

Chapter 11

Environment

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11.1 Introduction

In the context of a Poverty Reduction Strategy Paper (PRSP), environment and poverty are linked in two major ways: (1) poverty alleviation should not damage the environment of the poor, which would only substitute gains in one area for losses in another, and (2) improving environmental conditions can help reduce poverty. The latter link is the focus of this chapter.

Environmental conditions have major effects on the health, opportunity, and security of poor people. Environmental activities can also provide effective ways to empower the poor. The many links between environmental management and poverty alleviation provide the rationale for systematic mainstreaming of environment in PRSPs and their associated processes.

This chapter aims to help PRSP teams integrate environmental problems and opportunities in their work and consider potential environmental and natural resource interventions in their poverty reduction strategies. The scope of environmental concerns is quite broad. It includes water supply and wastewater disposal, solid waste removal, indoor and urban air pollution, and natural resource issues such as land degradation, deforestation, and loss of coastal ecosystems and fisheries. However, it is important that “environment” does not only bring restrictions and problems to mind. Better environmental management provides many opportunities to build sustainable livelihoods. Natural resources can be put to more productive use to alleviate income poverty.

This chapter has a multisectoral perspective. However, while analysis needs to be multisectoral, many of the resulting interventions can be implemented by individual agencies. These can be responsible for sectoral programs (health, infrastructure, public works, agriculture) and need not be only environmental institutions.

This chapter first suggests that teams working at the country or subnational level begin by analyzing the linkages between poverty and environment. Then desirable but realistic targets need to be set with a focus on the main problems. The next stage is to evaluate possible public actions for reaching those targets on the basis of their expected cost-effectiveness, institutional capacities, and lessons from past experience. Finally, a system for monitoring the outcomes of the interventions must be put in place. The results are fed back into the next-stage analysis, and so on.

Section 11.2 of this chapter provides an overview of the ways in which environmental conditions can contribute to different kinds of poverty. Section 11.2.1 on environmental health gives a working definition of environmental health and disability-adjusted life-year (DALY); sketches a developing country panorama of the overall burden of disease, showing the considerable significance of environmental factors; and makes a case for a multisectoral approach to environmental health.

Section 11.2.2 focuses on environment and economic opportunity and emphasizes that poor people tend to be highly dependent on natural resources for their livelihood. The extent of this dependence may not be revealed by traditional income analysis. Property rights, communal or private, formal or informal, lay the foundation for natural resource utilization. Incentives by way of regulated prices, taxes, and subsidies send important signals to resource users about economic opportunities. Natural resource utilization should be seen not only in the context of limiting access and exploitation, but also from the perspective of sustainable opportunities for poverty reduction.

Section 11.2.3 on environment and security highlights the very significant cost of damage inflicted by natural disasters and how poor people face a relatively higher degree of insecurity because of such disasters.

Section 11.2.4 on environment and empowerment argues that when communities are empowered, natural resources can serve as a foundation for economic opportunity on which social capital can be built. Income-generating schemes can be combined with measures that enhance the environment, but communities are often heterogeneous and may harbor large differences in interests and attitudes.

Sections 11.3 and 11.4 summarize an approach to mainstreaming of environment in PRSPs that has been developed within the World Bank. Section 11.3 outlines an approach to analyzing the links between environment and poverty in order to define priorities both between sectors and within the environmental

field. Section 11.3.1 deals with understanding the environmental contribution to poverty reduction. This section raises a set of issues that need to be considered when mapping out this relationship.

Section 11.3.2 is dedicated to choosing targets for improvement and selecting the most effective public actions and reviews the prime areas of intervention and cost-benefit as well as cost-effectiveness analysis of interventions.

Monitoring and evaluating outcomes is the topic of section 11.3.3. The approach taken is one of integration with the overall monitoring and evaluation (M&E) framework for the Poverty Reduction Strategy (PRS). However, careful attention must be paid to the selection of indicators to capture changes in the environmental conditions that most affect the poor. This section offers specific suggestions for the selection of indicators and gives examples of choices for environmental health and natural resources management.

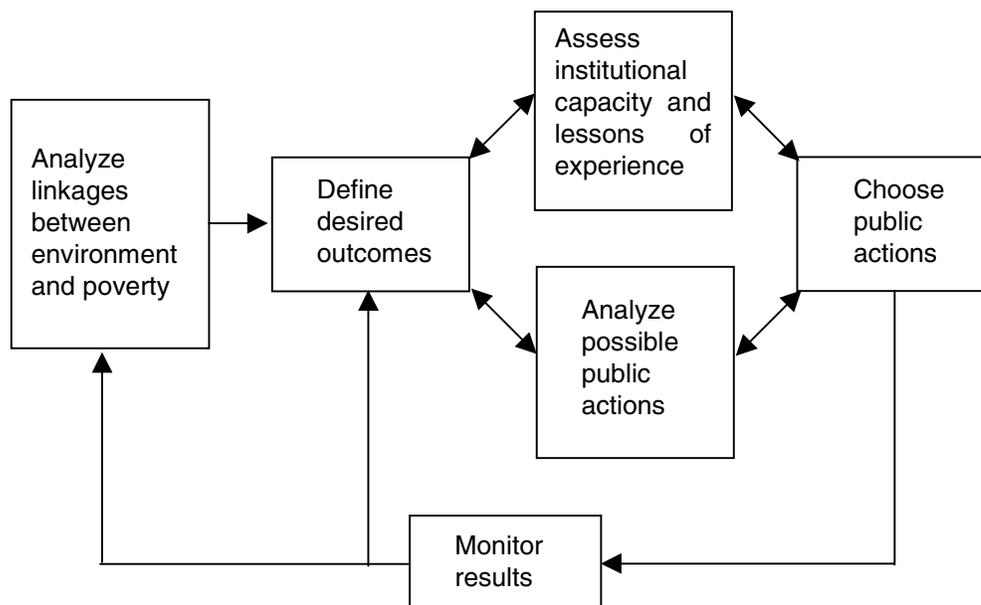
Section 11.4 presents good practice in mainstreaming environment from a review of 25 Interim Poverty Reduction Strategy Papers (I-PRSPs) and PRSPs. While many PRSPs give little attention to environmental matters and links to poverty, it is encouraging that the full PRSPs tend to score better in this respect. The references and technical notes to the chapter provide more details on particular topics.

The chapter therefore follows the basic stages of the approach embodied in the PRS initiative: developing a comprehensive understanding of poverty, choosing the most effective public actions to reduce poverty, and monitoring outcomes and impacts (see figure 11.1). By design, these stages cut across sectors and development themes in order to facilitate the socioeconomic and policy analyses that will guide public action aimed at reducing poverty.

We consider direct environmental contributions to poverty reduction rather than methods of ensuring that poverty reduction activities are environmentally sustainable. The latter are well elaborated elsewhere.¹

Some aspects of the broader environmental agenda—conservation of natural areas, biodiversity, preserving the global commons—may not be primarily targeted at poverty reduction, but can result in positive poverty side benefits. For example, several programs in southern Africa give local communities a stake in conserving wildlife by sharing tourist revenues. Costa Rica’s Certifiable Tradable Offsets program provides revenue to smallholders in return for conserving forest cover, thereby sequestering carbon. The clearing of invading alien species in South Africa provides both environmental benefits and poverty alleviation at the same time.

Figure 11.1. Process for Preparing Environmental Sections of a Poverty Reduction Strategy



Conversely, many environmental interventions aimed at poverty outcomes will also yield benefits for the natural environment. Cleaner water, cleaner air, and better sanitation will not only reduce the burden of disease for the poor but will also produce a more enjoyable environment. Community-based forest management may serve to both increase incomes for the poor and provide environmental services. Actions to reduce the likelihood of natural disasters, such as institutional arrangements to preserve upland forest, also conserve natural areas.

In other instances, however, tradeoffs between the environment and livelihoods for the poor may be inevitable—for example, where natural areas are converted to agricultural production. The most difficult tradeoffs concern long-term versus short-term benefits. In many instances, exploiting a natural resource may have short-run poverty benefits, but these actions may entail long-run costs in loss of biodiversity or accumulation of greenhouse gases. A good environmental assessment, fed into a cost-benefit analysis, can underpin what is ultimately a political decision about the right tradeoff in a particular situation.

Market failures and policy distortions often bias exploitation decisions against consideration of environmental values. Poorly defined or enforced property rights can create an incentive for quick exploitation and disregard for external impacts. Subsidies of natural resource extraction encourage their use beyond what their full costs to society would warrant.² When local users do not manage local resources, the full benefits of sustainable management do not accrue to them. These are only some of the reasons why we cannot expect environment to take care of itself as an automatic result of economic development.

11.2 Setting the Stage

A broad definition of poverty extends beyond income or consumption to include inequality, health, education, and vulnerability. These dimensions of poverty in turn affect the elements of well-being: security, empowerment, and opportunity. The “Overview” to this book elaborates on these dimensions.

