Chapter 2
Beyond Paradigms: Socio-ecology's Heritage and Prospective

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Abstract This chapter aims to review the ecological, political, and social foundations for sustainable socio-ecological systems. Specifically, it will explore the assumptions and elements behind ecological systems and services. To that respect, Milbrath (1989) was one of the first researchers to link the "social learning" concept to sustainable development through the "self-educating community" expression to define situations of mutual learning, where actors learn from each other and from nature. From the socio-ecological perspective, sustainable development is linked to the resilience and capacity building of actors who negotiate and reach collective decisions (Pahl-Wostl et al. 2007b; Schusler and Pfeffer 2003; Woodhill 2004; Muro and Jeffrey 2008). These perspectives help considering a better view of the communities' decision-making practices, their capacity to endure adaptation and change, as well as their ability to collectively learn how to adjust toward new scenarios of governance policies about resource, access, and sustainability. Hence, this chapter could elicit a glimpse into these and other components of the human-natural complex adaptive systems that are the interest of socio-ecology as a field of study.

Keywords Socio-ecology · Social learning · Knowledge-based development
Adaptive social ecosystems · Anthropocene

2.1 Introduction

In order to bring a meaningful contribution to this book, this opening chapter had first the temptation to make a review of the epistemic and ontological assumptions underlying the major development paradigms. This in order to support the theoretical underpinnings of sustainable development, which is seemingly one of the core

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values of ***social ecology***. From Thomas Kuhn's *Structure of Scientific Revolutions* (1962, 2012) to the Actor-Network Theory or the Object-Oriented Ontology, we can easily end up in the aisle of the philosophy and methodology of ***sustainability***. However, if a multilevel outlook is proposed by a "systems perspective," it is nowadays arguably accomplished by socio-ecological models, which as a final view become rather diluted when confronted with the overwhelming evidence of the Anthropocene. This latter paradigm highlights how we are going through a dramatic and rather catastrophic climate change with all its implications, questioning "the world's ecosystems and their ability to sustain human life" (Göpel 2019: 29). However, since this book aims to provide a stimulating and honest account of community experiences into sustainable development, the very idea of knowledge-based development (KBD) and adaptive models is worth revisiting from this stance.

Following this line of thought, it is also worth to mention alternative economic models, in the sense that mainstream as well as alternative economic paradigms had each one an impact upon sustainability thinking and practical applications. These include the Economy for the Common Good, Transition Towns, the Commoning Movement, and Bhutan's Gross National Happiness framework. However, critics are finding that the Economy of the Common Good is mostly a prescriptive business model with no contingencies attached, Transition Towns is a relatively unknown network, and Bhutan's GNH has practically phased out. Nonetheless, the Commoning Movement exhibits a more mature conceptual and institutional design. Above all, it has developed a set of contingencies based on empirical research, in which "a radical revision of technological means begins the transition. A reconsideration of human goals completes it" (Göpel 2019: 52). This is as close as it gets between Strong Sustainability and Anthropocene Perspective – only the other way around: A reconsideration of human goals is first, followed by technological means enabling path dependencies. Alternative economic models can include elements such as integrated value systems (happiness, subjective well-being, human development index, quality of life, discretionary time, etc.). More particularly relevant to knowledge-based development (which includes *capital systems* and the reference to *values research,* etc.), these approaches lead us to questions such as "What types of capital exist and where do they come from?". This is how "Strong Sustainability" emerges once an integrated value perspective is taken into account. Hence, for Göpel (2019: 113), "understanding humans in nature is a pre-requisite to survival." Moreover, perhaps the most clear convergence between the whole spectrum of both sustainability and Anthropocene studies is Elinor Oström and her discussion on the commons as an economic practice. Most important is her call for building "institutions that bring out the best in humans." Even if survival is the ultimate purpose, at present, it can become our best sustainability model proposal.

