Chapter 5
A Regulatory Primer of International Environmental Policy and Land Use

Beth Ann Fiedler

Abstract A review of international environmental regulation and land use in action establishes the high-level legal foundation of regulatory guidelines to define concepts, highlight important areas of law to promote fundamental understanding, create general discourse, address existing conditions, and prioritize ecosystem destruction avoidance from common ground. The analysis discusses natural resources, land use, and economic development on a global scale guiding the reader through high-level international environmental policy with a focus on land use and land degradation. The chapter demonstrates the overarching role of international environmental policy and land use in the development of policy at subsequent levels of government—national, state, or local—shaping land use policy and decision-making that can incrementally contribute to overall improvements to the global landscape, and thus population health.

5.1 Introduction

The topic of land use spans the gamut from the international land governance in global organizations such as the Organization for Economic Cooperation and Development (OECD) to requesting local permits to construct an addition to your home according to your local zoning ordinance. Land use is diverse and linked to several major areas of public administration. They include transportation, agriculture, recreation, and forests but also natural resource management, waste disposal, and urbanization (USDA 2016). Efforts to address various problems often result in a conflict of authority impeding resolution because of the intersection of these many activities often resulting in a land use imbalance. The subsequent disparity is a global problem demonstrated by the inability of the ecosystem to naturally dissipate extreme heat in concrete and pavement laden cities or to purify ground water sources that are bombarded with agricultural runoff in rural areas. The impact of human

B. A. Fiedler (✉)
Independent Research Analyst, Jacksonville, FL, USA

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development and production, natural disasters, and others combine to hinder the natural process of corrective action resulting in land degradation.

(INTOSAI 2013, p.12; United Nations 1997):

> Land degradation is "the reduction or loss of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, or range, pasture, forest or woodlands resulting from natural processes, land uses or other human activities and habitation patterns such as land contamination, soil erosion and the destruction of the vegetation cover."

Deforestation, biodiversity loss, soil erosion, and desertification are the primary types of land degradation that impact the quality of air and water as soil becomes contaminated from waste, mining, or because of public services (INTOSAI 2013). The Food and Agricultural Organization (FAO) of the United Nations reports that 25% of the globe is designated as highly degraded land requiring immediate remediation (FAO 2011, p.18). However, the persistent rate of decline is most evident in areas of high levels of poverty precluding the capacity to respond with the amount of financial investments required to make improvements. "The rate of socio-economic change and the accumulation of environmental problems have outpaced institutional responses" (FAO 2011, p.21) resulting in less positive impact in developing regions that often require the most attention.

Recognizing that there exist physical and human contributions to the designation of land use as a stressed resource consequent to human activity and production (INTOSAI 2013) is key to developing solutions. Therefore, every community planning decision and valuation of the existing landscape is critical to halting the further destruction of the planet's natural capacity to support life and to rectify degrading conditions.

The relationship between and among the environment (e.g., natural resources, land use) and economic development is inherently embedded in the four levels of environmental law discussed herein. Focusing on environmental problems that converge on land use and land degradation, this chapter will review the complex nature of international law from these perspectives. The nuances of the convergence of environmental and public health policy are most apparent in the implementation, policy strategy, and enforcement at the local (e.g., state, city) levels of government. However, international regulations act as fundamental guidelines and frameworks driving national and thus local policy implementation. Therefore, we begin by introducing international environmental policy.

5.2 International Environmental Policy

How we use land effects everyone. "Land use matters for many of the most important policy questions of our time: environmental sustainability, CO_2 emissions and biodiversity, and public health" (OECD 2017b, p.9). Deforestation and forms of land degradation through the built environment, such as urbanization and road construction, can directly impact air quality and access to clean water. The long-term

Table 5.1 Primary international environmental agreements for natural resource conservation, particularly contributing factors leading to land and water preservation

Treaties	Brief description	Find more information
1972 United Nations (UN) Convention on the Human Environment[a]	Recommends an international framework for environmental action and the creation of a UN Environmental Organization	http://staging.unep.org/Documents.multilingual/Default.asp?DocumentID=287
1992 United Nations Conference on Environment and Development (UNCED), which produced the Rio Declaration[a]	Global environmental integrity; Led to 1994 UN Statement of Forest Principles	http://wedocs.unep.org/bitstream/handle/20.500.11822/19163/Rio_Declaration_on_Environment_and_Development.pdf?sequence=1&isAllowed=y
1997 Kyoto Protocol, enacted 16 Feb 2005[a]	National commitment to reduce carbon dioxide and other greenhouse gas emissions; engage in "carbon trading" to offset inability to reduce emissions	http://unfccc.int/resource/docs/convkp/kpeng.html
2002 World Earth Summit[a]	Sustainable development	http://www.earthsummit2002.org/Es2002.pdf
United Nations (UN) Sustainable Development Summit, enacted[a] Jan 2016[b]	Sustainable development goals 2030	http://www.un.org/sustainabledevelopment/sustainable-development-goals/