Figure 11.2 shows how opportunity, security, and empowerment relate to various dimensions of poverty. It also indicates typical environmental determinants of poverty. The dimensions of poverty and its determinants can fit into several of the groupings (for example, health affects people’s income and security). We focus on the dimensions of poverty that are most affected by the environmental agenda, namely, health, economic opportunity, security, and empowerment. In each country, these dimensions of poverty should be identified and grouped in a way that best accords with local conditions.

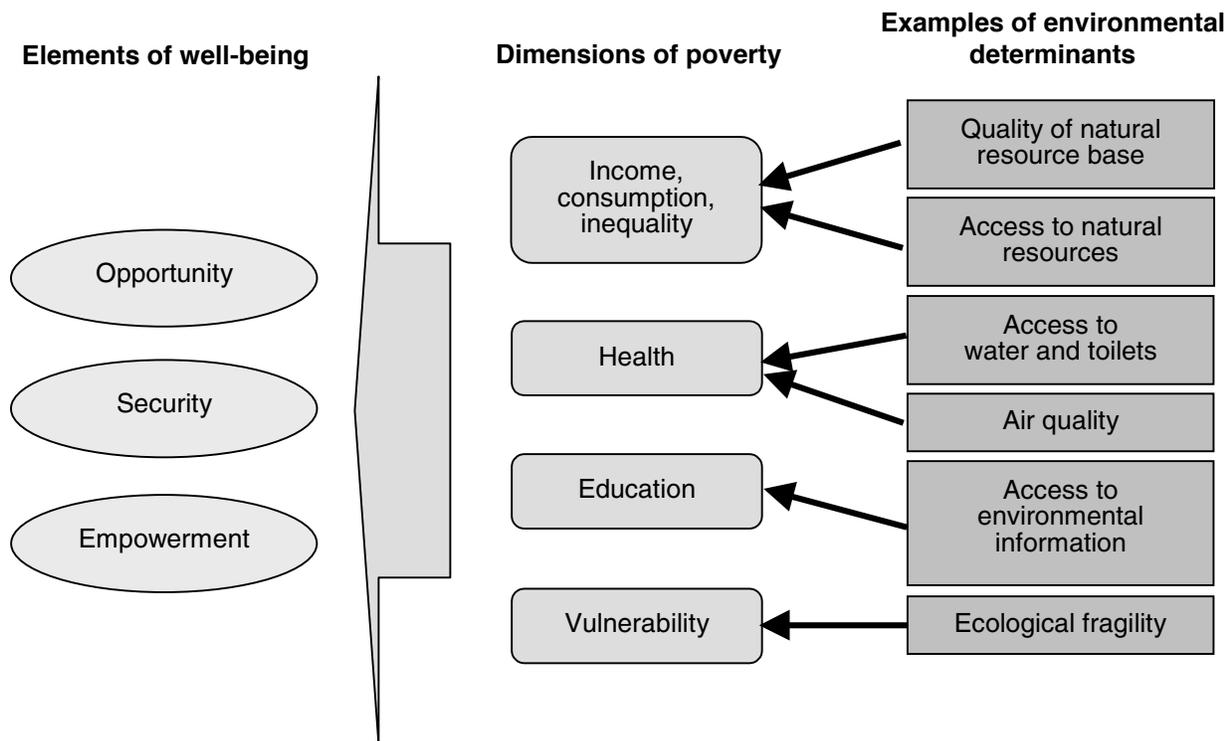
11.2.1 Environment and health

This section provides a working definition of environmental health and DALY; sketches a developing country panorama of the overall burden of disease, showing the considerable significance of environmental factors; and makes a case for a multisectoral approach to environmental health.³

Environmental health can be defined as all activities that prevent health risks through control of human exposure to (a) biological agents, such as bacteria, viruses, and parasites; (b) chemical agents, such as heavy metals, particulate matter, pesticides, and fertilizers; (c) disease vectors, such as mosquitoes and snails; and (d) physical and safety hazards, such as traffic accidents, fire, extremes of heat and cold, noise, and radiation (Lvovsky and others 1999). In comparison, the World Health Organization (WHO) does not include traffic accidents and insect vectors in its definition, but it does include deforestation and land degradation. (Listorti and Doumani 2001).

With such a broad panorama of concerns, the issue of setting priorities becomes critical. We need a measure for the magnitude of the problems as well as a tool to measure the level of improvement from interventions. The use of DALYs as a measure of the burden of disease has provided a consistent basis for systematic comparisons of the magnitude of health impacts and the cost-effectiveness of alternative interventions designed to improve health. Box 11.1 explains how DALYs are calculated.

Figure 11.2. Dimensions and Determinants of Poverty



Source: Adapted from Bucknall, Kraus, and Pillai (2001).

Table 11.1 gives a sense of the magnitude of the health effects of various environmental problems. The sum of all causes is less than 100 percent, as only DALYs related to environmental causes are considered. The impact of a poor environment on health is significant, particularly in Sub-Saharan Africa.

While countries differ considerably, poor water supply and sanitation stands out as the top global concern. The WHO estimates that 3.3 million people die every year from diarrheal diseases, and at any one time there are 1.5 million with parasitic worm infections stemming from human excreta and solid waste in the environment. They estimate that more than 3 billion people are without adequate means of disposing of excreta. That said, it should be noted that indoor air pollution—a problem that is much less highlighted—also stands out as a very significant source of poor health.

At the county level, it is possible to obtain a reasonable understanding of causal relationships between environmental conditions and health outcomes and the relative contribution of environmental conditions to health. Several recent studies have found the standard of water and sanitation to be closely related to child health (Jalan and Ravallion 2001). One study in India found that environmental causes were responsible for 20 percent of the burden of disease (about the same as malnutrition). Within that, water and sanitation are responsible for 11 percent of the total burden of disease, and indoor air pollution for 6 percent. (Hughes, Dunleavy, and Lvovsky 1999; see also chapter 18, “Health, Nutrition, and Population”).

There are complex interactions between health outcomes and factors such as water supply, as illustrated by box 11.2. For example, access to safe water may affect mothers’ choices about breastfeeding. If

Box 11.1. DALYs as a Measure of the Burden of Disease

DALYs are a standard measure of the burden of disease. They combine life-years lost because of premature death and fractions of years of healthy life lost as a result of illness or disability. A weighting function that incorporates discounting is used for years of life lost at each age to reflect the different social weights usually given to illness and premature mortality at different ages. The combination of discounting and age weights produces the pattern of DALY lost by a death at each age.

Source: Murray and Lopez (1996).

Table 11.1. Burden of Disease from Major Environmental Risks

<i>Environmental health group</i>	<i>Percent of all DALYs in each country group</i>							
	<i>Sub-Saharan Africa</i>	<i>India</i>	<i>Asia and Pacific</i>	<i>China</i>	<i>Middle East and North Africa</i>	<i>Latin America</i>	<i>Former socialist economies of Europe*</i>	<i>All least developed countries</i>
Water supply and sanitation	10	9	8	3.5	8	5.5	1.5	7
Vector diseases (malaria)	9	0.5	1.5	0	0.3	0	0	3
Indoor air pollution	5.5	6	5	3.5	1.7	0.5	0	4
Urban air pollution	1	2	2	4.5	3	3	3	2
Agro-industrial waste	1	1	1	1.5	1	2	2	1
All environmental causes	26.5	18.5	17.5	13	14	11	6.5	18

*Excluding Central Asia and Caucasus.

Source: Lvovsky and others (1999).

water is available, they may choose either not to breastfeed or to breastfeed for a shorter period of time. Hence, health interventions need to anticipate behavioral responses to changes in infrastructure and may need to combine such measures with a health education component.

11.2.2 Environment and economic opportunity

This section makes the following main points:

- Poor people tend to be highly dependent on natural resources for their livelihood. The extent of this dependence may not be revealed by traditional income analysis.
- Property rights, communal or private, formal or informal, lay the foundation for natural resource utilization.
- Incentives by way of regulated prices, taxes, and subsidies send important signals to resource users about economic opportunities and may determine sustainability.
- Natural resource utilization should be seen not only in the context of limiting access and exploitation, but also from the perspective of opportunities for sustainable economic opportunities.

Analysis of the relationships between the environment and economic opportunity fits well with the concept of sustainable livelihoods adopted by a number of development agencies. The U.K. Department for International Development (DFID) defines livelihood as comprising “the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base” (DFID 1999, adapted from Chambers and Conway 1992).

Box 11.2. Working Across Sectors: Rural Water Supply and Sanitation

In the case of environmental health, it is particularly important to work cross-sectorally. For example, research has consistently shown that health benefits from improving drinking water are less pronounced than those from sanitation (Klees, Godinho, and Lawson-Doe 1999). Benefits from improving drinking water quality occur only when sanitation is improved and water quantity is optimal. Increases in water quantity do more to improve health than improvements in water quality because of the improved hygiene that goes along with it. Hygiene education is often required, though, before communities can realize the potential health benefits (Klees, Godinho, and Lawson-Doe 1999).