Hence, as the interconnected environmental, energy, economic, and equity crises of our twenty-first century are posing complex and often unpredictable challenges to our communities around the world, we are located right at the core of the sustainability and Anthropocene studies discussion. Clearly, conventional forms of urban planning, design, and governance – often centralized, hierarchical, and inflexible – are ill-suited to these new realities. Capacity development for governance in our

communities is therefore setting the pace for building and strengthening our communities' resilience. Moreover, resilience thinking is about understanding and engaging with a changing world. By understanding how and why the system as a whole is changing, we are better placed to build a capacity to work with social and environmental crisis, as opposed to being a victim of it (Walker and Salt 2006: 9). Among those crises, resource scarcity is characterized by connectedness, complexity, uncertainty, conflict, multiple stakeholders, and, thus, multiple perspectives. Resources are thus unknowable in objective terms although this understanding does not currently conform the dominant paradigm for sustainable development. Clearly, it is no longer possible to rely only on scientific knowledge for management and policy prescriptions. *Social learning*, as a core part of some socio-ecological models, which is built on different paradigmatic and epistemological assumptions, seems to offer managers and policy-makers some alternative and complementary possibilities for a number of contemporary ecological crises.

Hence, this chapter aims to explore the interrelationships between environmental sustainability, social learning, and resilience through the economic and social challenges and opportunities that sustainable socio-ecological systems bring. The uniquely complex nature of these interdependent issues opens up opportunities for social ecology to make groundbreaking contributions to address the challenges that community development spaces pose. This chapter will therefore intend to explore the convergence between ***resilience***, social ***learning,*** and ***governance***, which are concepts embedded in development models such as ***knowledge-based*** and ***sustainable development*** for specific communities. In that sense, this chapter aims to develop a better understanding of development processes through the lens of social ecology and other frameworks that follow parallel principles and thereby observe communities' ability to develop and support them to exploit their resources, their access, and their communities' knowledge base.

2.2 Social Ecology

Social ecology is a study approach that embraces an ecological, reconstructive, and communitarian view on society. This theory looks to reconstruct and transform current outlooks on both social issues and environmental factors while promoting direct democracy (Clark 1988). Social ecologists make emphasis on small-scale economic structures and the social dimensions of the ecological crisis. Social ecology traces the causes of environmental degradation to the existence of unjust, hierarchical relationships in human society, which is seen as endemic to the large-scale social structures of modern capitalist states. Social ecologists advance models of decentralized small-scale communities and systems of production. They provide guidance for developing successful programs through social environments and the idea that behaviors both shape and are shaped by the social environment. The principles of social ecological models are consistent with social cognitive theory

concepts which suggest that creating an environment conducive to change is important to making it easier to adopt healthy behaviors.

A major proponent of social ecology was the American environmental anarchist Murray Bookchin (1921–2006). Bookchin made a number of crucial contributions to further development of a Social Ecology Theory. Most significantly, he broadened the theoretical basis of the communitarian, organicist, and regionalist tradition developed by Reclus, Geddes, and Mumford by making dialectical analysis a central focus (ibidem). He opened the possibility for more critical and theoretically sophisticated discussions of concepts like holism, unity-in-diversity, development, and relatedness (Bookchin 2007). He also develops Mumford's defense of an organic world view into an account of diverse forms of domination and of the rise of hierarchical society. Of particular importance is Bookchin's emphasis on the central role of the developing global capitalist economy into ecological crises, which is a highly contemporary issue. Back in the 1960s, Bookchin felt that "by the very logic of its grow-or-die imperative, capitalism may well be producing ecological crises that gravely imperil the integrity of life on this planet" (Bookchin et al. 2015). Since then, social ecology developed in the deepest sense into a radical ecology. It actually stemmed into other theoretical variations such as *deep ecology*, *ecofeminism*, and *eco-socialism,* all of them encompassing a look into social problems (first) in order to discover the roots of ecological crises (Clark 2000). After Bookchin, a number of authors further developed the social ecology concept, of which the working group at the University of California, in Irvine, is worth mentioning in the following paragraphs.