Source: [a]Cornell University Law School, Legal Information Institute (n.d.); [b]United Nations (2017)

global implications of decreasing forest and plant life are important. Reduction in these natural resources equates to less capacity to perform oxygen-producing photosynthesis and to provide root systems to stabilize ground water, cover to protect fresh water systems from evaporation, and impede against natural disasters such as landslides, avalanches, and coastal erosion. Thus, these and other human altered environmental conditions "can directly impose health risks or impair ecosystem services that subsequently influence health" (Myers et al. 2013, p.18756). International agreements (Table 5.1) represent an overarching method to manage natural water resources (e.g., oceans, fisheries, polar ice caps) and atmospheric conditions by monitoring and reducing carbon emissions and other airborne particulates (Cornell University n.d.).

The Rio Declaration captures the important nature of preserving natural forests and recommending the utilization of environmental impact assessments to limit the impact of development while the Kyoto Protocol is particularly concerned with reducing carbon emissions. Both are important to human health having direct and indirect impact on air and water quality. While the international declarations include overlapping ideologies to protect natural resources, they also generate a framework

for cooperative action to prompt national governments to build environmental governance into policy directives. INTOSAI recommends that achieving this objective requires that all nations pool resources and share knowledge to effectively implement global initiatives towards sustainable resource management (2013).

Consequently, these international treatises must trickle down to national objectives in which the general framework is applied to conditions specific to each country. Taking into consideration such information as production activity, population growth, population movement, current land use, natural resources, and national policy will eventually form planning systems and new policy to address these and other environmental conditions (Choi and Lee 2016).

Regional policy (e.g., states, multi-national) and local governments further build upon this framework to make local government environmental and land use decisions encompassing a wide array of guidance and public law. Subsequently, variance in land use strategies is inherently different even within national boundaries due to several factors. They include dynamic conditions, such as population or demographic changes, but also the level of cooperation, types and number of institutions, roles of leadership defined in statutes and development of partnerships embedded into the political structure and policy development process (OECD 2017a, 2017b).

Other key factors to consider include, "the types of actors involved in land use governance and even the levels of social trust in a society, which affects relationships between and among residents, businesses, governments and non-governmental groups" (OECD 2017b, p.15). Determining the project scale and the span of cooperation and collaboration between and among the economic regions will help to streamline the number of spatial planning stakeholders making success feasible through improved coordination and monitoring of multi-sourced funds (Cheshire 2007; Institute for Spatial and Landscape Development 2008; Tudor 2014; Turkoglu et al. 2012).

Access to land has extended socioeconomic consequences in addition to the impact of land use on environmental conditions due to the high value placed on land, built environment, and property. Notable is that land use decisions can increase land value impacting other areas of quality of life, such as housing affordability, and the subsequent impact on economic growth and production (OECD 2017b). These disparities are in direct contrast to the United Nations (UN) Sustainable Development Goals (SDGs) emphasizing economic opportunity (Goal 8), reduced inequalities (Goal 10), and sustainable human settlements (Goal 11) (UN 2017).

The regional capacity to promote clean air and retain ground water sources through natural plant life and vegetation found in forest areas and a strong agricultural presence is important to elevating populations out of poverty, providing a healthier environment, and increasing quality of life. On the other hand, the problem of the impact of agriculture on natural resources and the environment remains a dilemma because of ecosystem destruction. Following international guidelines has led to the introduction of various instruments (e.g., regulatory and economic) as well as collaborative arrangements to control agricultural expansion to limit natural habitat encroachment. They include national regulation in Brazil, community-based

partnerships in Australia, and economic instruments in the United States that have achieved moderate success but not without pitfalls (Tanentzap et al. 2015). Researchers demonstrate that local obstacles exist to policy implementation (e.g., enforcement, implementation cost); social rewards for local partnerships may limit long-term, national solutions; and the problematic nature of environmental outcomes as an incentive as opposed to economic benefits in the long-term sustainability of individual farmers (Tanentzap et al. 2015).

