CHAPTER 4

Natural Resources and Environment Governance for Nature-Positive Food Systems

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KEY MESSAGES

- COVID-19 has brought home the necessity of better integration of natural resources and ecosystems with human food systems to increase the resilience, health, and sustainability of food systems.
- Environmental degradation and climate change, in which food systems play a prominent role, are likely to increase the frequency and severity of natural disasters and may increase future pandemics, both of which cause shocks to food and health systems.
- Common agricultural practices often degrade ecosystem services such as soil fertility and natural pest control, and can contribute to greater reliance on external inputs with potential for further damage.
- Poor people are heavily dependent on natural resources for their livelihoods and are often most severely affected by environmental shocks and resource depletion.
- The vicious cycle of unsustainable resource use and environmental degradation must be replaced with

a virtuous cycle of healthier food and ecosystems using approaches that improve outcomes for humans and nature.

- National laws and institutions, plus local formal and informal institutions and norms about respecting (or exploiting) nature, shape how people interact with the natural resource base and thus the outcomes for food and natural systems.

RECOMMENDATIONS

- Protect environmental health to reduce the likelihood of emergent zoonotic diseases and natural disasters.
- Foster an integrated approach by thinking in terms of “eco-agri-food systems” that encompass natural resources and ecosystem services as part of food system policies and institutions.
- Strive for “nature-positive” food systems that maintain or even restore ecosystems and the natural resources and ecosystem services on which we all depend for our food.

- Assess how laws, institutions, and mindsets affect ecosystem functions to help identify and implement effective incentives – from regulation to market-based and normative incentives – for sustainable, nature-positive food systems.
- Tap local knowledge and goals through participatory processes and develop multistakeholder platforms to support effective, inclusive governance.
- Promote landscape- and watershed-level governance to maintain complex multifunctional landscapes that increase ecosystem services.

All food systems depend on the world's stock of natural assets, including soil, air, water, and all living things, and on the range of ecosystem services they generate. Maintenance of soil fertility, nutrient cycling, pollination, biological pest control, climate regulation, and water purification are among the many ecosystem services that are vital to agricultural production.¹ Yet human activities are causing rapid and sometimes irreversible damage to these resources and services. Climate change, land degradation, biodiversity loss, groundwater mining, solid waste, and water and air pollution, in turn, disrupt human social and economic activities, especially in our food systems. These problems are compounded by growing inequities in access to natural resources and basic necessities such as water and food; by poor governance of natural resources; by a short-term focus on GDP-driven economic growth; and by underinvestment in innovations that can reduce our environmental footprint.

The coronavirus pandemic has brought home the necessity of managing our natural resources and ecosystems to increase the resilience, health, safety, and sustainability of our food systems. The novel coronavirus likely emerged from intensified human-wildlife

interactions, linked to habitat loss and environmental degradation, and future pandemics are almost certain to be caused by zoonotic diseases emerging from disrupted habitats. Other global and regional shocks to food systems and human wellbeing will also be sparked by environmental degradation and climate-change-induced disruptions that lead to conflict and worsening food security, with the largest impact on poor and vulnerable populations. Meeting the Sustainable Development Goals of Ending Poverty (SDG1), Zero Hunger (SDG2), and Good Health and Well-Being (SDG3) requires action on SDG15 to Protect, Restore, and Promote Sustainable Use of Terrestrial Ecosystems. Yet the current pandemic and other crises often mean that investments in the environment and sustainability are postponed or ignored as funding is directed to immediate humanitarian needs.²

Expanding our concept of “food systems” to “eco-agri-food systems”³ – to encompass natural resources and ecosystem services – can help us meet the SDGs, reduce the impact of food production, and transform our food systems in the long term. With greater investment in the integration of natural systems with human food systems, we can even move toward “nature-positive” systems that restore ecosystems and increase the provision of ecosystem services.