2.2.1 Conceptual Social Ecology

Social ecology as a concept was conceived after social ecology programs at UCI had celebrated their first 25 years of existence. *Conceptual Social Ecology* presents a number of facets of social ecology: its current definition and basic assumptions; its founding scientific presentations; its evolution as an organizational unit within the University of California, Irvine (UCI); and its approach to research on contemporary problems of the social and physical environments. Key conceptual authors of social ecology's original intellectual foundations in UCI are Arnold Binder, Daniel Stokols, and Ray Catalano. Arnold Binder founded the social ecology undergraduate interdisciplinary program in 1970 which was accorded status as a formal academic school at UCI in 1992. Authors of distinctive definitions of social ecology are Daniel Stokols, Thomas Crawford, Dave Taylor, and Valerie Jenness.[1]

It was Daniel Stokols who identified four assumptions of the social ecology perspective and core principles of Social Ecological Theory (see Table 2.1). He has

[1] UCI. School of Social Ecology https://socialecology.uci.edu/pages/conceptual-social-ecology

Table 2.1 Elements of social ecology paradigm

SE	Four assumptions	Six underlying recommendations	Five principles
	Assumption 1: Multiple facets of both the physical environment (for example, geography, architecture, and technology) and the social environment are integral to a social ecological analysis.	1. Identify a phenomenon as a social problem.	1. Principle one: Multiple dimensional analysis. Environmental settings have multiple dimensions which influence the person-environment interaction.
		2. View the problem from multiple levels and methods of analysis.	
	Assumption 2: The relative scale and complexity of environments may be characterized in terms of a number of components such as:	3. Utilize and apply diverse theoretical perspectives.	2. Principle two: Differential dynamic interplay (the emphasis is on interrelationships between personal and situational factors).
	(a) Physical and social components	4. Recognize human-environment interactions as dynamic and active processes.	
	(b) Objective (actual) or subjective (perceived) qualities		
	(c) Scale or immediacy to individuals and groups		
	Assumption 3: The social ecological perspective incorporates multiple levels of analysis and diverse methodologies.	5. Consider the social, historical, cultural and institutional contexts of people-environment relations.	3. Principle three: Relevance of systems theory.
			4. Principle four: Interdependence of environmental conditions.
	Assumption 4: The social ecological perspective incorporates concepts from systems theory to take into account both the interdependencies that exist among immediate and more distant environments and the dynamic interrelations between people and their environments.	6. Understand people's lives in an everyday sense.	5. Principle five: Inherent interdisciplinarity. Social ecology analyses emphasize the integration of multiple levels of analysis with diverse methodologies.

Source: Adapted from Stokols (1996, p. 7)

described the development of the ecological paradigm and applied the social ecological perspective to problems of health promotion.[2]

Last but not least, Eleanor Finlay describes Social Ecology Theory as "a coherent leftist vision that underscores the potential for human beings to play a mutualistic and creative role in natural evolution." This could be possible by uprooting the irrational, hierarchical, and ecologically destructive society we currently live under and by replacing it with a "socially enlightened and ecological society" (Finley 2017). An essential element of such a society would be the Aristotelian notion of politics, that is, the direct management of towns, cities, and villages by the people who live in them. According to Finley, social ecology maintains that we can

[2] https://socialecology.uci.edu/pages/conceptual-social-ecology

supplant capitalism and the state with a global federation of directly governed democratic municipalities.[3] In this sense, social ecology intersects directly with resilience, social learning, and governance as it will be depicted in the next paragraphs.

2.3 Social Ecology Paradigms, Social Learning, and Governance

Relentlessly, one of the most important indicators of a city's progress and development is its sustainability. The characteristic connectedness, complexity, uncertainty, conflict, multiple stakeholders, and thus multi-perspectives of resource management makes it unsuitable to depend only on scientific knowledge for planning and strategies. Social learning, a process-based theoretical model, seems to offer professionals and policy-makers new options and harmonizing potentials (Ison et al. 2007). The following development models and definitions aim to get a better perspective of where principles of social ecology, such as resource management and sustainable community development, converge.