To further complicate the matter, some of the land required by farmers and cattle ranchers has been at the expense of forests. Examples include the development of oil palm plantations in the lowland rainforests of Indonesia, cattle ranches established on the savanna of Brazil, and soybean production in parts of the Amazon rainforest (McClellan 2017). "Primary forests account for 80% of land biodiversity" and "exchange of carbon between vegetation, soil and atmosphere" (INTOSAI 2013, p.50). The destruction of these habitats often releases plant, animal, and insect life into foreign areas unable to contain the unique protective balance within the natural ecosystem (Ostfeld 2017a). "The destruction of forest habitats for many species facilitates the transmission of infectious diseases to humans through contact with mosquitoes, monkeys, virus- and bacteria-carrying rodents that are potentially hazardous to humans" (INTOSAI 2013, p.50). The persistence of malaria and the introduction of the Zika Virus are two examples of the public health consequences of the transition from forest to agricultural areas (Robbins 2016).

Therefore, developing ways to counter this effect is important to maintaining biodiversity and abating infectious and zoonotic disease. Environmental research institutions, such as the Stanford Woods Institute for the Environment, report that one way to responsibly expand agriculture with less environmental impact is to clear forests along the outer perimeter versus cutting out tracts within forest boundaries (Chaplin-Kramer et al. 2015; Jordan 2015; Solie 2015). Chaplin-Kramer's et al. method of spatially implicit analysis and planning optimizes large-scale land mass conversion focusing on how land is converted and not just the prevailing system of analysis that relies on the total quantity of land slated for conversion (2015). This novel perspective that values nature reports the impact on the whole system by reducing total potential deforestation impact (e.g., biodiversity loss, carbon storage) and enveloping community, social development and economic sustainability.

Nonetheless, food demand and living space for a growing population often require hard tradeoffs apparent in the national socioeconomic status of a country and lack of policy limiting deforestation for agriculture, building materials, fuel, and other uses (Table 5.2). Despite forest losses reported in low and lower middle-income countries whose citizens depend on these resources or daily needs, many governments have not enacted a quota or provide best practice methods to educate citizens to follow that could limit destruction.

Table 5.2 demonstrates that while low-income countries have gained 647,126 km^2 (249,857 mi^2 or about 1916 mi^2 less than the size of Afghanistan in 2013) of land used for agriculture from 2000 to 2014, they have simultaneously lost about 252,280 km^2 (97,406 mi^2 or 2480 mi^2 more than the size of Guinea in 2013) of natural forest land from 2000 to 2015. On the other hand, high-income countries have

Table 5.2 The World Bank world development indicators for forest and agricultural land use, square kilometers (km^2) based on country socioeconomic status†††

Socioeconomic Status†	Agriculture[a] km^2		% Land Area[d††] Agriculture		Forest[b] km^2		% Land Area Forest[c††]	
	2000	2014	2000	2014	2000	2015	2000	2015
High Income	13,510,032	12,748,640	38.56	36.41	9,994,008	10,090,494	28.56	28.85
Upper Middle Income	20,236,524	20,454,795	34.84	35.16	20,234,599	20,174,822	34.77	34.68
Middle-Income Aggregate‡	31,027,899	30,653,799	38.19	37.69	26,479,802	26,071,323	32.55	32.06
Lower Middle Income	10,791,375	10,199,004	46.62	44.07	6,245,203	5,896,501	26.98	25.48
Low Income	4,888,131	5,535,257	36.53	39.23	3,990,720	3,738,440	29.82	27.40

Source: [a]The World Bank (2017a); [b]The World Bank (2017b); [c]The World Bank (2017c); [d]The World Bank (2017d). All based on most recent complete available data.

Notes: †Socioeconomic status is based on the 2015 Gross National Income (GNI) per capita defined as the average income per citizen. Low-income economies was $1025 or less such as Haiti, Tanzania, Senegal, and Cambodia; Lower middle income between $1026 and $4035 such as Cambodia, Cameroon, and Kenya; ‡Middle-income aggregate between $1026 and $12,475 combines the categories of Lower Middle Income and Upper Middle Income; Upper middle income between $4036 and $12,475 such as China, Egypt, Nigeria, Jordan, or Ecuador; and High income was $12,476 or more such as Singapore, Luxembourg, and the United Arab Emirates; ††rounded to two decimal places; †††Multiple # of $km^2 \times 0.38610216$ = # square miles (mi^2). Find the international list of the World Bank GNI per capita at https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?year_high_desc=true.

lost 761,392 km^2 (293,976 mi^2 or about 2046 mi^2 more than the size of Chile in 2013) of agricultural land and 96,486 km^2 (37,253 mi^2 or 1334 mi^2 more than the size of Hungary in 2013) of forest. Of course, the impact of decreasing agricultural space is more easily offset by higher income nations than lower income nations because of their greater capacity to import goods. (Country land area to provide readers with a spatial reference of these losses and gains in this and following paragraphs were obtained from Compare Infobase, Ltd. 2017; NationMaster 2013.)