FOOD SYSTEMS AND ENVIRONMENTAL DEGRADATION

Underinvestment in agriculture, together with an underappreciation of the crucial role of nature in sustaining our food systems, has contributed to drastic deforestation as well as degradation of land and water systems that in turn affect agricultural productivity.⁴ Some 27 percent of global forest loss from 2001 to 2015 can be attributed to land-use change for production of commodities such as soybeans, beef, and palm oil. Other culprits are forestry (26 percent), shifting agriculture (24 percent), and wildfires (23 percent).⁵ The near disappearance of some of the world’s large rivers and freshwater lakes, such as the Aral Sea and Lake Chad, and the associated public health impacts have been linked to excessive irrigation development.⁶ Heavy application of agrochemicals has contributed to the extinction of many insect species, jeopardizing the sustained provisioning of insect-based

ecosystem services and threatening a progressive collapse of natural and human-dominated ecosystems alike.⁷ Injudicious use of synthetic pesticides, in particular, is associated with biodiversity loss and human health impacts.⁸ Agriculture also contributes significantly to greenhouse gas emissions.⁹ While intensive, high-input farming that increases land productivity can degrade natural systems, low-input production systems, such as those in large parts of Africa south of the Sahara, can lead to rapid conversion of remaining natural habitats,¹⁰ including tropical forests, but achieve only low productivity levels, which are linked to food insecurity and civil strife.

ENVIRONMENTAL DEGRADATION AND SHOCKS

Among the consequences of habitat loss as agriculture expands is a growing risk of zoonotic and vector-borne diseases. Human incursion into forests and intensification of livestock production can prompt the crossover of pathogens from wildlife to livestock and people, facilitating the spread of zoonotic diseases such as Ebola, SARS, MERS, Lyme disease, and Rift Valley fever. Similarly, expansion of irrigation can increase risks of mosquito-borne diseases including malaria, Zika, dengue, and chikungunya. Agricultural drivers were likely associated with more than a quarter of all – and more than half of all zoonotic – infectious diseases that have emerged in humans since 1940.¹¹ Thus, protecting environmental health is essential to protect human and animal health.¹²

Degradation of ecosystems, together with climate change, threatens the productivity of our food systems; it also causes shocks such as droughts and floods that, like the coronavirus pandemic, affect human livelihoods, health, and long-term options. The biodiversity that underpins food production is disappearing owing to land use changes, pollution, and climate change.¹³ Wetlands, tropical forests, croplands, and grazing lands are particularly affected by degradation, increasing risks for food, nutrition, and water security. And climate change affects all these systems, adding another stressor to natural resources, including increasingly frequent natural disasters.

This depletion of vital natural capital often affects the world’s poorest people most severely.¹⁴ Land degradation alone already affects the wellbeing of 3.2 billion people.¹⁵ High poverty levels and

dependence of livelihoods on unsustainable use of natural resources creates the conditions for a “poverty-environmental degradation” trap – a vicious cycle in which poverty leads to resource degradation, which leads to more poverty, increasing both human vulnerability to natural hazards and the fragility of the ecosystems on which poor people depend.¹⁶

SYSTEMS THINKING FOR NATURE-POSITIVE FOOD SYSTEMS

By recognizing the dependence of agriculture – and food systems more broadly – on nature, we can focus attention on reducing damage caused by production, or even better, on achieving “nature-positive” production that meets food needs *and* protects and restores ecosystems (Box 1). For example, the ecosystem services provided by noncrop habitat and diverse land use in agricultural landscapes are essential to farming and, if

fostered, can reduce dependence on agrochemicals.¹⁷ These services include pest suppression, soil conservation, nutrient retention, and crop pollination.¹⁸ Diverse land uses also support biodiversity and cultural assets essential to human wellbeing.¹⁹ Common agricultural production practices too often degrade ecosystem services, which leads to greater reliance on purchased inputs and an increased propensity to further damage ecosystem services.²⁰ Breaking out of this vicious cycle requires integrated solutions.