2.3.1 Social Learning Processes

Bandura's (1977) *Social Learning Theory* explains that individuals learn from each other through observation, imitation, and modelling. It is often described as bridging the behaviorist and cognitive learning theories mainly because it includes attention, memory, and motivation concepts. However, Reed et al. (2006) argue that social learning has more than bridging functions; it extends to (1) demonstrating that a cognitive change has occurred among the participating persons, (2) demonstrating that this new awareness is not limited to the participants but extends to the wider communities of practice, and (3) showing that it occurs through social exchanges between and among networked social actors. The meaning of social learning could improve our capacity to critically assess outcomes and to better appreciate the processes through which social learning takes place. In this way, it may be possible to better facilitate the desired outcomes of social learning processes (Reed et al. 2006).

With this in mind, our rural and urban communities, through social capital, are likely to adapt to contextual changes due to a systemic coordination and cooperation through their learning processes. In order to examine possible outcomes in terms of adaptive responses to change in city systems, we will need to understand the links

[3] http://www.kurdishquestion.com/index.php/insight-research/social-ecology-kurdistan-and-the-origins-of-freedom.html

between resources management, resilience, social learning, and governance within the rural and urban systems (Ruiu 2017).

Milbrath (1989) was among the first researchers to link "social learning" concept to sustainable development through the "self-educating community" expression to define situations of mutual learning where actors learn from each other and from nature. Sustainable development is viewed as a wicked problem (Rittel and Webber 1973), whose solution is function of the capacity of diverse actors to discuss, negotiate, and reach collective decisions (Pahl-Wostl (2006), Pahl-Wostl et al. (2007a), Pahl-Wostl et al. (2007b), Pahl-Wostl et al. (2007c), Pahl-Wostl (2009), Pahl-Wostl (2015), Pahl-Wostl (2017)). These perspectives help considering a better view of the communities' decision-making practices, their capacity to endure change, as well as their ability to learn how to adjust toward new scenarios of governance policies about resource, energy, and sustainability. This chapter elicits a glimpse into these factors as possible examples of complex adaptive systems problems.

2.3.2 Social Learning and Governance

Surely one of the successful definitions of the state in terms of public management has been that of the "enabling state" (Gilbert 1989, 2002, 2005). In theorizing a potential relational state, Gilbert has advanced that the enabling state seemingly offers an approach oriented to the market that focuses on benefits that promote participation in the workplace and overall individual responsibility (Gilbert 2002). Gilbert's approach emphasizes a state whose role is to provide social protection through public support, thus generating private responsibilities (Gilbert 2005). On the other hand, Pierpaolo Donati, in his seminal work on the *Relational Sociology* (2010), assumes that knowledge creation is dependent on relational/social capital – it is at least "processed" in social interactions – but the dynamics of knowledge production and associated increasing competition undermines the traditional social capital (families, workplaces, local communities).

These ideas were previously embraced by Etzioni (1988) and Giddens himself (Giddens 1994, 1998), but in the last decade, emerging notions of public management have also included the iconic concept of governance. Kooiman (2003) defines governance as the totality of public and private interactions dedicated to solve problems and create social opportunities. He calls it *interactive governance*. There are relevant aspects in this perspective that relate to the definition of relational state, where a strong state is not something that is derived from a Constitution, but it happens to be something contextual and entrepreneurial (Pierre and Peters 2000). Governance approaches that would be relevant to the notion of relational state are those in which the institutions are strengthened and those in which the state is analyzed not only from the inside out but also from the "outside-in" (Mendoza and Vernis 2008). All these elements and changes clearly portray the need for public managers' relational leadership and network entrepreneurship skills. Indeed, today's context is already requiring public managers to exercise a "humble and facilitating"

leadership style, based on openness, dialogue, and participation, with the ability to think at the partnership/network level, give strategic direction, and encourage experimentation and diversity (Mendoza and Vernis 2008: 25).

