Section Overview

The five chapters in this section all relate to issues raised earlier, particularly in Section I, where general features of theory and method were discussed. They all address common pool resources – the foundation of equitable sustainability and key to how we might live within our means. In the final analysis, problems such as renewable energy, access to adequate fresh water and food, not to mention reduction of greenhouse gas emissions, all depend on local decisions and implementation. Claude Peloquin and Fikret Berkes explore a complex and highly informative “folk model” of dynamic environmental relations – one which institutionalizes practices that track resource availability. Amber Wutich treats a common property resource problem vital to the well-being of over half of the world’s population, namely urban water supply. James Eder looks at a large USAID project to see what exactly “community participation” means in practice. James M. Acheson and Jon McCloskey show that while deforestation is a world-wide problem it has to be understood in terms of local circumstances. The case of deforestation in central Maine highlights the complexity of forest ownership and the wide variety of motives of those involved in cutting or burning forests. David Pimentel and colleagues take a jaundiced view of current efforts, promoted by many, to alleviate the world’s need for more energy through the use of supposedly renewable biofuels.

At no time in human history has an understanding of the environmental impacts of human activities been as vital as it is today. A person from any point in time prior to the eighteenth century would find the earth unrecognizable today as a result of human impacts. So much so that the Noble Prize-winning scientist Paul Crutzen of the Max Planck Institute has proposed that we need to designate a new geological era reflecting the last 300 years of human activities: he suggests calling it the “Anthropocene” (New Scientist Feb 28, 2009, p 29). Should current projections of a global temperature rise of 2–6.4°C this century come to pass there will be a further massive change in human settlement patterns and a high probability of significant conflict over resources. This is not to embrace a doomsday scenario, although it is possible that there will be a culling of human population from the 9 to possibly 12 billion projected for 2100 (ibid). But at whatever level of population,
human adaptability will be put to the test. Global problems will be solved or not at the local level and will undoubtedly entail the management of common resources, be they forests, savannahs, fisheries, or water tables. How people perceive their environments and how they structure their productive or extractive activities will be of crucial importance. Conservation efforts, sometimes regarded as optional individual virtues, will become a collective necessity if current scientific thinking is even remotely on target.

But how we collectively plan for this is highly problematic. Environmental scientists offer numerous often scary scenarios to which decision makers and economists have begun to respond with countermeasures, such as subsidies for biofuels, carbon trades or off-sets, regulations to curtail marine and fresh water pollution, standards for smoke stack emissions – the list is long. It is hard to argue that these measures are merely wrong or misguided palliatives, but there may be a fundamental flaw in our paradigm for assessing risks, costs, and long-term benefits. Robert Nadeau, a distinguished philosopher of environmental science and public policy has argued that the economic theory most used in planning and corporate decision-making has no way to assess the environmental cost of economic activities and internalizing these costs in pricing systems. To paraphrase his argument, he faults the current paradigm as being based on the following wrong-headed assumptions (2008):

1. That the market is a closed system uniting producers and consumers.
2. Natural resources exist outside of this closed system, but their economic value is determined by the market system.
3. Current costs or damages to natural resources cannot be included in the pricing mechanism.
4. Natural resources are either inexhaustible or can be replaced by others or by technological innovation.
5. There are no biophysical limits to the growth of the market system.

In some respects Nadeau’s critique of neoclassical economic theory mirrors the shortcomings with ecosystem approaches that assume closed systems we discussed earlier. Certainly, the failure to bring environmental costs into commodity pricing is a problem which aggravates the current environmental crises and such looming disasters as a projected 59% increase in the rate of annual ice loss in west Antarctica, which will accelerate a decline in fisheries and regional fresh water shortages globally. We see everyday instances of this failure to internalize collectively borne costs in pricing to users (and often to producers). Cheap access to water for farmers and city dwellers alike is taken as a right, turning agricultural land into shopping malls is heralded as economic development, and in a number of countries, including the United States, the costs of ore mined by leveling mountain tops are essentially limited to those of extraction and transportation.

One huge anthropogenic calamity is the Sea of Aral, once the world’s fourth largest lake, which was turned into a barren wasteland by 1985. This case is often thought of as emblematic of the chaotic and reckless central planning peculiar to
the USSR, although analogous situations, driven by market pressures, perhaps not quite as dire, can be found throughout the world. Philip Micklin, an American geographer, and Nickolay Aladin, a Russian brackish water hydrologist, have documented the unfolding of this disaster and the steps now underway to reverse it. By the late 1960s the effects of several decades of projects diverting the Amu and Syr rivers to vastly expand irrigated crop land in this arid zone had begun to have visible effects. In 1960, there were over 100,000 ha of wetlands around the Sea of Aral, which by 1990 were reduced to 15,000 ha. Fish were reduced from 32 species to 6, and birds from 319 species to 160. The lake itself, which once offered a harvest of 40,000 metric tons of fish annually by 2000 had no commercial fishing left at all as over 54,000 km² of seabed were exposed by the receding waters. Not only was shipping abandoned, but the seabed itself became the source of toxic dust storms affecting surrounding populations in four countries who came to experience high rates of often lethal skin and respiratory diseases. Since 2005 there has been a partial rebound at the north end of the lake due to closing of some irrigation canals and the repair of others, while at the same time a barrier restricting run off to the main basin of the Aral to the south is being built. Nevertheless, it is impractical to attempt to bring the entire system back to its 1967 level. Not only would this be hugely expensive, but also population growth now means that several million people depend on the land irrigated by the Amu and Syr rivers for food and cash crops.