In some cases, innovations in “future foods” can decouple agriculture from nature and reduce environmental impacts. Alternative foods such as mycoproteins, insects, cultured meat, spirulina, sugar kelp, and chlorella hold promise to provide the full spectrum of essential macro- and micronutrients, and could reduce our reliance on traditional production systems for crops, fish, and livestock.²¹ But these innovations will not widely replace traditional production in the near future.

BOX 1 ECO-AGRI-FOOD SYSTEMS

“Eco-agri-food systems,” a term developed by The Economics of Ecosystems and Biodiversity (TEEB) initiative, emphasizes entire value chains, as well as the ecological, economic, social, and human foundations of food.^a Natural ecosystems provide some of the largest and most important but economically invisible inputs to most types of agriculture through ecosystem services. Many targets of the Sustainable Development Goals are underpinned by the delivery of ecosystem services, including those pertaining to the food system.^b

Agricultural ecosystems (agro-ecosystems) are now the world’s largest ecosystems. They are actively managed by humans to provide food, fiber, and fuel and draw upon many supporting and regulating services as “inputs” to production, such as soil fertility, nutrient cycling, pollination, and biological pest control. Some of these services, such as soil fertility, are determined at the field or farm scale and, hence, are driven by management choices of private land users; others, such as pest and plant-disease control and pollination, are driven by landscape features including the diversity and spatial configuration of different types of land use. Landscape features are, in turn, determined by varying mixes of private, collective, and public land-rights holders. Some ecosystem services, such as sediment retention and nutrient retention, are delivered at even larger spatial scales (for example, watersheds) and influenced by both exogenous factors such as weather, topography, and management practices adopted by multiple land users.

In sum, a spectrum of local and larger-scale factors typically determines ecosystem service provision. Critically, ecosystem services and agricultural management are closely intertwined – ecosystem services influence management, and management in turn, particularly the choice of techniques, influences ecosystem services. This tight coupling of agricultural and natural ecosystems means that how eco-agri-food systems are managed matters not only to food security and the economy but also to the health of the planet.

Source: ^aTEEB (The Economics of Ecosystems and Biodiversity), *Measuring What Matters in Agriculture and Food Systems: A Synthesis of the Results and Recommendations of TEEB for Agriculture and Food’s Scientific and Economic Foundations Report* (Geneva: UN Environment, 2018); ^bS. Wood et al., “Distilling the Role of Ecosystem Services in the Sustainable Development Goals,” *Ecosystem Services* 29A (2018): 70–82.

FIGURE 1 Actions for nature-positive food systems

INTEGRATION OF NATURAL AND AGRICULTURAL SYSTEMS

By helping producers use agriculture to restore and maintain ecosystem services, better integration of natural and agricultural systems provides the key to greater sustainability and resilience. For example, sequestration of carbon in agroforestry systems can be increased. Wetlands, if maintained or restored, will provide water storage and purification, buffer climatic extremes, and provide a source of income and food diversification. Habitat conservation and coordinated landscape management at scale can support healthier ecosystems and enhanced biological pest-control services. And expanded collection and conservation of plant genetic resources *in situ* can provide resources for future crop development. Various certification efforts, such as that of the Rainforest Alliance, and – on the consumption side – the “ugly” fruit movement have helped to advance some of these ideas. None, however, is a silver bullet.

Applying systems thinking – that is, taking into account the overall structure, interlinkages, and feedback loops to the food system – can allow us to develop synergistic solutions that support both food security and planetary health. Systems thinking can also be used to redefine food system boundaries, expand the range of externalities that are taken into account,

and help us to reconsider what is within the sphere of influence and control of the system; this is important for addressing the interrelated nature of the SDGs that affect food system outcomes.

The proposal to redefine food systems as “eco-agri-food systems,” put forward by The Economics of Ecosystems and Biodiversity (TEEB) study, effectively includes all activities along the food value chain in one single system – from ecosystems to farms to intermediaries and processors to retailers and consumers.²² This allows us to recognize and account for all major externalities along these value chains, and to work toward increasing nature-positive activities and reducing nature-negative activities (Figure 1). Putting this framework into operation will be challenging; nevertheless, the holistic system lens can help identify potential synergies that can contribute to multiple goals.