Hand washing is very important in reducing water-related diseases. A worldwide study of 144 water and sanitation interventions found that improved water and sanitation services were associated with a median reduction of 22 percent in diarrhea incidence and 65 percent in deaths from diarrhea. But improved excreta disposal and hand washing can reduce under-five mortality rates by 60 percent, cases of schistosomiasis by 77 percent, intestinal worms by 29 percent, and trachoma by 27–50 percent (Esrey and others 1991).

Environmental conditions contribute to people’s economic opportunities in many ways, particularly in rural areas.⁴ The relationships are site specific and often difficult to quantify: the extent of soil erosion may have no immediate effect on people’s well-being, or it may reduce their economic opportunity considerably. Institutions, policies, characteristics of the community, gender relations, and other factors will mediate the effects. Hence, detailed qualitative information is needed in addition to available quantitative studies and surveys to assess who are the poor, what is the character of poverty in a given context, and the extent to which environmental factors contribute to or detract from people’s livelihoods.

The poor depend on natural resources—owned either by themselves or the community or that are open-access property—for farm and grazing land, wild food, fish, fuel, fodder, and other necessities. These resources may be the primary source of livelihood or they may supplement the family’s daily needs or income. Cavendish’s (1999) study from Zimbabwe illustrates these general statements with specific numbers. The study measured the nature and extent of “environmental income”: livestock fodder, fuelwood, natural fertilizers, wild fruits, vegetables and insects, gold from panning, wood for carpentry, grasses for baskets, and so forth, which added up to about 100 items in total. Cavendish collected his data during two separate agricultural years in four villages in Zimbabwe. The number of households interviewed was close to 200 in 29 villages.

The graphs below (figures 11.3 and 11.4) show the level of dependence on environmental income. Two facts stand out: (1) the poorest are most dependent on environmental income in relative terms, but (2) the somewhat better-off use more natural resources in absolute terms. These findings pose a dilemma for policymakers: interventions to enhance natural resources management (NRM) are of great importance to the poor but may actually benefit the less poor unless carefully targeted. The findings also show that environmental pressure will not automatically diminish with greater prosperity. On the contrary, it would most likely lead to further investment in livestock that draws even more on the limited grazing resources of these villages.

Other empirical evidence reinforces the view that the poor are often dependent on common property resources (CPRs) for their livelihood. A survey of 82 villages in India found that the poor obtain 66–84 percent of their fodder from CPRs in some states. CPRs also provided 14–23 percent of the income of the poor and 137–196 days of employment per poor household (Jodha 1986). Since the poor often acquire a significant part of their income and consumption from natural resources, their ability to meet their daily needs is also affected when the quality of natural resources degrades.

Figure 11.3. Income Shares by Quintile and Major Income Source

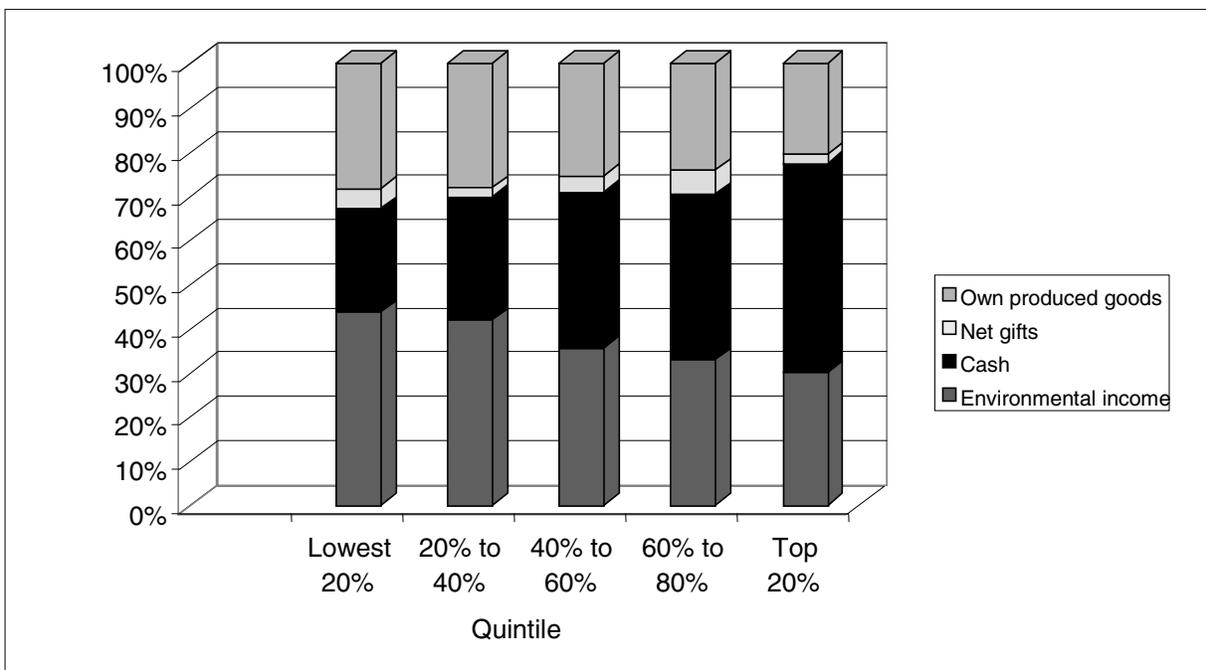
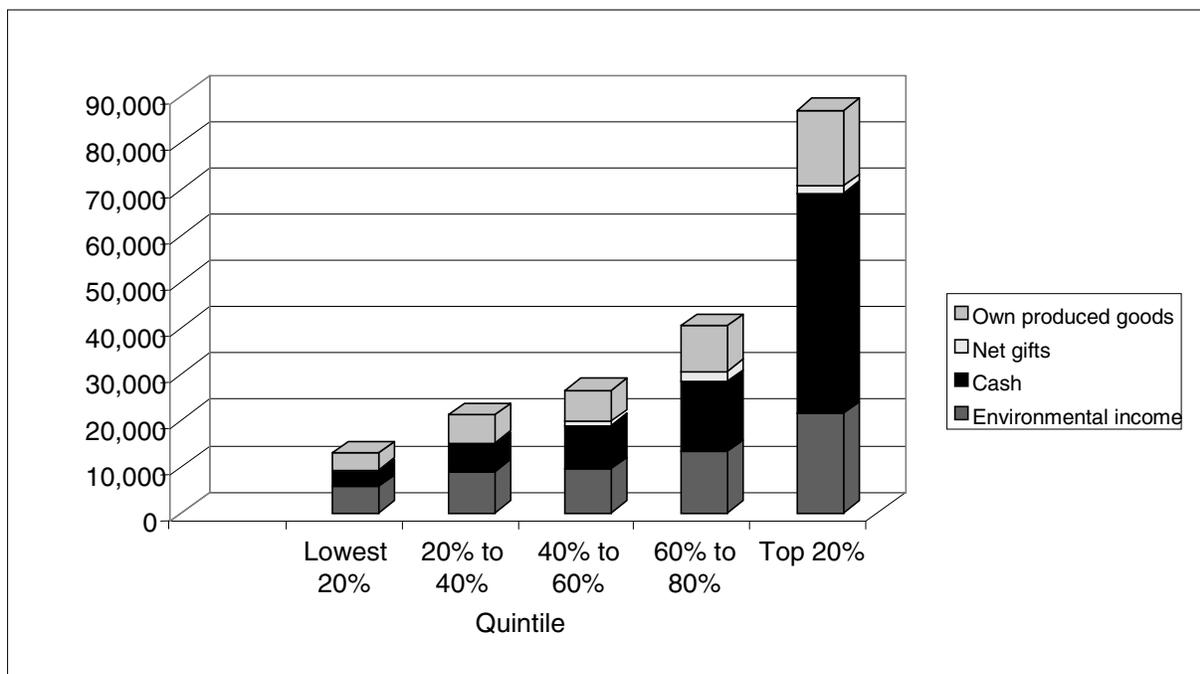


Figure 11.4. Income in Z\$ by Quintile and Major Income Source



Poor rural women in developing countries are disproportionately affected by the degradation of natural resources because they tend to be primarily involved in the collection of fuel, fodder, and water. Depending on the availability of biomass resources, collection of fuel and fodder may take between two and nine hours. In Lombok, Indonesia, and in some areas of Kenya, women spend seven hours each day cooking and collecting dead wood or agricultural residues as fuel (Aristanti 1997). They often have to walk longer distances and spend more time and energy to collect fuelwood as a result of deforestation. This reduces their time spent on income-generating activities, indirect income through crop production, and household responsibilities, and may also have a negative effect on health.