2.3.3 Dimensions of Governance

With the new millennium, the concept of governance has been extended with some "adjectives." Among others, we are talking about evolutionary governance, cooperative governance, and associative governance. Some authors affirm that governance is expressed in "modes" or "ways": through hierarchies, persuasion, markets, and community involvement and by association (Bell and Hindmoor 2009). For the purposes of this chapter, we have concentrated on evolutionary governance and associative governance, which have been raised from the theoretical explanation of social processes and the relationship between the state (government) and the actors around it.

For example, the theoretical position of the Evolutionary Governance Theory (EGT) is based on the explanation, from various theoretical bases, of the different stages in which the **dynamic** capacity of governability of social groups is developed as they are organized. From this perspective, governance is not something given or fixed but something that is changing according to the elements and actors of the context. This vision is complemented by the theoretical vision of the associative governance, with which we try to emphasize the relationships that arise between the actors and the bonds of trust that arise from a regional context in the use of the resource (Storker 1998).

Thus, the contemporary concept of governance refers to an empirical phenomenon that has been impacting the forms of state intervention and how the state has been transformed (Dancause and Morin 2013). It also comes from a new theoretical perspective that helps us to understand the processes of integration and management of the social system, as well as the role of the state in these processes (Enjolras 2005). Indeed, the concept of governance is used to better understand "the introduction of new methods for the development of public policies based on negotiation, as well as new ways of implementing these policies, especially through partnerships" (Canet 2004). On the other hand, the concept of associative governance allows us to rethink the relationships between the different economic, political, and social actors, as well as forms of public intervention. Its starting point is that the state no longer plays the same role it had been doing in the past. But above all, it notes that its fundamental characteristic is the nature of the links between the actors (Stoker 1998). For their part, Hamel and Jouve (2006) have also rightly pointed out the ideological role played by governance, which has served to justify and legitimize the transition of governments from Keynesianism to neoliberalism (Bell and Hindmoor 2009).

On the other hand, it is possible to link the increasingly widespread use of the concept of governance with the fact that the state has lost its central role in the formulation of public policies. Experts have pointed out that this has happened on three levels:

international relations, economic regulation, and the relations of the state with local powers (Canet 2004). Some see the state as one of several actors, acting in concert with other representatives of the private sector and civil society (Duchastel and Canet 2004). In terms of public policy and state regulation, and due to the complexity of social structures, it is observed that hierarchical, vertical, and coercive relationships have gradually been replaced by more horizontal relationships, with incentives, negotiation, and cooperation, which they involve a wider variety of economic and social actors (Canet 2004; Levesque 2001). It is therefore clear that in the areas of economic development and social development (where the social economy is at the intersection of these two), the state no longer plays the leading role. It has become, rather, a "partner" with multiple normative, human, and financial resources.

The interest in governance arises from finding ourselves in a period of constant change and climate crisis, in which social ecology has something to say. In it, new problems are faced and new solutions are also proposed; it is no coincidence that governance is such a mentioned topic. Governance is one of the ways in which academia has found a mechanism to analyze change (Levi-Faur 2014: 7). These changes arise and are institutionalized in different levels or spheres. They can be conceptualized in three directions: upward (regional, transnational, intergovernmental, and global), downward (local, regional, and metropolitan, as recommended by social ecology perspectives), and horizontally (private and civil authority spheres) (Levi-Faur 2014: 7). For the purposes of this chapter, we will understand governance as a complex social process, and it is advanced that "governance is an ongoing process of steering or enhancing the institutional capacity to steer and coordinate" (Pierre and Peters 2000; Kooiman 2003). It is a "norm-generating process" (Humrich and Zangl 2010: 343) as well as a group of "practices of governing" (Bevir 2011:1) and the exercise of public authority (Heinrich 2011: 256, in Levi-Faur 2014). Most importantly, "the notion of governance, **when applied to resources management** refers to the capability of a social system to mobilize energies, in a coherent manner, for the sustainable development of resource resources" (Rogers 2002). Clearly, resource governance refers to the range of political, social, economic, and administrative systems that are in place to develop and manage resource resources, and the delivery of resource services, at different levels of society (Rogers and Hall 2003). As mentioned above, relevant to this chapter is to define resource management and governance processes as social learning processes mainly because they can be linked to concepts that are embedded in collective ways of learning. One of those embedded concepts, in which resource management, governance, and learning converge, is resilience.