Micklin (2007) and Micklin and Aladin (2008) offer some general conclusions from their observations. Among them are that humans can quite rapidly wreak environmental damage which is costly and time-consuming to repair, if repair is possible at all; that an environmental system may appear relatively stable and productive until the point at which it tips into disaster; and that sustainable solutions to man-made problems must be politically and socially feasible not simply technically possible – it is technically possible to restore the Aral, but would not be a sustainable solution if human impacts and consequent social upheaval were ignored.

About 50 years ago, most developed countries mandated that foreign aid be contingent upon studies of its impacts on equity and the poor, as well as assessments of the social and environmental impacts of proposed development projects. As a consequence, a large number of social scientists are employed world-wide in efforts to understand what works and what does not in development assistance while assuring appropriate conservation and sustainability. Development projects may have a profound effect on local ecological systems. Large dams, for example, almost always have a legacy of large-scale environmental damage such as destruction of habitat, downstream pollution, increased salinity of the soil as a result of a rise in the water table, increased risk of flooding and erosion, and even, many people argue, an increase in the risk of earthquakes. But innovations need not be so massive as a huge irrigation project or a giant dam to have significant effects on ecological systems. A new strain of rice introduced in Nepal increased yields as much as 200%, but because the rice grew on short, tough stalks that produced little fodder for cattle and required threshing machinery that was not available locally, the potential benefit was offset by serious costs.
The researcher concerned with development must always consider the strengths as well as the weaknesses of the local system of knowledge or practices. In Bali, Indonesia, according to Stephen J. Lansing (1991), an elaborate network of temples dedicated to water goddesses is controlled by priests who regulate and coordinate the irrigation of fields belonging to thousands of farmers. In an effort to modernize farming, the government encouraged farmers to irrigate their fields according to whatever schedule they judged would increase their rice production. As a consequence, fields were irrigated according to individual farmer’s timetables, and unexpectedly, this provoked an ecological crisis that resulted in a massive decline in overall yields. When farmers planted and irrigated on their own schedules, pests that were formerly controlled by the coordinated flooding dictated by the temples simply moved from field to field. Coordinated irrigation turned out to be a vital means of crop cycling and pest control. In this case, we see a traditional religious institution playing a critical, even if unplanned, role in resource management. Lansing, an anthropologist, was instrumental in making government planners aware of the value of this supposedly noneconomic and anachronistic cultural system.

Much of the present crisis in food production is attributable to the fact that the growth rates of the populations of many countries in the tropics have outstripped their ability to feed themselves. But most of the agricultural techniques that are being imported by such countries are based on farming methods first developed in temperate climates. In the Amazon region of South America, large development projects involving the clearing of forests, introduction of new food crops, and mechanization have had very poor economic results. Tropical soils are generally thin and subject to rapid erosion and breakdown of nutrients once the protective cover of the rain forest is removed. As a consequence, intensification of agriculture or other uses of once-forested land often result in less rather than more food. Most cleared land in the Brazilian Amazon is used for cattle ranching but 85% of recently cleared land is now altogether unproductive because of soil degradation. Many people who have worked in tropical agricultural systems think the way out of this dilemma is to pay more attention to developing more productive farming based on plants and techniques that are already locally established.

George Appell, who has worked on development projects in Indonesia, offers a set of principles that, in somewhat abridged form, aptly summarize the sorts of negative impacts that planned change occasions and that have to be weighed against possible benefits (Appell 1988, quoted in Bates 2005, p 223ff):

Every act of development necessarily involves an act of destruction.
Any new activity introduced is likely to displace an indigenous activity.
Each act of change has the potential to cause physiological, nutritional, psychological, and/or behavioral impairment among some segment of the subject population.
Modernization can erode indigenous mechanisms for coping with social stress, such as regulating conflict and solving family problems.
One more caution might be added to this list: the costs and benefits of any innovations or planned changes are not going to be distributed equally throughout the population; some people will benefit more than others, and some may lose altogether. What must be kept in mind is whether the distribution of costs and benefits is fair or desirable.

The ultimate cost–benefit outcome of any development project or effort to effect some form of desired social change can be influenced by many factors. Some of the most important are environmental and ecological factors, traditional values and beliefs, and social ties. All of the chapters in this section address such issues.