The linkages between the natural and agricultural systems imply that these systems can improve in tandem if we put in place a virtuous cycle of healthier ecosystems and reduced dependence on external inputs, with further positive implications for the environment.²³ A systems view requires concerted action in many areas, beginning with valuing ecosystem services and investing in them, including appropriate technologies and institutions for different contexts.

Taking a landscape approach is one way to put this into practice. For example, working at the landscape level, sustainable intensification of some areas through more efficient use of water, land, and other inputs, plus adoption of higher-yielding seeds, precision agriculture, and judicious use of (clean-energy-powered) irrigation and fertilizers, followed by solar-powered agro-processing, can reduce pressures on other natural areas, such as forest frontiers and semi-natural habitats, and so prevent degradation and further habitat loss.

To achieve better integration of natural and agricultural systems, appropriate governance will be essential.

GOVERNANCE FOR NATURE-POSITIVE FOOD SYSTEMS

Governance affects how people interact with each other and with the natural resource base. Through a variety of decision-making mechanisms, governance shapes agreements over rights, responsibilities, rules, and regulations, which in turn shape people's behavior and the outcomes for food and natural systems.²⁴ Although "governance" is often conflated with "governments," the state is not the only source of authority or rules. National laws and government agencies certainly play a role, but more local formal and informal institutions, such as resource user groups, can be equally or more important. Local social norms about respecting (or exploiting) nature also shape behavior. Assessing the extent to which laws, regulations, and the norms of state and local actors value ecosystem services can be an important starting point for understanding the motivations of these actors and identifying effective incentive structures for nature-positive food systems.

GOVERNANCE FOR LANDSCAPES AND COMMUNITIES

Landscape-level governance is particularly important for the sound use of natural resources and provision of ecosystem services. Much agricultural production takes place within a mosaic of land uses, including crop fields, animal grazing areas, forests and agroforestry areas, wetlands, and water bodies. There is also a mosaic of landownership and governance. Crop fields and agroforestry lands are often held privately; grazing lands, forests, wetlands, and water bodies are often held collectively and managed as community

commons, even when they are officially under state ownership. Maintaining complex, multifunctional landscapes requires coordination across multiple uses and actors to increase ecosystem services and reduce negative environmental impacts. This generally requires a combination of formal and informal coordination mechanisms. It is challenging for such governance arrangements to keep pace with rapid technological changes, as illustrated by depletion of groundwater aquifers when mechanized pumping allows farmers to extract water faster than it is recharged. Building trust among the actors and sharing reliable information are among the key ingredients for effective deliberation and collective problem-solving.²⁵

Multistakeholder platforms (MSPs) are increasingly seen as a useful approach for creating negotiation space and knowledge exchange in integrated landscape initiatives.²⁶ By bringing together different actors, including government, the private sector, and civil society, MSPs can help achieve a shared understanding of how each actor's behavior affects others, and facilitate agreements on rules, rewards, and penalties for actions that increase or decrease ecosystem services. The Nairobi Water Fund, for example, is a recently formed MSP that aims to improve the efficiency and allocation of water use across the Upper Tana watershed (Box 2). However, MSP arrangements are not a panacea: power differences among groups will affect whose voices are heard, and some agreements reached may not be enforceable. Government actors can lend legitimacy to MSP decisions and support follow-up on agreements, thus enhancing trust and enforcement of agreements.