Prolonged searching for ever more scarce fuelwood eats up women's time, taking away time and energy from productive activities such as childcare. It can also have direct effects on their health. For example, a 1996–97 study involving over 1,000 fuelwood-carrying women in 10 locations across 12 districts in Uttaranchal, India, found that the proportion of miscarriages was 30 percent, five times higher than the average rate reported in the National Family Health Survey of 1992–93. During pregnancy, the women carry heavy loads of wood, manure, and grass, a factor contributing to the high rate of miscarriages (Dasgupta and Das 1998).⁵

Property rights that govern access to these resources play an important role in maintaining productivity and enabling the equitable use of natural resources. A country's PRSP needs to survey how property rights are distributed across the main types of natural assets: land, vegetation, and water. Formal title and full transferability is not necessarily required for good husbandry, but perceived security of use will influence how people make decisions about exploiting and investing in natural resources. Nor is privatization of property rights a guarantee of sound environmental stewardship; the owner may choose to deplete the resources and move elsewhere with profits if that is possible. Inequality in the distribution of property rights may also trap people in poverty. The legacy of colonialism and apartheid has left some countries with property rights that force poor people to exploit marginal lands.

The relationships between the natural resource conditions and the income or consumption of households are not straightforward. Sometimes poverty can force people to exploit natural resources unsustainably, for example, by forcing them to cultivate on steep slopes, which can lead to erosion and declining yields over time. But increasing income can also lead to overexploitation, for example, by allowing the poor to buy chain saws or bigger fishing boats. The relationships also vary over time. A community can see its income or consumption increase in the short term if it mines natural resources, for

example, by felling a mature forest. Over the longer term, however, those practices cannot be maintained. It is therefore helpful to build on a country-specific analysis of those links that are the most important given the income level, income distribution, and nature of natural resource exploitation.

The relationships between macroeconomic policy, structural reforms, and the environment are also complex. Changes in relative prices and rates of growth in the economy are likely to affect the environment through, for instance, changes in resource extraction or pollution emissions. Trade liberalization can also harm certain groups of poor people that depend on natural resources. For example, artisanal fishing communities can see fish stocks decline if liberalization brings export opportunities that increase commercial fishing activities. However, it can also open up new export markets for activities that are environmentally benign and lead to substitution of erosive annual food crops with perennial tree crops for export.⁶

One example of links between economic policies and natural resource degradation can be taken from Colombia. Heath and Binswanger (1996) found that public investment, the trade regime, credit policies, taxes, and subsidies all tended to favor large livestock farms in fertile valley bottoms. In contrast, most poor farmers were forced to carve out their living on steep slopes, resulting in deforestation and erosion. Poverty and environmental degradation went hand in hand, as enhanced profitability for large livestock farmers made the best land unaffordable to the poor. Heath and Binswanger concluded that the impact of policies is to “constrain the poor’s access to land and encourage environmental degradation.”

Environment represents not only a set of problems but also a set of opportunities. Nature-based tourism is a mainstream economic activity in many countries. The Kenya PRSP notes that foreign tourism constitutes the second largest source of foreign exchange, and most of that is based on the attraction of natural resources such as pristine beaches and exotic wildlife. For some local poor groups, even minimal tourism can bring in considerable resources. The Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) project in Zimbabwe, the Lupande project in Zambia, and the Herero Community Guards project in Namibia are projects that aim to provide local groups with an economic rationale for conservation.⁷

Christie and Compton (2001) notes that 80 percent of the world’s poor live in 12 countries, and that in 11 of these tourism is significant or growing. Of the 100 poorest countries, tourism is significant in almost one-half of the low-income countries and in virtually all the lower-middle-income countries. “Significance” is defined as accounting for more than 2 percent of gross domestic product or more than 5 percent of exports. Much of this tourism is dependent on an attractive natural environment. It also offers numerous job opportunities for people without much formal training.

11.2.3 Environment and security

This section highlights

- the significant cost of damage inflicted by natural disasters, and
- the manner in which poor people face a relatively higher degree of insecurity because of such disasters.

While all members of a community suffer from external shocks—financial, environmental, social, and others—the poor are often disproportionately affected because they have the least ability to cope. This section focuses on the vulnerability of the poor to severe environmental changes, a major issue for developing countries. In 1998 total losses from natural disasters in developing countries amounted to approximately US\$40 billion. In other words, these losses amounted to some 70 percent of net official development assistance. (Sharma and others 2000). Poor countries suffer more from environmental shocks than better-off countries. For example, in 1992 a cyclone hit Bangladesh and caused 100,000 deaths. The same year, Hurricane Andrew, a storm of similar intensity, hit the southeastern coast of the United States and caused 32 deaths.

Poor people are vulnerable to environmental shocks at both the macroeconomic and microeconomic levels. Macroeconomic-level shocks affect an entire area, a whole country, or a whole group of countries. Cyclones, earthquakes, droughts, and the like affect everyone and can be severe enough to cut several

points off a country's gross domestic product. Hurricane Mitch in 1998 is estimated to have caused total damages to Honduras's capital stock, valued at replacement cost, equivalent to one year's gross domestic product. Honduras's poverty rate also increased (Government of Honduras 2000). The poor have less ability than the nonpoor to cope with environmental shocks. They are often dependent on more marginal areas, possess fewer assets to sell that would enable them to smooth their consumption, have fewer options for gaining income elsewhere, and frequently receive less information about impending disasters or have capacity to respond to whatever information they do have.

Some evidence suggests that environmental shocks can be worse for the poor than even severe economic shocks. Analysis of the recent economic crisis in the Philippines, for example, found that the extreme weather associated with El Niño was responsible for a greater share of the overall increase in poverty (47–57 percent of the total impact on measures of incidence, depth, and severity of poverty) as compared to the labor market shock, which by itself accounted for 10–17 percent of the total poverty impact. The labor market shock reduced inequality, but the El Niño shock *increased* inequality. The ability of the poor to protect their consumption was more limited than that of the nonpoor (Datt and Hoogeveen 2000).

Microeconomic-level environmental shocks affect smaller numbers of people in both rural and urban areas. Because poor people tend to live in more marginal areas, their houses and land may be more prone to drought, flooding, landslides, subsidence, disease, and the like. Qualitative studies of poor people's perceptions of poverty show clearly the disruption, health damage, and economic cost of the effects of poor people's vulnerability to microeconomic-level environmental shocks. Women are often particularly vulnerable and most likely to bear the consequences of reduced food consumption, disease, and the need for rebuilding shelter.

Environmental disasters can affect both short- and long-term poverty. Disasters clearly exacerbate economic deprivation in the short term; they can also compromise a household's long-term economic well-being if survival requires the sale of assets, such as those the family had planned to use to finance their children's education.

Increasingly, environmental degradation and natural disasters cause their victims—many of whom are poor—to leave their homes in search of better conditions elsewhere. Environmental refugees pour into megacities, where they increase the number of poor people living on marginal and sometimes disaster-prone land. Global climate change is expected to increase the frequency of extreme climatic events.

11.2.4 Environment and empowerment

This section covers the following points:

- When communities are empowered, natural resources can serve as a platform of economic opportunity onto which social capital can be built.
- Income-generating schemes can be combined with measures that enhance the environment.
- Communities are often heterogeneous and may harbor considerable differences in interests and attitudes.

Environmental activities can contribute to the empowerment of local people. Local communities that are empowered to participate in decisionmaking on environmental resources can help themselves to maintain their livelihoods, gain equitable access to resources, and use these resources sustainably. A large-scale example of this is the Joint Forest Management Program in Andhra Pradesh, India, discussed in box 11.3.

Another example of empowerment in NRM is the Niger Household Energy Project, launched in 1989 with the aims of rationally managing the fuelwood supply around main urban centers to secure sustainable income for poor people and of protecting the environment, conserving fuelwood, and improving environmental health by introducing more efficient stoves and fuel substitution. The project introduced a differential tax on fuelwood: higher for unmanaged natural woodlands and lower for the

Box 11.3. Empowerment: Joint Forest Management in Andhra Pradesh, India

Since 1992 Andhra Pradesh has embarked on an ambitious program of joint forest management. As of March 1998, some 3,665 forest protection committees had been formed at the village level, with oversight of almost 900,000 hectares, of which some 170,000 hectares had been treated. This movement is said to engage about 650,000 people, and 150 nongovernmental organizations (NGOs) are associated with the implementation of joint forest management in Andhra Pradesh.

The World Bank is already involved in forest rehabilitation and conservation through the Andhra Pradesh Forestry Project, with a credit from the International Development Association (IDA) of US\$77.4 million. This project was launched in 1994 with the main objectives of supporting the regeneration and afforestation of degraded forests, plantation forestry, expansion of community forestry, and research and protected areas management. Since reconstruction in early 1997, it has achieved good results in terms of regeneration of degraded forests and joint forest management support.

Sources: World Bank Andhra Pradesh Forestry Project documents.

controlled areas under community management. At the heart of this project is empowerment of the poor, as villages are given management authority over local forests on a 60-year franchise from the government. The project staff notes that “ownership of the project by the people is essential for the project’s success.” The project also provides literacy and accounting training, and villagers have responsibility for settling any disputes concerning rights to forested areas. Thus social capital is built along with rising incomes and environmental protection (World Bank 1995).

Communities can be marked by social differences and relations of power and inequality around factors such as gender, race, caste, class, and so on. It is important to consider local capacity constraints in managerial capacity and not push reforms too far, too quickly. Any attempt to empower local communities and target public expenditures to them should take into consideration these relationships of inequality in addition to the interests of different segments of the community. The example from India in box 11.4 illustrates this point.

