

Chapter 2

Introduction to Ecological Dimensions of Hunger

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Introduction

Global hunger is a complex multi-faceted problem that typically has been the domain of agronomists, economists, and rural socialists. Less frequently, however, have we asked what ecology's, and ecologists' contribution might be to alleviating extreme and hidden hunger. Ecology has many contributions to make in finding, and developing ecologically based, sustainable solutions to this development goal. The hunger section of this book, in addition to several other chapters, provides compelling evidence of ecosystem services that are critical to sustaining agricultural production including pollination, pest control, and increasing the stability of agro-ecosystems (Chap. 3). Milder et al. (Chap. 5) demonstrate how taking a landscape scale approach permits the co-existence of production, conservation, and livelihood improvement goals in human dominated landscapes, and gives detailed information on relevant landscape measures appropriate to evaluating the conservation, production, and livelihood status of such landscapes. Remans et al. (Chap. 4) demonstrate that human nutrition is a critical ecosystem function with direct ties to farm-scale agrobiodiversity. All three chapters demonstrate, and define how integrated approaches, including a focus on ecosystem functions in agricultural landscapes, can reduce both acute and hidden hunger.

The UN Hunger Task Force Report, "Halving Hunger: It can be done," published in 2005 by Sanchez and colleagues, reminded us that too many people (852 million in 2005) are still chronically or acutely malnourished. They made a series of general recommendations including calling for the restoration and conservation of the natural

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resources essential for food security, securing local ownership, access, and management rights to forests, fisheries, and rangelands, developing natural resource-based “green enterprises” and paying poor rural communities for environmental services. Agricultural food production is, at its heart, an ecological enterprise that relies on the management of species interactions. Food production is also probably one of the few ecosystem services that has been fully exploited by humans and is the only service to be increasing rather than decreasing as highlighted by the Millennium Ecosystem Assessment. The ecological tradition of elucidating complex systems and relationships between species and the environment while working across multiple scales and disciplines equips ecologists with the tools necessary to tackle similarly and multifaceted problems associated with alleviating hunger.

Agricultural production and biological conservation have often been presented as diametrically opposed. However, agricultural food production is important not only in terms of being the source of our sustenance, it is also the human activity that occupies the greatest extension of the global terrestrial surface area. The “natural capital” of clean water, soils, fish, wildlife, and other resources encompassed in these landscapes provide about two-thirds of household income for the rural poor. As such, agriculture is not only critical to producing the food that sustains us, and to employing the rural poor, it is also essential in maintaining ecosystem services (Chap. 3).

The ecosystem services paradigm highlights synergies between conservation and production, and provides a framework for simultaneously meeting both essential development goals. Farming communities can put wild and associated biodiversity to use for a multitude of ecosystem services including pollination services, pest control services, and multiple soil and water related services (highlighted in Chap. 3). International attention on payment for ecosystem services (PES) has largely focused on payments for carbon, biodiversity conservation, and hydrological services. However, many ecosystem services operate on a much smaller spatial scale, such as the benefits of integrating biodiversity conservation into farm management. Fortunately, interventions that improve the provisioning of ecosystem services at the farm scale frequently are the same as those that improve ecosystem services at larger scales (see Chaps. 3 and 18).

Though there is increasing scientific knowledge regarding ecological integration in agroecosystems, several hurdles remain. For one, the dialog between scientific knowledge and local knowledge must be improved (Chap. 3, Vol. 2) to fill the gap between these distinct worldviews. Improving the role of ecology in education will be essential in bridging this gap, particularly if the future global economy is to be based on a sound understanding of the impact of humans on ecosystems and the environment. In a similar vein, March (Chap. 23) in this volume discusses a new model in seed distribution systems for rural farmers that stresses the importance of understanding farmers’ seed needs and preferences, which helps build resilience into social and agroecological systems.