INCENTIVES FOR SUSTAINABILITY

Policies for sustainable management of resources have largely focused on regulatory instruments that decree what people may or may not do, such as banning burning or cutting down trees, in order to reduce "nature-negative" impacts. However, a number of policies reward nature-positive practices that sustain environmental services. For example, payment for ecosystem services (PES) initiatives provide financial rewards for sustainable practices, such as paying people to plant or keep trees.²⁷ Watershed management programs designed to manage upstream-downstream linkages of water, soils, and pollutants likewise offer

BOX 2 NAIROBI WATER FUND ENCOURAGES SUSTAINABLE PRACTICES IN THE UPPER TANA RIVER WATERSHED

The Nairobi Water Fund was recently set up by The Nature Conservancy and partners to improve downstream water quality for millions of water users and provide benefits to farmers from more sustainable water use. The Fund provides farmers in Kenya's Upper Tana River Basin with support for small-scale water-storage development, grass and tree seedlings, and expert advice on sustainable agricultural practices, including terracing, planting napier grass for erosion control and livestock fodder, and maintaining vegetative buffers near the river's tributaries. For farmers, these practices have potential to increase crop yields. Downstream benefits include reduced water-treatment costs and increased hydropower generation. Together, these benefits are sufficient to create a "business case" for public and private sector funding. Engagement of various stakeholders was important in creating buy-in.^a However, even with these engagement processes, women and farmers with small landholdings are often unable to adopt space-consuming sustainable land management practices, such as use of water-storage pans or setting land aside for buffers; identifying the preferences and abilities of both women and men could help address this disparity.^b

Source: ^aA.L. Vogl et al., "Valuing Investments in Sustainable Land Management in the Upper Tana River Basin, Kenya," *Journal of Environmental Management* 195, Part 1 (2017): 78-91. ^bR. Nijbroek and E. Wangui, *What Women and Men Want: Considering Gender for Successful, Sustainable Land Management Programs: Lessons Learned from the Nairobi Water Fund*, GLF Brief 7 (Global Landscapes Forum, CIFOR, 2018).

payments in cash or kind to upstream farmers and residents to change their practices in ways that improve the flow and quality of downstream water.

Both coercive regulatory and remunerative payment approaches require considerable information for implementation, enabling institutions (such as tenure security), and enforcement authority (Chapter 2). This makes it challenging for state agencies or PES schemes to operate locally appropriate programs over large areas. However, state efforts can be complemented by local institutions and by normative incentives. Norms regarding the environment can strongly shape people's behavior, especially in cooperating for collective goods.²⁸ Norms for sustainable practices can be strengthened by changing the mindset of officials and community actors through campaigns that highlight the importance of ecosystem services, and that recognize and praise certain behaviors (such as planting trees) or create a stigma for other behaviors (such as deforestation).

Given the urgency and complexity of transforming food systems to meet the needs of all, both today and in the future, all three types of incentive mechanisms are needed: regulation, financial rewards, and

"nature-positive" norms. Experience has shown that sustainable solutions require not only technical information and government intervention, but also active stakeholder involvement through a variety of participatory processes that tap into local knowledge and objectives.²⁹ Box 3 illustrates this through the experience of the Promise of Commons initiative in India.

NATURE-POSITIVE APPROACHES

Food systems played a key role in the enormous improvements in living conditions registered over the past 50 years. Yet, many food systems are now widely viewed as seriously flawed or "broken";³⁰ nearly 10 percent of the world's population suffers from persistent hunger; low-quality diets for many perpetuate malnutrition over generations; and the environmental costs of our food systems affect climate, water, and food production. COVID-19 has been a wake-up call for agriculture and food systems to proactively and more aggressively preserve natural systems to reduce the risk of future disease outbreaks, natural disasters, and climate change that may cripple national economies and people's livelihoods.

BOX 3 PROMISE OF COMMONS IN INDIA

In India, over 80 million hectares are classified as “commons,” including community forests, pastures, and water bodies. These common areas provide a source of livelihoods for over 350 million people through fodder and forest products as well as critical ecosystem services, including provisioning of surface and groundwater, soil nutrients, pollination, and pest control. Yet many of these commons have experienced encroachment, decreased vegetative cover, and declining water availability.