2.3.4 Social Learning, Governance, and Resilience

Increased resource demand and the consequences of climate change clearly pose serious risks to the provision of sustainable urban resource services, for example, drinking resource, sanitation, and safe drainage, especially in cities. These

challenges call for a transition toward improved resource management, including considerations of "resilience." However, because the resilience concept has multidisciplinary origins, it is open to multiple interpretations, which poses a challenge to understanding and operationalizing the concept. It is thought that building resilience needs to take three distinctive dimensions into consideration: socioeconomic, external hazard considerations, and larger social-ecological (regional) systems to be sustainable. Indeed, resilience as a notion adds value to understanding and addressing the complex urban resource management within its three dimensions (Fath et al. 2015).

Resilience is a rich and complex concept. It has roots in systems theory (a key concept for social ecology), and it has a variety of interpretations and applications every time human agency and/or networked, collective action is involved. The concept has been defined by a number of authors (see Table 2.2), but for the purposes of this chapter, we follow upon the work of the *Resilience Alliance*, one of the leading scholarly bodies working on the resilience of social-ecological systems.

They have defined *resilience* as "the capacity of a social-ecological system to absorb or withstand perturbations and other stressors such that the system remains within the same regime, essentially maintaining its structure and functions" (Holling 1973; Gunderson and Holling 2002; Walker et al. 2004). Moreover, it describes the degree to which the system is capable of self-organization, learning, and adaptation, as illustrated in Fig. 2.1.

The concept of resilience started in Systems Ecology, framing the resilience concept explicitly in the adaptive cycle with the observation that resilient systems are the "ones that successfully navigate all stages of growth, development, collapse, and reorientation of this cycle" (Johannessen and Wamsler 2017). Resilience refers to the capacities, competencies, and cultures needed by social organizations to bounce back, requiring consideration of the entire life cycle for success (Johannessen and Wamsler 2017). *Resilience* is also a key concept in terms of social capital, which is relevant for the purposes for this chapter, but has the following challenges:

Table 2.2 Definitions of resilience – sampler

First author, year	Domain	Definition
Kimhi, 2004	Community	Individuals' judgment of the ability of their community to successfully solve the ongoing political violence
Allenby, 2005	Community	The system's capacity to retain its function and structure in the face of internal and external transformations and to degrade graciously if it must
Gunderson, 2003	Community	The recovery time of a social-ecological system determined by (1) that system's ability for regeneration in an active environment and (2) group's ability to learn and change (which, in turn, is mainly a function of the institutional context for knowledge sharing, learning, and management and partly by the group's social capital)

Source: CARRI Report (2013)

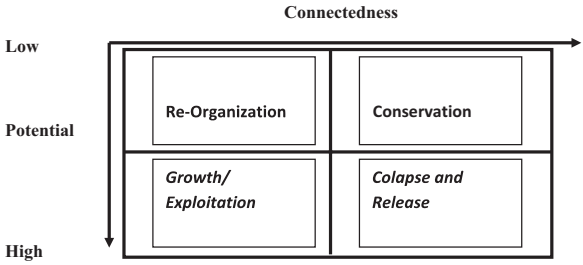

Fig. 2.1 The adaptive cycle. (Source: Adapted from Gunderson and Holling 2002)