Forming a committee to manage common property resources is no guarantee of success. Some committees work and others do not. What makes a village committee successful? Stalker (2001) suggests that four factors are associated with success:

- **Transparency.** People in a community need to understand how decisions are made and whether other people in the program are sticking to the rules. Transparency comes from holding open meetings, sharing minutes of meetings, and publicly penalizing people who fail to follow the rules.
- **Participation.** A critical mass of community members must understand the potential benefits of the scheme and participate in setting project rules.
- **Inclusion.** Who participates and who benefits from the scheme is important. Committees should have conflict resolution mechanisms, divide the benefits to include different community groups, and allow different groups opportunities to influence decisionmaking.
- **Ownership.** The community must feel a sense of ownership of the resource, believing it is their resource to manage and maintain over the long term.

Box 11.4. Women’s Empowerment and Village Water Supply

In villages in the arid region of Vidarbha, Maharashtra, India, women and girls spend much of the day walking to fetch the water required for their household. The village recently formed women’s organizations (*mahila mandals*) that allowed them to share knowledge about the time they spent fetching water and about possible links between the quality of water and their health. Through these organizations, they realized that not only they and their neighbors had little access to safe water, but that the problem was pervasive in all 10 surrounding villages. This created strong community awareness. The women formed alliances with the female members of the local village council (*panchayat*), held protest marches, and performed street plays. One result of their efforts was to pressure the *panchayat* to repair malfunctioning tubewells and revive a running-water supply scheme. As a result of the women’s efforts, within six months 17 community wells were deepened in eight villages, and pipelines were laid for drinking water in two villages. The women also initiated programs for social forestry and rainwater harvesting to protect the environment. For the first time in the recent history of these villages, there was sufficient safe drinking water in seven villages during the summer months of 1997.

Source: Devasia (1998).

Decentralization and local empowerment are not a guarantees for environmental stewardship. Indeed, the opposite may result: devolution of power to the local level has increased pressure on forests in view of the income, employment, and revenue needs of local government and their constituents (World Bank 2000). Hence, it is important not to take a romantic view of community empowerment as the panacea for poverty alleviation and environmental protection. The approach to “joint” forest management in India is an attempt to balance the short-term and long-term needs (see box 11. 3).

Globalization and liberalization of markets have also increased incentives for exports of forest and other natural resource-based products. Hence, when tradeoffs between environmental conservation and poverty reduction are resolved locally, they may result in short-term exploitation. However, this will be mitigated by two factors: (1) local resource control also means that the fruits of sustainable management and reinvestment in natural resources will accrue locally, and (2) financial transfers from the outside can make a big difference as to how these tradeoffs are resolved, especially in critical ecosystem areas.

11.3 Environmental Contributions to the PRSP

This section sets out the relevance of the environment to the PRSP at three key stages: poverty diagnostics, choosing the most effective and efficient public actions to address the identified problems, and monitoring and evaluation.

11.3.1 Understanding poverty links

This section raises the issues that need to be considered when mapping out the relationship between poverty and environment. Teams should survey available information to get an idea of where environmental problems and poverty overlap. It will then be important to gain an understanding of particular problems in particular areas. This may involve reading existing case studies or commissioning small, rapid surveys of the most vulnerable areas. Technical note J.2 gives examples of tables outlining the links between environmental conditions and outcomes.

Suggestions as to the types of information necessary to consider the links between environment and poverty are listed below under the headings of health, economic opportunity, security, and empowerment. Much of this information may be available through analyses done for other sectors, but some may have to be collected in surveys targeted at the poor.

Environment and health

- Prevalence of and deaths caused by diarrhea and vector-borne diseases
- Prevalence of and deaths caused by acute respiratory infections
- Coverage of safe water supply
- Distribution of water sources
- Average water use (liters per capita per day)
- Water uses
- Transport of water
- Time spent collecting water
- Those who collect water
- Hand washing typical practices
- Coverage of sanitation
- Kind of toilets or latrines the community has
- Use of coal, wood, or dung as primary fuel
- Share of households using improved stoves or cleaner fuel
- Coverage of urban solid waste collection

- Levels of particulate matter suspended in urban air
- Levels of airborne lead or lead in foodstuffs

Environment and economic opportunity

- Percentage of poor people who depend directly on natural resources for their livelihood and during times of crisis
- Influence of macroeconomic policies on local access to natural resources
- Distribution and type of property rights to natural resources
- Changes in natural resources
- Soil quality, vegetation, and the availability of game, fish, and other important sources of nutrition in nature
- Conflicts in use of natural resources
- Time spent collecting fuelwood and trend over time
- Relationship between population growth and resource degradation

Environment and security

- What is the frequency of hurricanes, cyclones, floods, landslides, and drought?
- How effective is the early warning or forecasting system?
- Does the country have effective emergency response systems?
- Do the poor live in the most vulnerable areas?
- What are the housing conditions of the poor?
- Do building codes exist, and are they enforced?
- Do formal or informal insurance schemes exist?
- In what form do people keep their savings?

Environment and empowerment⁸

- To what extent are local groups organized?
- What institutions do local communities use to manage resources?
- Do certain segments of the local community have a greater voice than others?
- To what extent are poor people aware of their rights and of policies and legislation?
- What are their sources of information?
- What are their links with local NGOs and government officials?
- Do environmental NGOs exist at a national level or local level?
- Do they focus on issues of concern to poor people, and are poor people involved?
- Are NGOs effective?

Collecting and analyzing information

The relationship between environmental degradation and poverty can never be completely characterized by the available data. Table J.1 in technical note J.4 gives examples of useful data sources. Particularly important are the data measured in Demographic and Health Surveys, which typically measure under-five mortality and access to water and sanitation in both rural and urban areas. Mapping these data into wealth quintiles provides important information on the distribution of environment-linked morbidity, helping to build the case for investments in environmental infrastructure for poor communities. In the longer run, it will be important to put in place the means to improve data collection to cover key priorities by, for example, adapting ongoing survey instruments, coordinating ongoing research, or

commissioning new studies. In addition, the health, nutrition, and poverty information sheets provide valuable information on many environmental features related to poverty (see chapter 18, “Health, Nutrition, and Population”).

The questions and relationships highlighted in this section are complex and vary by circumstances and over time. Therefore it would be wise to quantify when possible and rely on qualitative research methods in circumstances that are not amenable to quantitative data collection. The PRSP could then put in place systems to quantify the most important variables at later stages.

11.3.2 Choosing the most effective public actions

Once the PRSP team has gained a broad understanding of the most important environmental factors relating to poverty, they will want to consider the public actions that are likely to be most effective and cost-efficient in changing these environmental conditions. This section⁹ therefore reviews the prime areas of intervention and the different ways to analyze whether these should be undertaken.

Prime areas of intervention

Public action broadly comprises policy reform and public spending and taxation. Both categories of interventions are important, and specific country situations will guide the choice of one or the other. The objective of this stage in the poverty reduction strategy is to rank public policies and actions according to their likely benefits and costs.

The process will be iterative (see figure 11.1 above) and will depend on the scale of the problem, the cost of intervention, institutional capacity for implementation, and the resulting benefit. If, for example, the most important problem is one that public action can do little to affect, it may be better to focus more resources on a problem that is less important but easier to address. Public actions can involve both modifying existing interventions and developing new ones. Interventions may aim to tackle the following, a number of which are also covered in other chapters.

- ***Health damage*** related to the environment can be reduced by combining increased coverage of safe drinking water and latrines with education on sanitation, introducing fuel-efficient stoves to reduce indoor air pollution, encouraging fuel switching to reduce levels of particulates and lead in urban areas, and taking measures to reduce standing water where disease vectors breed.
- ***Increase economic opportunity*** through improved natural resource management by removing policies that encourage short-term “mining” of renewable natural resources, developing community-based watershed management programs to increase safe water supply, enhancing the supply of fuelwood and nontimber forest products, reducing land degradation, and providing security in access to natural resources.
- ***Reduce vulnerability*** to natural disasters by stabilizing land on slopes above crowded areas in cities prone to flooding, improving the natural hazard forecasting system, and ensuring that the information is available to poor groups and that they have the ability to respond to it. Policies to reduce vulnerability may also include emergency income transfers and access to insurance and microcredit (see chapter 17, “Social Protection”).
- ***Empower excluded groups*** by developing community-based interventions related to management of local natural resources, such as forests, grazing areas, water supply, sanitation, or soil management, including environmental information in school curricula so that people understand the relationships between their well-being and environmental conditions.

Assessing expected costs and benefits

There is an extensive literature on methodologies for calculating the costs and benefits of environmental changes. Although the quantification may be uncertain, cost-benefit analysis offers a systematic way to consider the best available information in a coherent format. It can therefore impose some rigor on the debate and pave the way for what ultimately must remain political decisions. Even the benefits of public

interventions to reduce vulnerability can be valued, in principle, by damage costs avoided (see, for example, Kramer, Sharma, and Munasinghe [1995] on the benefits of flood control).