To counter these problems, the Foundation for Ecological Security (FES) is using a systems approach to develop the multi-organizational Promise of Commons Initiative. The core elements of this approach are securing community rights over the commons; strengthening collective action for responsible local governance of resources; and access to resources and finance for restoration activities. Securing collective rights is seen as essential to creating the incentives and authority for managing common resources. In addition to forming or strengthening local organizations such as forest- and water-user groups both directly and in partnership with other organizations, FES also pools technical tools, such as water budget calculators, and provides them to communities to help them plan where to plant trees or place water-harvesting structures so as to optimize ecosystem services at the landscape level. The initiative then helps communities tap into rural employment program funds or other public funds to finance restoration projects.

Together with 83 NGO partners, FES currently works with 29,221 villages across 10 ecological regions of India, restoring 8.71 million acres of common lands. FES also works with government agents at the state, district, and subdistrict levels to promote recognition of the value of the commons and overcome the notion that these are “wastelands.” FES convenes multistakeholder platforms that bring government and other agencies together with communities to identify needs and opportunities to improve both governance and technical interventions in the commons in ways that also benefit private agricultural lands and livestock production.

Evaluation studies show marked improvements in a range of ecological and economic indicators related to the Promise of Commons. Standing biomass on the community-managed lands is 2.6 times greater than on unmanaged common lands; and the grass biomass is 2.4 times greater.^a Secure rights and better resource conditions have improved the availability of water, fodder, and nontimber forest products, leading to income gains. On average, household incomes have increased by 30 to 50 percent over a period of 3 to 5 years, and the value of benefits derived from the commons per household per year increased from US\$130 to \$330.^b

Increased incomes and savings have allowed the majority of households to increase spending on food, education, health, housing construction and repair, and purchase of agricultural inputs and assets. The estimated value of returns, including environmental benefits, are eight times the cost of the investment.^c A recent comparison between communities where FES had been working and comparable communities where they had not intervened shows that the coronavirus pandemic had negative effects on farm and nonfarm livelihoods in both types of communities; but those where FES had been working were significantly less likely to resort to risky coping strategies, such as eating seed stocks or taking out loans. This suggests that the FES interventions aimed at improving livelihoods and ecological health have also strengthened resilience.

Source: ^aFES (Foundation for Ecological Security), *Ecological Health Monitoring: A Summary Report 2016–17*, Anand, India, n.d.; ^bFES, *Restoration of Ecological Security as a Means of Improving and Securing Livelihoods in the States of Karnataka and Rajasthan: A Mid-term Assessment*, NR Management Consultants, New Delhi, n.d.; ^cD. Mondal, S. Singh, and J.V. Dhameliya, “Assessing the Value of Our Forests: Quantification and Valuation of Revegetation Efforts,” FES Working Paper (FES, 2005).

While technological solutions, such as cultured meat, offer promise, the largest potential for gains lies in better integration of natural and food systems. Realizing these gains requires broader perspectives that integrate complete landscapes and watersheds and consider these as integral to our human systems. These broad integrative perspectives differ from common reductionist approaches that focus on fields or farms. Nature-positive approaches require new forms of governance that give individual actors confidence that the ecosystems services on which their operations depend will also be nurtured by other actors in the system.

These governance issues often present the thorniest challenge to improving natural and food system integration. Polycentric governance – separate institutions with their own roles and responsibilities, but that are working toward a common objective – presents a promising path forward. Given the scope of the challenges, multiple-incentive mechanisms, such as regulations plus subsidies, can be usefully employed by engaged institutions. At the same time,

the potential role of nature-positive norms must not be forgotten as communities of all sizes grapple with the common property issues that almost invariably arise at the interface of natural and food systems. This is particularly true in lower-income settings, where externally imposed regulations are difficult to enforce, subsidies are difficult to finance, and penalties would have excessive negative impacts on those who are already poor.

The integral dependence of food systems on natural systems means that food systems must work with, and not against, natural systems. Achieving better integration between natural and food systems can be eased by technological solutions; however, governance issues across eco-agri-food systems will likely be more fundamental to transformation and, as such, should be a focus of continued research and experimental practice. Only then will we be able to more proactively address the growing risk of zoonotic diseases and other risks from environmental degradation and disasters that threaten to disrupt our food systems and our lives.

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