Second, the planning and management of ecosystem services for hunger alleviation must take a landscape scale perspective in order to be truly integrative as is highlighted by Milder et al. in Chap. 5. The landscape scale is the level at which

many ecosystem processes operate and at which synergies and tradeoffs between and among environment and development objectives are often mediated (O'Neill et al. 1997). Bringing multiple stakeholders to the table to understand individual perspectives is the first step in building a shared vision that includes ecological integration leading to actions and policies that increase synergies while decreasing tradeoffs. Milder et al. in their chapter, demonstrate that by revealing landscape dynamics across multiple spatial and temporal scales, these processes can also help identify the “bottlenecks” to sustainable rural development, many of which may be non-obvious. The landscape highlighted by Milder et al. includes the explicit recognition that conservation and production goals are critical components of landscape management. Estrada and DeClerck (Chap. 14, Vol. 2) provide an example as to how landscape ecology can be used to locate farms that are critical to providing ecosystem services within a larger landscape.

Remans et al. (Chap. 4) adopt the concept of econutrition, highlighting the relationships between agricultural production, ecology, and human nutrition. The authors discuss how interdisciplinary approaches that combine the knowledge bases of ecologists, nutritionists, and agronomists to develop strategies to alleviate hidden hunger. Increasing crop functional diversity, for example, can alleviate anemia, particularly in communities that are strongly dependent on subsistence agriculture. Second, the integration of ecology with nutrition fosters environmental interventions that simultaneously have direct and indirect impacts on human health and nutritional well-being.

It is important to recognize that development interventions should not occur in isolation, and that finding opportunities for synergies between development goals are essential. Synergies are found when providing corridors for wild biodiversity simultaneously increases crop production by increasing pollinator services, creates barriers for crop pests (Chap. 3), improves water quality (Chap. 6–9), or improves human health (Chap. 10–14). Such examples for bundling ecosystem services present opportunities for reducing the cost of ecosystem services. Effective management of multiple services will require a strong ecological understanding of the relationship between land use and the provisioning of these services.

The world's poor do not solely depend on terrestrial landscapes as a primary source of food. Millions of medium and small-scale fishers and fish farmers, often very poor, depend on fishing and aquaculture, with over 97% of fishers living in developing countries. For these people, fish provide their primary source of protein. In contrast to terrestrial food production, where wild biodiversity makes a relatively small contribution to the human diet, marine and fisheries are populated by predominately wild species and managed through a complex framework of national and international agreements. More so than in terrestrial landscapes, management of fisheries must and has begun to take an ecosystems approach. McClennen details the use of ecosystem approaches in Chap. 16, Vol. 2 highlighting the ecological principles for sustainable fisheries.

In addition, agricultural landscapes and their management have impacts that reach far beyond alleviating hunger. Myers demonstrates the important consequences of land use change on human health in Chap. 11, and Keesing highlights the role of

landscape and community ecology in understanding how fragmentation and altering of ecological communities affects the spread of infectious diseases. Agricultural lands are also one of the biggest users of water for irrigation. Food grows where water flows, as the saying goes. Access to water is often the biggest limitation to increasing production as well as maintaining year-round production in arid systems.

Increased agricultural productivity through “Green Revolution” technologies, including inorganic fertilizers, improved seed, and small-scale irrigation projects are likely to contribute significantly towards meeting the United Nation’s goal of halving global poverty by 2015, but sustained poverty alleviation will require more. Ecology and ecologists alone will not be able to solve these critical development challenges; what is clear, however, is that the tools and skills that ecologists manage provide essential components to lasting, sustainable solutions. Ecologists must begin to consider how their field can contribute not only to the conservation of biodiversity, but to the relationship between conserved biodiversity and provisioning of nontraditional ecosystem services such as human health. Likewise, nutritionists, agronomists, and other development practitioners must recognize that many of the solutions to increasing human well-being and health can best be achieved by focusing on a healthy environment and the conservation of ecosystem services.

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