Claude Peloquin and Fikret Berkes note that scholars studying human–environmental systems necessarily deal with complex relationships emerging from numerous interactions and they employ the scientific models discussed or exemplified in many of the preceding studies in this volume. The people who are the object of studies are also part and parcel of larger complex adaptive systems and they too operate within recognized models which are similarly complex, nonlinear, and dynamic even though such indigenous models may differ greatly from one another. In some cases, institutional arrangements may encode or encourage practices which track the availability of resources in a manner which promotes sustainability. Such institutional mechanisms may be religious beliefs and rituals, as well as more explicitly conservation-directed measures such as hunting seasons, harvest limits, etc. Peloquin and Berkes look at one extractive activity of local importance, the hunting of wild geese in eastern Canada, and show how the James Bay Cree hunters evaluate and respond to shifts in the abundance and availability of this resource. Where the scientific observer might quantify a number of key variables and infer change and causality from the data reflecting, say, temperature, kill rates, body weight of prey, subcutaneous fat, and the like, the Cree “eyeball” a large number of seemingly disparate variables and note unusual occurrences to arrive at a qualitative and probabilistic model that parallels the scientific model in detecting change in a complex system.

Over half of the world’s population, which currently stands at close to seven billion, lives in cities or in villages now absorbed by urban sprawl. A recent United Nations report by the World Water Assessment Programme states that urgent action is needed if we are to avert a global water crisis. The water problem that has attracted the most scientific attention to date is clearly related to food production. Local shortages in water for agriculture have been occurring regularly around the world. In 2009 alone, there were major water crises in Korea, the United States, Madagascar, Australia, and China. But during the last decade, the rate of increase in urban water consumption for sanitation and drinking has vastly outstripped increases in water used for irrigation. This is due to growing rural-to-urban migration worldwide. In many instances, the urban poor lack adequate drinking water, let alone what is needed for sanitation. Amber Wutich’s fine-grained study of water use and management among the poor in Cochabamba, Bolivia, is very important in a number of ways. In Cochabamba, as in most cities, water is a common pool resource where sustainability has to be balanced against needs in the face of acute scarcity. For the purposes of her study, Wutich uses and expands on the six principles
Trawick identifies in long-enduring Andean irrigation institutions: Community autonomy; uniform, equitable access; proportionality, i.e., people should consume only what they need and contribute accordingly to the common system; contiguity, i.e., people take turns in the order in of their allotments of water; transparency, i.e., everyone can monitor and sanction everyone else; and regularity, i.e., the system’s ability to respond to abnormal scarcity.

Worldwide, forests are being cut or burned at an unsustainable rate and the species diversity and composition of extant woodlands is being altered. In almost every instance this is, as James M. Acheson and Jon McCloskey show for Central Maine, USA, a classic collective action dilemma. Some individuals foist the costs of their actions onto others: the larger population suffers the costs of air pollution (in the case from burning), soil erosion, stream siltation, loss of wildlife habitat, and the short-term impacts of accelerated CO$_2$ emissions, not to mention diminished recreational opportunities. Their case study of deforestation in central Maine is particularly insightful because it documents the complexity of the problem with excellent data from ownership records, direct observation, and satellite data. While the pattern of ownership or access may be specific to Maine, with its history of major paper factories as well as large nonindustrial landowners, there is much that is worth bearing in mind as one confronts this global problem. Deforestation has multiple causes, even within one region, so diverse processes inevitably have to be considered. The motivations of actors to cut or burn are varied and subject to change; any effort to curb overexploitation will have to focus on establishing incentives that fit the specific situation.

James Eder attempts to go beyond the rhetoric of development and conservation to see how practical projects contend with complex social realities. Considering conservation as a social or institutional process, much as does Flora Lu, he examines coastal resource management in Palawan, the Philippines. Looking at a USAID project, he is particularly concerned with the ever-elusive goal of “community participation” or community comanagement, deemed desirable by nearly all designers of development projects. The problem Eder addresses is what actually constitutes “community?” Any local population consists of actors with divergent interests, and many different subsets of these can be thought of as “community,” including groups based on subsistence activities, gender, and social class. Moreover, all belong to territorial communities embedded within a hierarchy of national territorial and bureaucratic institutions of governance. If this is not complication enough, one must also ask what exactly is meant by “participation?” Women, the poor, and those marginalized for whatever local reasons may easily have their interests subordinated. Community pluralism has to be accounted for in establishing mechanisms fostering debate and equitable decision making, and resolving conflict.

David Pimentel, Alison Marklein, Megan A. Toth, Marissa N. Karpoff, Gillian S. Paul, Robert McCormack, Joanna Kyriazis, and Tim Krueger offer a considered, hard-hitting empirical response to a major policy issue. Most of the discussions in the political arena in industrial societies have focused on short-term cost–benefit models when it comes to responding to potential global shortages of fossil energy and accordingly many have embraced biofuels as renewable energy sources.
Biofuels by necessity compete with food as both are dependent on the same resources for production. While most policymakers are probably aware of this basic fact, what they seem to miss is what this paper demonstrates: the very high long-cycle costs of processing most of the suggested sources of renewable energy. This chapter examines the uses and interdependencies among land, water, and fossil energy deployed to food production as opposed to biofuel. It also estimates the probable environmental impacts of biofuel production where it replaces food production.