Actions to reduce health damage can be valued by (a) gains in productivity among the affected population, (b) savings in medical cost, or (c) measuring the willingness to pay for the improvements among the affected population. Examples of this analysis can be found for water supply (Toma Enterprises Ltd. 1996; Whittington, Okorafor, and others 1993) for sanitation (Whittington, Lauria, and others 1993) for both water and sanitation (Hughes, Dunleavy, and Lvovsky 1999), and for air pollution abatement (Lvovsky, Hughes, and Maddison forthcoming).

Estimating the distributional consequences of interventions is more difficult, that is, exactly who wins and who losses.¹⁰ It is possible to allocate distribution of benefits and costs if the specific “weights” attached to these groups can be determined. In a PRSP context, impact of each intervention should ideally be evaluated: (a) the percentage of the benefits that accrue to the poor and (b) the value of the benefits to the poor relative to household income or consumption.¹¹

Cost-benefit analysis of public actions should take into account potential synergies among sectors. For example, better health outcomes may be achieved through public policy actions in several sectors, ranging from education and health (improving access to health facilities) to environment (improving water quality and sanitation and reducing outdoor and indoor air pollution).

In other cases, the most effective interventions may involve tradeoffs either within groups in a given community or between communities. For example, a rural livelihoods project based on charcoal production may increase household overall income but require that women walk farther to gain firewood. It is important to be aware of potential unintended consequences. Similarly, it is crucial to consider people’s well-being over the long term. These impacts can be weighted together by use of a discount rate. This can also be varied to reflect different preferences to determine how it changes the outcome of the analysis. That is one example of a sensitivity analysis, which should form part of any cost-benefit analysis.

Cost-efficiency analysis

Often a full assessment of the benefits of an intervention is not feasible, but giving consideration to cost-efficiency is possible and remains important. For example, for environmental health interventions, it may be difficult to agree on the value of saving a DALY but easier to agree on the importance of achieving that goal as efficiently as possible.

Assessments of the burden of disease provide a first step in establishing priorities. However, each problem should not simply be allocated resources according to its size. Within the categories of major problems, it becomes necessary to assess the cost-efficiency of interventions, that is, getting the most out of limited resources. Here, the DALY concept proves helpful again, as it allows comparison of the cost per DALY saved by different interventions. Table 11.2 provides some examples.

Although cost-efficiency will vary across countries and even locally, this type of comparison is useful to keep in mind when designing interventions. If it is not already available, the PRSP work could take the initiative for country-specific studies to allow such comparisons.

Table 11.2. Cost-Efficiency of Environmental Health Interventions

<i>Measure</i>	<i>US\$ per DALY saved</i>
Hygiene behavior change	20
Malaria control	35–75
Improved stoves (indoor air)	50–100
Improved sanitation	120
Improved quality of urban air	most > 1,000

Source: Adapted from Lvovsky and others (1999).

11.3.3 Monitoring outcomes and evaluating interventions

This section extends the general framework presented in chapter 3 to deal with monitoring and evaluation of interventions that are particularly relevant from a poverty-environment perspective. In particular, this section will discuss the choice of useful indicators.¹² To briefly recap the key terms: intermediate indicators can be either input indicators (the quantity and quality of resources used for an intervention) or output indicators (the quantity and quality of works, goods, and services produced as a result of the inputs); final indicators comprise outcome indicators (the quantity and quality of the results achieved through the use of outputs)¹³ and impact indicators (the long-term changes in living conditions among the beneficiaries).

A key question is how best to choose indicators. The points below offer some generic guidance for the selection of indicators, which are also applicable from an environmental perspective:¹⁴

- relevance for the objectives of the intervention;
- realistic collection or development costs;
- clear cause-and-effect links;
- high quality and reliability; and
- appropriate spatial and temporal scale.

A major area of intervention discussed in this chapter is environmental health. Obviously, the choice of indicators here must be guided by professional health specialists as well as statistical expertise. Some suggestions are provided here, focusing on the major illnesses affecting the poor: malaria, respiratory infections, and diarrhea. In the context of the PRSP, it would be important to collect the data per income group in, for instance, quintiles.

Table 11.3. Selected Environmental Health Indicators

<i>Environment-related illness</i>	<i>Intermediate indicator</i>	<i>Final indicators</i>
Malaria	<ul style="list-style-type: none"> • Proportion of households having at least one treated bednet • Percentage of health facilities reporting no disruption of stock of antimalarial drugs (as specified by national health policy) for more than one week during the previous three months 	<ul style="list-style-type: none"> • Malaria death rate (probable and confirmed) among target groups (under-five and others) • Number of malaria cases, severe and uncomplicated (probable and confirmed), among target groups • Percentage of patients with malaria getting treatment at health-facility and community levels within 24 hours
Respiratory infections	<ul style="list-style-type: none"> • Availability of ventilation in cooking area • Children sleeping in cooking area • Percentage of households using clean fuel and improved stoves 	<ul style="list-style-type: none"> • Prevalence of acute and chronic respiratory infections • Prevalence of chronic lung disease
Diarrhea	<ul style="list-style-type: none"> • Access to safe water (private and public) • Access to sanitation (private and public) • Hours per day of piped water • Quantity of water per capita per day • Time taken and distance involved in collecting water • Disposal practices of children's feces • Percentage of child caregivers and food preparers with appropriate hand washing • <i>E. coli</i> per 100 milliliters of water consumed by source • Persons per room of housing 	<ul style="list-style-type: none"> • Prevalence of diarrhea
Broad indicators	<ul style="list-style-type: none"> • Public health expenditures 	<ul style="list-style-type: none"> • Infant mortality rate • Under-five mortality rate • DALYs

Source: Adapted from Shyamsundar (2001).

Appropriate design of output, intermediate, and outcome indicators can help to guide specific interventions. For air pollution, for example: if reducing acute respiratory infections (ARIs) per person per year by x percent for poor people is the desired outcome, one possible intervention might be a clean fuels initiative for transportation. The outcome indicator in this case is clearly symptom days per person per year for the impoverished. Output indicators for the project would include such obvious items as total quantity supplied and shares of clean transport fuels in proportion to total transport fuel supply. Intermediate indicators could include concentrations of ozone and particulate matter (PM10) in urban centers, particularly in poor neighborhoods.

The role of each level of indicator is to provide signals about the effectiveness of the intervention. For example, if quantitative restrictions are the policy tool chosen to change the fuel mix, smuggling and black markets may offer a way around the restrictions, in which case the intermediate indicator (pollution concentrations) will not fall in line with policy implementation. Care is required in interpreting intermediate indicators, however. Perhaps pollution concentrations are not falling because of a sudden rise in the vehicle fleet, so that total fuel demand offsets the increase in average “cleanliness” of each unit of fuel. Any evidence that interventions are not having the desired effect on intermediate indicators may require further analysis and possibly even a redesign of interventions.

It is also possible, however, that the intermediate indicator (pollution concentration) does fall with policy implementation, but that the outcome indicator (ARI incidence among the poor) does not respond in kind. This is a signal that further analysis is required to increase the effectiveness of the intervention. The analysis may show, for instance, that the rich appropriate all the benefits of the intervention or that other sources of ARIs are on the increase. In the latter case, the difficult task of estimating what the situation would have been in the absence of the intervention (the counterfactual) may be required.

Box 11.5 discusses the intricacies of choosing indicators in the related area of water and sanitation. Further suggestions are given in technical note J.2, which deals with project-specific indicators.

Another major area of interventions discussed in this chapter concerns NRM. Such interventions aim to enhance economic opportunities, reduce vulnerability, and enhance security. Table 11.4 offers some suggestions for indicators.

In summary, M&E from an environmental perspective is best integrated closely with the overall framework for tracking the progress of the PRS. However, it does require specific attention to the inclusion of indicators that reflect the environmental conditions that are most important to the poor.

11.4 Mainstreaming of Environment in the Early Interim and Full PRSPs

This chapter argues that environment should be integrated into the PRSP because the quality of the environment is inextricably linked to the quality of life for poor people. Against this background, a review has been undertaken to assess the extent of environmental mainstreaming in the PRSPs. up to early 2001 A total of 25 Interim and full PRSPs in countries in Africa, Latin America, and Eastern Europe and Central Asia are reviewed (Bojö and Reddy 2001).

Box 11.5. Choosing Good Indicators: Water and Sanitation

Rural water and sanitation projects usually aim to improve human health. But a review of 144 studies attempting to measure the health impacts of water and sanitation interventions (Esrey and others 1990) concluded that only 42 were methodologically rigorous, and those reported vastly different results. Even if a project is successful in producing clean water, it may not protect people from pathogens, either because they are exposed through other sources or because they may not use the piped water as their only source of drinking water. Chinese villagers who know the importance of boiling water still drink from irrigation ditches during long days of hot field labor. A survey from Mali showed that people found the safe water “bland” and used it only in the dry season when they could not get the river water. Monitoring health benefits requires careful contextual and epidemiological work over a long period. It is often either beyond the capacity of or unaffordable for many agencies. Measuring time savings, however, is significantly easier. Households consistently rank time savings from water collection high on their priority lists, and we can value those time savings. Thus measuring time savings can be an inexpensive proxy indicator for the final indicators that we would ideally like to measure. Such data are often collected through the regular Living Standard Measurement Study surveys.