However, a compelling item in Table 5.2 is the Middle-Income Aggregate of the Lower Middle-Income and Upper Middle-Income countries. In this socioeconomic national status, we find losses in both land for agriculture (−341,100 km^2 or 131,699.45 mi^2 or 1100 mi^2 more than the size of Finland in 2013) and forest (−408,479 km^2 or 157,715 mi^2 or 667 mi^2 more than the size of the nation of Paraguay). The losses of agriculture and forest land in lower income nations, −592,371 and −348,702 km^2, respectively, negate the positive improvements in Upper Middle-income nations, +218,271 and +59,777 km^2, respectively. If not offset by the Upper Middle-Income nations, the lower middle-income losses would have been comparable to agricultural loss slightly less than the size of Madagascar and forest loss approaching the size of Germany.

Yet, there is a turn towards national resource conservation based on empirical evidence linking environmental conservation to health benefits. For example, Cambodian policymakers can now make an informed decision to support tropical forest conservation there based on research conducted by the National University of Singapore revealing the negative impact on children's morbidity and mortality (e.g., diarrhea, fever, and acute respiratory infection) linked to deforestation (Ostfeld 2017b; Pienkowski et al. 2017).

The tradeoff between increasing agricultural land at the expense of forests is not without hazard to natural habitats and public health. The next section relays the problem of land use imbalance and the global consequences to public health.

5.3 Balancing Urgent Global Population Needs Against Long-Term Global Population Health

> Even though land use planning is primarily a local task and concerns local issues, it has consequences for issues of national global importance: the long-term stability of ecosystems, social justice, food and energy security, long-term economic growth, housing costs, and the mitigation of and adaption to climate change. Planning also has a crucial role to play to accomplish 6 of the 17 UN Sustainable Development Goals. (OECD 2017b, p.14)

The role of international treatise embedded in the UN SDGs is important to a global approach to a multiplicity of environmental and population health concerns. Table 5.3 demonstrates that land use planning and implementation plays a pivotal role towards achieving overall objectives. The difficulty in simultaneously achieving balance in global population needs for quality of life, environmental protection, and population health with more than one-third of the SDGs emanating from land use planning is daunting. This statement is based on the inherent nature of multiple government functions embedded in the topic of land use and the potential

Table 5.3 United Nations sustainable development goals prominent in planning (United Nations 2017)

	Goal brief	Objective(s)
7	Affordable and clean energy	Ensure access to inexpensive, reliable, and sustainable energy
9	Industry, innovation, and infrastructure	Foster innovation to bring forth sustainable industrialization and resilient infrastructure
11	Sustainable cities and communities	Plan inclusive human settlements and cities factoring in safety, resilience, and sustainability
13	Climate action	Prioritize climate change remediation
14	Life below water	Develop seascapes using sustainable development
15	Life on land	Remediate land degradation through restoration and incorporating sustainable management practices for new land development to protect, halt, and reverse degradation and biodiversity loss

for conflict between and among sectoral government objectives. But with growing recognition of the link between man and nature and cooperative response, we would add that the task, though daunting, is not impossible.

Unprecedented global land use planning and resource management may be the necessary step in balancing these variety of outputs with limited natural resource inputs. While the OECD Land-Use Governance Survey conducted in 2015–2016 across the 32 OECD nations reports that "all levels of government use spatial and land-use plans as instruments to shape land use" (OECD 2017a, p.9), spatial or strategic planning and policy is emphasized by national governments while land use objectives are determined locally for most nations with some exception. However, large municipalities with dense population, overlapping regions, or overlapping national boundaries may require a regional plan and coordination (Institute for Spatial and Landscape Development 2008; Tudor 2014; Turkoglu et al. 2012). "Spatial plans aim to structure the general pattern of human activity across space without necessarily determining land use at any given location" while "land-use plans aim to prescribe particular land used for specific locations" (OECD 2017a, p.9).

Clearly the role of land use planning and resource management must continue to morph and stretch beyond current limitations to achieve global objectives inclusive of public health. Novel policy development, critical thinking on the dual nature of environmental and public health, and innovation in the research community may be a good place to start.