(a) Transferring and integrating different forms of resilience across diverse communities and social settings
(b) The evolution of resilience as an adaptive capacity for the institutions and practices that regulate the formation and utilization of sustainable *development* strategies
(c) The complex combination of system forces, including policy, technology, and city capitals, with the creation, measurement, and representation of *resource* initiatives
(d) The new role of government, which advances learning adaptive capacities and *sustainable development* schemes (Fath et al. 2015)

Moreover, a first definition of Social Ecology System (SES) dates back to 1988. In it, Berkes and Folke found that it implied to analyze resilience in local resource management systems (Berkes and Folke 1998). Since then, studies of interlinked human and natural systems have emerged as a field on its own right, promoting interdisciplinary dialogue and collaboration in a wide set of fields and practices. As the SES concept celebrates its 20-year existence, an overview emerged on how authors use the concept in relation to research that deals with social and ecological linkages (Colding and Barthel 2019). Resilience is still a sought-after variable, but it is also true that a number of resilient systems have become less effective under the new ecological conditions they are facing.

2.4 Social Ecology Prospective

Hence, an analysis from a social ecology (SE) standpoint is seemingly a very robust social construction. However, it is contended that resilience and sustainability indicators for SE are becoming less meaningful under the emerging Antropocenic views. First, the sense of purpose in socioeconomic techno-systems makes it incompatible with current Anthropocene thinking. Perhaps the first and most common ground from major philosophers of the Anthropocene (Timothy Morton, Donna Haraway, Slavoj Zizek, Jean Dupuy) is that by definition, this complex reality we call the Anthropocene is now by far beyond human control. The key result is the decentralization of human agency. In that sense, social planning without empowerment, decision-making, and agency becomes quite challenging.

Even if *social ecology* and *deep ecology* reconcile their differences, the Anthropocene process remains an emerging, major challenge, not only for these two disciplines but for a number of others less robust in their social constructs. Based on the writings of its major theorists, deep ecology's basic areas of disagreement with social ecology may be identified.

(a) Social ecology argues that the idea of dominating nature resulted from the domination of human by human rather than the reverse. That is, the causes of the ecological crisis are ultimately and fundamentally social in nature. The historical emergence of hierarchies, classes, states, and finally the market economy and capitalism itself are the social forces that have, both ideologically and materially, produced the present plundering of the biosphere.
(b) Deep ecology, by contrast, locates the origin of the ecological crisis in belief systems, be they religions or philosophies. Most particularly, deep ecologists identify ancient near eastern religions and the scientific worldview as fostering a mindset that seeks to dominate nature. It is by asking deeper questions, as Arne Naess puts it, that these origins are identified so that the social causes of the ecological crisis are somehow relegated to the category shallow.

But social ecology at large views the natural world as a process – and not just any process but a development toward increasing complexity and subjectivity. Unlike sociobiology, which reduces the social to the biological, social ecology emphasizes the gradations between first and second nature: Second nature emerged out of first nature. Yet the boundary between human and nonhuman nature is real and articulated.

This is why it is important to draw parallels and comparisons between conceptual models and practices that are shedding some light into the sustainable development phenomena. Table 2.3 depicts a first-approach comparison between the principles of the commons (Ostrom 1990), the principles of social ecology, and the social processes of knowledge-based development (Carrillo 2004). With different views and assumptions, they are bringing to our postmodern world different voices that echo that of Bookchin in his critique to the capital system we are still in: "It is gravely imperil the integrity of life on this planet" (Bookchin 1988, 2007; Bookchin et al. 2015). Some of the parallel views between these three contemporary schools of thought converge not only in concepts such as sustainable resource management, governance, collective learning, or resilience. Their basic assumptions seemingly lie on ethics, inclusivity, diversity, creativity, etc. And they also lie on justice and freedom, which no matter how old they are, they still constitute the basic aspirations of most human groups and organizations. In this sense, Table 2.3 can shed some light on contemporary concepts and tools that could trigger a necessary *third way* to the multiple environments and human crises right on the present and immediate scenarios we are facing.