Table 11.4. Selected Indicators Related to NRM Interventions

<i>Poverty issue</i>	<i>Poverty–environment indicator</i>	<i>Natural resource problems</i>
Income and opportunity	<ul style="list-style-type: none"> • Time to collect water and fuelwood • Distance to collect water and fuelwood • Percentage of annual household consumption from CPRs • Percentage of annual household consumption from forest products and fisheries 	<ul style="list-style-type: none"> • Deforestation • Water scarcity • Overfishing • Lack of clear or enforced property rights
Insurance	<ul style="list-style-type: none"> • Percentage of household consumption from forest products and fisheries when crops fail 	<ul style="list-style-type: none"> • Deforestation • Land degradation • Overfishing
Vulnerability	<ul style="list-style-type: none"> • People affected by floods, hurricanes, cyclones per year • People affected by landslides per year • Number of deaths from natural disasters • Percentage of people living in areas prone to flooding, landslides, and so on • Percentage of farmers with land on slopes • Stunting before and after disasters 	<ul style="list-style-type: none"> • Natural disasters • Deforestation • Lack of information
Food security	<ul style="list-style-type: none"> • Percentage of farmers without access to cultivable land • Percentage of farmers without access to irrigation • Falling crop yield trends • Percentage of farmers who know about drought-resistant crops • Percentage of dried wells 	<ul style="list-style-type: none"> • Soil fertility loss • Waterlogging and salinization • Water scarcity

Source: Adapted from Shyamsundar (2001).

The rest of this section highlights what issues of environmental concerns and opportunities had been identified in the PRSPs; the to which poverty–environment causal links were analyzed; and environmental management responses and indicators put in place as part of the poverty reduction efforts. Consideration is given to how the design and documentation of the process has allowed for mainstreaming of environment in PRSPs.

11.4.1 Good practice

A major finding of the review is that good practice does exist, and the following are some of the good practices identified in the PRSPs.

Issues in focus

Under this heading, the description of environmental issues pertaining to land, water, air, and biodiversity is assessed.

The Kenya I-PRSP describes the environmental issues relating to land use and water and suggests strategies, monitoring indicators, and cost of implementation of the strategies relating to land use, water, and energy. The Kenya I-PRSP is also sensitive to loss of biodiversity.

Pollution resulting from the lack of environmental regulation is well illustrated by the Honduras PRSP, which notes that

a study in Tegucigalpa showed up to 8.96 gm/m³ of lead in the air and . . . high lead intoxication in the children attending public schools. The study also notes that contaminants in soil and water are responsible for a high index of diarrheic diseases in the capital of Tegucigalpa. Soil and water pollution is further compounded by solid waste dumping with low coverage of garbage collection services, poor waste management, and the lack of sanitary landfills. Respiratory diseases are also common, especially among children under five . . . partly caused by increasing number of cars and the presence of factories that are not subject to any kind of environmental regulations.

The Rwanda I-PRSP notes that the major portion of the energy consumed by poor people is in the form of fuelwood. Shortage of fuelwood imposes time and financial costs on poor households and makes it harder for children to attend school. Poor access to energy has also impeded the development of agro-processing and nonagricultural activities, compromising the prospect of economic diversification. In the water supply sector, access to potable water in rural areas fell from 64 percent in 1984 to 50 percent in 1996. One-third of the water supply infrastructure does not function, and poor households cannot afford the fees for drinking water.

Mauritania is a country severely affected by drought and desertification in the Sahel region:

With the exception of mining and fisheries, the country is under-endowed in directly exploitable natural resources. Vegetation and forest resources are sparse and water resources, both surface and underground, are either limited or difficult to reach. Due to limited water resources, the arable land potential of Mauritania is less than 0.5 million ha (< 1% of country's geographical area). In addition, 60% of the farms are less than 1 ha and lack secured tenure.

Poverty–environment links

Some of the issues examined by PRSPs and their perspective of poverty–environment links provide useful insights into policy analysis and implementation.

The PRSPs of Honduras, Burkina Faso, Mauritania, and Guinea present maps showing regional distribution of poverty, population, and natural resource attributes. The poverty and resource maps help in the assessment of spatial and temporal relationships between poverty and the resource base. They can also be used to track the effects of policy and management interventions relating to poverty reduction.

The Burkina Faso PRSP notes that climatic conditions and low agricultural productivity, related to degradation of soil and water resources, are major constraints to economic growth and contribute to massive poverty and severe food insecurity among rural inhabitants. Income from farming and livestock raising is highly dependent on rainfall, which varies considerably from year to year.

The Honduras I-PRSP presents a detailed assessment and quantification of vulnerability due to Hurricane Mitch. The PRSP notes that “Hurricane Mitch had a severe impact on living conditions in Honduras and this in turn affected poverty levels nationwide.”

The Kenya PRSP notes a concern of property rights related to natural resources, and it proposes to implement a land law to create an efficient and equitable system of land ownership. In the context of water, the PRSP notes “the incidence of violation of water rights, conflicts, and pollution have dramatically increased.”

On the theme of policies influencing NRM, the Ghana PRSP stresses benefits accrued in terms of policy and funding during the period of structural adjustment. Community water and sanitation and urban water supply benefited from the injection of capital as well as a new framework for management. In the urban water sector, the Ghana Water and Sewage Corporation has been restructured into a limited liability company. A program to increase tariffs in order to safeguard the financial viability of the utility

is under way and takes into account poor households' ability to pay. Policy changes are under way to encourage cocoa growers by raising producer prices, reducing the export tax, and allowing licensed buying companies to export a certain quota of the domestic production. Such measures will influence the tradeoff between cocoa bushes, a perennial tree crop that provides good ground cover, and alternative crops. Further study would be required to determine how this change in relative prices affects the environment.

Georgia's energy sector reform reflects the need for reassessing the responsiveness of market interventions on the poverty–environment impacts during the privatization process. After the collapse of the Soviet Union, Georgia did not have access to the cheap energy resources of the erstwhile centralized economy. Privatization of the electricity market raised the energy tariff by a factor of 2.4 to reach about one-fifth of the average monthly family income. Inability of the poor to use electricity also resulted in increased demand for fuelwood. The system of energy allowances to households adopted early in the reform was found to be inadequate and inefficient in comparison to the later system of targeted budgetary support to the poor to cover household electricity expenditure. Georgia's energy privatization experience shows the need for careful design of policy instruments to safeguard the poor as well as their environment.

Response systems

As expected, the response systems of countries vary depending on their socioeconomic conditions, environmental challenges, institutional framework, and previous measures undertaken. Good practice for investment and monitoring systems is summarized below.

The Kenya I-PRSP presents the institutional, regulatory, and legal framework for implementing the environmental impact assessment and environmental audit through creation of a national environment management authority, a national environment council, an environment tribunal, an environmental trust fund, and an environment information system, at a cost of more than US\$3 million. The Kenya PRSP also makes detailed proposals for restructuring forestry institutions and forest management. The proposals include a full forest inventory, new licensing procedures, improvement of wood recovery rates from 30 percent to 50 percent, promotion of farm-based wood production, involvement of 30 percent of women in forest-based activities, and collaborative agreements with rural communities, at a cost of about US\$10 million.

The Burkina Faso PRSP specifies a program of soil and water conservation designed to break the vicious circle of soil degradation, poverty, and food insecurity. It also refers to new legislation pertaining to environment, water resources, and mining. Testing ways to provide for more secure property rights to land under a national land management program is also related to environmental management. A cost assessment of programs relating to irrigation, measures to combat vulnerability, and projects for strengthening of institutional capacity is also presented.

Inspired by the disastrous Hurricane Mitch, the Honduras I-PRSP commits to “to manage risk and deal with disasters under a new legal and institutional framework.”

In Rwanda, there are still 250,000 households living in camps under plastic sheets, and more than 60,000 live in damaged housing. The government commits to a resettlement program to ensure that new settlements have access to such basic public services as water and sanitation.

Georgia's PRSP proposes privatization of land and water resources, promotion of a land market, creation of water user associations, and installment of a rural credit policy establishing guarantee funds and insurance against climatic hazards, as interventions aimed at improving soil and water resources management, restoring agricultural infrastructure, and ensuring adequate property rights and income sources to vulnerable groups.

Despite the livestock sector's potential for reducing poverty in Mauritania, it is seen as “poorly integrated and inadequately structured.” The government proposes to integrate the agriculture and livestock sectors, adopt a farming code to facilitate the opening of pasture and range lands, improve milk and meat production and processing, introduce environmentally friendly pasture and range management, promote

economic and environmental studies to support additional value added in the leather and hide industries, and establish research and extension programs for improving the livestock contribution to rural economy. To limit the impacts of climatic fluctuations on the food security and incomes of the poor, the Mauritania government intends to promote early warning systems and establish rapid response mechanisms. The plan includes a food security observatory and a national reserve stock, with a physical reserve of food products and a financial reserve enabling the managers to respond to a food crisis.