New policy development, though sometimes seen as the slow road to resolution, is certainly important as a guide to national and lesser levels of government to plan, budget, and to obtain resources to implement policy instruments able to define and address national problems contributing to global environmental decay. However, what is often overlooked is the impact of current policy on the forward motion of novel legislation. Existing land use policies detail "how land is permitted to be used" based on environmental regulations, building codes, spatial and land use planning while nonspatial policies (e.g., tax codes, agriculture, energy policy) impact "how individuals and businesses want to use land" sometimes deterring development (OECD 2017b, p.75). The problematic conflict between spatial and nonspatial regulation is that land use decisions stemming from these separate restrictions result in "how land is [actually] used" (2017b, p.75) versus potentially advantageous positioning of new development (e.g., transportation, housing, grocery store, bike path, industry). This regulatory gap, if you will, presents another problem—"how to ensure that national objectives are represented in local land-use regulations" (OECD 2017a, p.10). How land is used comes into sharper focus considering this perceptive observation bringing forth "the question of how to provide clear and unambiguous regulations, while at the same time leaving lower levels of government and private actors sufficient flexibility" (OECD 2017a, p.10). Targeting policy in answer to this question provides a starting point for application of international environmental and public health objectives embedded in the UN SDGs.

Other approaches to problem resolution offer new opportunities to utilize critical thinking, science, and technology to balance environmental health with public

health. First, Richard Ostfeld of the Cary Institute of Ecosystem Studies in Millbrook, NY has considered the dual concern for environmental and public health proposing to formulate new policy under the umbrella of planetary health (2017a). "Careful analysis of the mechanisms that underlie co-benefits to environmental and human health, could uncover key principles and inform new applications, while providing concrete options for policy and management" (Ostfeld 2017a, p.e2). Ostfeld proposes key metrics, such as species diversity and risk of exposure to zoonotic diseases, that concurrently afford the opportunity to gauge impact on both environmental and human health, respectively (2017a). Second, other research proposes scientific approaches to mitigating some of the environmental impact on respiratory health by increasing the land use land cover (LULC) in critical areas. Rao et al. (2017) suggest increasing the tree canopy by 5% can reduce the concentrated amount of ambient air pollution in critical areas by 6%, and thus improve respiratory health in those locations with benefits to the entire city. The introduction of metric development and scientific research to address concurrent environmental and health problems through critical thinking, research design, modeling, and simulation promises to substantiate a common interest towards balancing both components.

5.4 Summary

This chapter generally introduces the primary treatises of international environmental law and land use offering several resources for further exploration. These international laws provide the foundation for national, regional, and local policy. Focusing on two major areas of land use: (1) agriculture land 2000–2014 and (2) forest land 2000–2015, global dynamic changes in natural resources are categorized according to their socioeconomic status. Selection of representation of the data in this fashion emphasizes the global distribution of these natural resources, their change in availability, and the capacity of nations to address environmental destruction based on their financial capacity. The impact of forest loss is particularly hard felt in low and lower middle-income nations with significant impact to health. However, the introduction of critical thinking and scientific research to address concurrent environmental and health problems promises to substantiate a common interest towards balancing both components.

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Glossary

Biodiversity The number of different species contained within specific ecosystems

Biodiversity loss A consequence of land degradation; when species are lost to an ecosystem due to deforestation and other human activity

Deforestation A consequence of land degradation; when human activity strip forests without concern for the long-term consequences of land and water quality

Desertification One consequence of land degradation; when a region that is already characterized as being dry with relatively less precipitation or naturally occurring bodies of water, plants, and animals suffers losses from human activity, weather, and other conditions

Environmental impact assessments Analyzing various effects on social, economic, environmental conditions and taking measures to minimize impact of new development

Land degradation When land is unable to produce natural resources (e.g., crops, wilderness, grazing areas) due to overuse, contamination or other causes elicited from human activity and production

Land use Linked to several major areas of public administration such as natural resource management, waste disposal, transportation, urbanization, agriculture, recreation, and forest

Land use planning Task of local governments to utilize national or regional spatial planning guidance to formulate specific land use

Malaria Dangerous disease transmitted when an infected mosquito bites several humans; impacts human red blood cells that, in turn, impact organs such as the brain, kidneys, and liver

Soil erosion A consequence of land degradation; when human activity removes soil stabilizing canopies that protect water resources and soil fertility is lost as weather (e.g., wind, rain, direct sunlight) removes top soil rendering it useless for crops

Spatial planning A task of national governments to determine the potential general structure of human activity to guide local planners on specific land use

Zika Virus Spread by infectious mosquitoes; particularly harmful to fetus development

Zoonotic disease The transmission of infectious diseases in animals to humans caused by a variety of pathogens including viruses (e.g., rabies, HIV, and Ebola), bacteria (anthrax found in soil consumed by goats, sheep; bartonella from cat scratches), fungi (dermatomycoses from rats), or parasitic activity (Trichinella found in cows and pigs)

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