems in right relationship with one another, as determined by bioregional contexts. As Girardet argues (Girardet, 2015: 11): "To find solutions to the damage we have done to the world's ecosystems, we need to start thinking about regenerative rather than sustainable urban development."

Regenerative development also emphasizes creating an economy in service of life—an orientation missing from the sustainable development approach (Dietz, 2019; Lovins et al., 2018). Rather than a gentle nudge against the dominant economic paradigm in hopes that we can sustain it a little longer, regenerative development places the achievement of balance between equity, economy, and ecology as the driving frame of reference and the most critical achievement to measure success. Advocates for this approach argue that sustainable development as it is currently practiced only provides lip service to this goal;

by making continued growth its central focus, equity and environment take a back seat to economic development in practice. The socio-ecological systems model could, therefore, be most realized in the regenerative development framework.

## Discussion and Conclusion

As this chapter has highlighted, environmental sociology has contributed to our understanding of human and environment interactions, but it has not fully embraced a central role in advancing the interdisciplinary field of socio-ecological systems. To encourage deeper engagement with this interdisciplinary effort, we have provided an overview of the field, an introduction to systems thinking, and an examination of the outcomes socio-ecological scholars and practitioners wish to achieve: sustainable development, resilience, and regenerative development. The achievement of these conceptual end goals are dependent upon our understanding of the interactions that take place between human and natural systems and the consequences those interactions have for human and ecosystem functioning. Importantly, practitioners who are responsible for achieving these end states in their communities rely on the findings of research in the interdisciplinary field of socio-ecological research to highlight leverage points and intervention opportunities to advance these outcomes.

Our attention to sustainable development, resilience, and regenerative development has been to inspire environmental sociologists to recognize the common cause shared with scholars in the interdisciplinary field of socio-ecological systems. Despite an impressive array of scholarship across numerous fields of study, rigorous consensus remains elusive regarding the ways sustainable development, resilience, and regenerative development are defined and achieved in socio-ecological systems. When John Fullerton (2015) compares a degenerative economy with a regenerative economy, he shows a continuum that places sustainable development in the middle between them. He equates degenerative economies with mechanistic design and reductionist thinking, while associating attention to natural systems design, holistic thinking, and patterns with a regenerative economy. When Hes and du Plessis (2015: 116) describe the different levels of socio-ecological systems operation, they cite physicist Bohm's four levels: operate, maintain, improve, and regenerate. The operational level is degenerative if out of balance; resilience and sustainable development are associated with the maintenance stage; and the regenerative approach to design and development is associated with improvement and regeneration. Laying out their "Regenerative Development and Design Methodology" Hes and du Plessis (2015: 120) list living systems thinking, permaculture, and developmental change processes as the primary "technologies" that characterize their approach. Thus, systems thinking is central to further theorizing and empirical research related to the achievement of sustainability, resilience, and regeneration.

Entire chapters and books have been dedicated to exploring systems thinking, theory, and methodologies. We cite many of these in this chapter, but our primary goal has been to provide a general overview of this approach and to invite environmental sociologists to explore more deeply the ways this framework serves to reveal insights about socio-ecological systems, while advancing work in this important interdisciplinary field. Herein, we briefly explored the differences between systems thinking and more traditional approaches to understanding the world, not to argue that environmental sociologists fail to apply this thinking to our socio-cultural models, but to explicitly highlight the tools we can use to advance our contributions to the ways human and environmental factors interact in socio-ecological systems. Environmental sociology has made significant contributions to this evolving interdisciplinary field, particularly through studies in human ecology, structural human ecology, and the sociology of disasters. We argue, however, that environmental sociologists can make even more significant contributions to socio-ecological systems by more explicitly engaging the interdisciplinary

literatures surrounding sustainable development, resilience, regenerative development, and systems thinking.

Scholars and practitioners recognize that to achieve sustainable development, socio-ecological resilience, or regenerative development, we have to integrate ecological science models with social science models. Each is based on extensive knowledge of interactions among diverse elements at a variety of scales. Putting them together is challenging and requires more than basic understanding of both human and natural sciences (Clement et al., 2020). As a primer, we hope this article provides useful tools and perspectives that environmental sociologists can use to more actively engage in these critical efforts.

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