Indeed, while the meaning of development in Anthropocenic times gets so fuzzy, the realities of climate change are at our door. In terms of development, one can ask: Has *sustainability* become *unsustainable*? If that is the case, can social ecology report accurate results on multidisciplinary research? Can it generate new indicators

Table 2.3 Analogy between the principles of the commons (Ostrom 1990), social ecology (Stokols 1996), and the social processes of KBD (Carrillo 2004; Fachinelli et al. 2014)

Principles of the commons (Ostrom 1990)	Principles of social ecology (Stokols 1996)	Social processes of knowledge-based development (Carrillo 2004)
1. Clearly defined limits	1. Identify a phenomenon as a social problem.	Every city's capital system is unique, and its assets can be leveraged in a number of ways, depending on the social processes and the social groups involved. KBD seeks development from city's assets within the capital system and on the distinctive aspects of any given city.
	2. View the problem from multiple levels and methods of analysis.	
	3. Utilize and apply diverse theoretical perspectives.	
	(P1) Multiple dimensional analysis. Environmental settings have multiple dimensions which influence the person-environment interaction.	
	(P5) Interdisciplinarity. Social ecology analyses emphasize the integration of multiple levels of analysis with diverse methodologies.	
2. Congruence between appropriation and provision rules and local conditions	4. Recognize human-environment interactions as dynamic and active processes.	Development is a conscious and deliberate effort through citizenship interactions in a dynamic and active knowledge-based processes.
		It involves the constant recreation of its entire capital system and its identity, intelligence, and financial, relational, human (individual and collective), and tangible and intangible capitals.
3. Collective choice arrangements	(P2) Differential dynamic interplay (the emphasis is on interrelationships between personal and situational factors).	The social processes aim to leverage a city's assets in order to trigger development. The emphasis is on interrelationships and networks in which citizens interact and generate *knowledge moments*, or *insights*, in which they are able to create and innovate the existing knowledge structures. This is intrinsically a collective process and takes place in public places.
4. Monitoring	(P3) Relevance of systems theory and (P4) interdependence of environmental conditions evaluate the whole interdependent system. Resilience is considered a paramount value, although it does not show clear indicators.	Citizens are accountable for the way they are able to provide and manage knowledge, in different contexts within the city. Their accountability is key to find a way forward and is mostly self-monitored.

(continued)

Table 2.3 (continued)

Principles of the commons (Ostrom 1990)	Principles of social ecology (Stokols 1996)	Social processes of knowledge-based development (Carrillo 2004)
5. Mechanisms for sanctions		The city's capital system generates a unique set of indicators that set the path forward. With time, the city is able to offer a profile through which it has been able to generate its own definition and characteristics of its KBD model and its regulating mechanisms.
6. Mechanisms for conflict resolutions	5. Understand people's lives in an everyday sense.	Citizens go through a number of social processes through which a decision-making path generates a set of regulating mechanisms, which can then be applied to conflict resolutions.
7. Recognition of organizational rights	6. Consider the social, historical, cultural, and institutional contexts of people-environment relations.	Citizenship is thought to go through a number of social learning experiences and come out of them with the technical capacity to articulate and develop highly organized social capital systems (i.e., networks), in which relational capital is paramount.
8. Self-governance	Governance with the participation of diverse groups.	Multi-governance with the participation of City Champions and a critical mass of change agents with sufficient understanding of KBD.

that describe the state of the human struggle and the ecology loss? Can it be combined with other schemes and models as its foundational aspirations suggested?

One can advance that if social ecology combines its powerful tools with other disciplines such as knowledge-based development (KBD), it could be asking and answering questions triggered by the Anthropocene events about sustainable development, social learning, resilience, and governance. Or even those devoted to KBD: What knowledge? For whom? Also, who knows? Who decides? (Carrillo 2019). These are clearly questions that only the multidisciplinary work could attempt to answer.

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