Process

While process design and documentation cannot be expected to specifically highlight the involvement of environmental constituencies, the more inclusive designs allow such voices to be heard. It is interesting to note that most of the countries that have been identified as providing good practice under this heading, such as Kenya, Rwanda, and Nicaragua, also score high on mainstreaming.

Notes

1. See the World Bank's set of 10 safeguard policies pertaining to environmental and social assessment, among other things.
2. Fisheries provide an illustration of this: the Food and Agriculture Organization of the United Nations (FAO) estimates that 44 percent of the main fish stocks are fully exploited, with no room expected for further expansion. About 16 percent are overfished, and there is an increasing likelihood that catches might decrease if remedial action is not undertaken. Another 6 percent appear to be depleted, with a resulting loss in total production, and 3 percent seem to be recovering slowly (FAO 1999). An important driving force behind overfishing is public subsidies to excessively large fishing fleets. Estimates of the size of these subsidies vary considerably but amount to many billions of dollars each year. In a study for the U.S. Department of Commerce in 1997, Milazzo estimated the subsidies range from US\$11 billion to US\$54 billion (quoted in Lutz 1998).
3. Cost-efficient choices for public health interventions are deferred to section 11.3.
4. See also chapter 16, "Rural Poverty."
5. See also chapter 10, "Gender."
6. A study of Munasinghe and Cruz (1995) contains a number of case studies that illustrate the links between economic policies and environmental impacts.
7. There is a large, and partially controversial, literature on CAMPFIRE. (See, for example, Africa Resources Trust and the Campfire Association [1996] for a presentation of the program concept, Muir and Bojö [1996] for a discussion about the cost and benefits across different districts, and Murombedzi [1999] for a critical analysis. For other project examples of wildlife management involving communities, see IIED [1994] and Roe and others [2000].)
8. See also chapter 7, "Participation."
9. See technical notes J.1, J.2, and J.3 for more examples.
10. See Squire and van der Tak (1975) and Helmers (1979).
11. Chapter 6, "Public Spending," provides a complementary perspective on the analysis of public spending.
12. See technical note J.5 for examples of project-specific indicators.
13. See Squire and van der Tak (1975) and Helmers (1979).
14. The list is adapted from Segnestam (1999).

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Overall relationship between poverty and environment

*Bojö, Jan, and Rama Chandra Reddy. 2001. "Poverty Reduction Strategies and Environment: A Review of 25 Interim and Full PRSPs." World Bank, Washington, D.C. Processed.

*Bucknall, Julia, Christiane Kraus, and Poonam Pillai. 2001. "Poverty and Environment." Background Paper for the World Bank's Environment Strategy. World Bank, Washington, D.C.

Ekbom, Anders, and Jan Bojö. 1999. "Poverty and Environment: Evidence of Links and Integration into the Country Assistance Strategy Process." Environment Group, Africa Region, World Bank, Washington, D.C.

The authors discuss various hypotheses regarding these linkages and consider the evidence and counterevidence for each. Their analysis suggests that environmental degradation indeed tends to exacerbate poverty. However, a review of empirical evidence suggests that the links between poverty and environment are very context specific. The paper also presents some good examples of joint poverty environment analyses in the World Bank's Country Assistance Strategies and Participatory Poverty Assessments.

Forsyth, Tim, Melissa Leach, and Ian Scoones. 1998. "Poverty and Environment: Priorities for Research and Policy." Paper prepared for the United Nations Development Programme (UNDP) and the European Commission, Sussex University, Institute for Development Studies, U.K.

This paper challenges the assumption that the only way to impede environmental degradation is to alleviate poverty. It also questions the assumption that the poor are forced to degrade landscapes in response to economic marginalization, population growth, and environmental degradation. On the contrary, the authors argue that the poor are often able to construct institutions so as to maintain natural resources sustainably. The paper draws on numerous case studies to demonstrate that expected patterns of downward spiral between poverty and environment were in fact misplaced. The authors show how local negotiation between different actors in rural and urban areas can lead to sustainable and equitable use of natural resources.

*Government of Honduras. 2000. "Interim Poverty Strategy Paper." Tegucigalpa, Honduras.

*Munasinghe, Mohan, and Wilfrido Cruz. 1995. "Economywide Policies and the Environment." World Bank Environment Paper No. 10. World Bank, Washington, D.C.

Parikh, Kirit S. 1998. "Poverty and Environment: Turning the Poor Into Agents of Environmental Regeneration." Social Development and Poverty Elimination Division, UNDP.

This paper focuses on including the poor in poverty reduction and environmental protection. The author argues that the poor depend on environmental and natural resources for a significant portion of their livelihoods. Hence, when natural resources degrade, their livelihoods are adversely affected. Often development projects have adversely affected the resources on which the poor depend, such as the flood control project in Bangladesh and deforestation in Brazil to promote cattle ranches. The author's thesis is that people can be agents of environmental regeneration, and innovative institutional arrangements can play a key catalytic role in this process.

*Segnestam, Lisa. 1999. "Environmental Performance Indicators: A Second Edition Note." Environment Department Paper No. 71. World Bank, Washington, D.C.

*Shyamsundar, Priya. 2001. "Poverty-Environment Indicators." Environment Department, World Bank, Washington, D.C. Processed.

Health and environment

Akbar, S., and K. Lvovsky. 2000. "Indoor Air Pollution: Energy and Health for the Poor." UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) Newsletter, no. 1, September. World Bank, Washington, D.C.

*Aristanti, C. 1997. "Gender, Biomass Energy and Health." *Wood Energy News* 12(1):8-10.

*Dasgupta, Jashodhara, and Abha Das. 1998. "Health Effects of Women's Excessive Work Burden in Deforested Rural Areas of Uttarkhand." Paper presented at the National Conference on Health and Environment, Center for Science and Environment, New Delhi.

Esrey, Steven A. 1996. "Water, Waste, Well-Being: A Multi-Country Study." *American Journal of Epidemiology* 143(6):608–23.

*Esrey, Steven A., James B. Potash, Leslie Roberts, and Clive Shiff. 1990. *Health Benefits from Improvements in Water Supply and Sanitation*. Water and Sanitation for Health (WASH) Project. WASH Technical Report No. 66. Prepared for the U.S. Agency for International Development under WASH FASR No. 035. Arlington, VA.

This report reviews studies published in the last 40 years on the relationship between water and sanitation and six diseases (diarrhea, ascariasis, trachoma, hookworm, schistosomiasis, and guinea worm). The study found many of the reviews to be methodologically flawed but widely differing results reported from those that followed sound methodologies. The study also found safe excreta disposal more effective at reducing the diseases than water supply. Safe water and sanitation more often reduced the severity of the diseases than the incidence. Improving the quality of drinking water was less important than safe excreta disposal and proper use of water for hygienic purposes.

*———. 1991. "Effects of Improved Water Supply and Sanitation on Ascariasis, Diarrhea, Dracunculiasis, Hookworm, Infectious Schistosomiasis and Trachoma." *Bulletin of WHO* 69(5):609–21.

*Hughes, Gordon, Meghan Dunleavy, and Kseniya Lvovsky. 1999. *The Health Benefits of Investments in Water and Sanitation: A Case Study of Andhra Pradesh, India*. Washington, D.C.: World Bank.

This study estimates the proportion of total burden of ill health in Andhra Pradesh that is attributable to environmental factors. It finds that diseases relating to water supply and sanitation are responsible for 11 percent of the total burden of disease, and those relating to indoor air pollution are responsible for a further 6 percent. The study evaluates the costs and health benefits of investing in water supply and sanitation and then subtracts the expected willingness to pay from the costs to produce net costs to the public purse. This allows policymakers a choice between different interventions aimed at reducing the total burden of disease related to poor water and sanitation.

*Jalan, Jyotsna, and Martin Ravallion. 2001. "Does Piped Water Reduce Diarrhea for Children in Rural India?" World Bank Policy Research Working Paper. Washington, D.C.

*Klees, Rita, Joana Godinho, and Mercy Lawson-Doe. 1999. "Sanitation, Health and Hygiene in World Bank Rural Water Supply and Sanitation Projects." Europe and Central Asia Region Studies Program, World Bank, Washington, D.C.

Lavy, Victor, John Strauss, Duncan Thomas, and Philippe de Vreyer. 1996. "Quality of Health Care, Survival and Health Outcomes in Ghana." *Journal of Health Economics* 15(3):333–57.

The authors take data from the Living Standard Measurement Study survey and estimate the effects of health services and public infrastructure on the health of children in Ghana. They look at child survival and stunting (height for age and weight for height). They find that increases in the prices of basic foodstuffs, especially cassava and maize, have a major negative effect on child survival and stunting, particularly in rural areas. The effects on child survival are larger for girls than boys, indicating different intrahousehold allocations. They also find that the quality of water and sanitation facilities significantly affects child survival and malnutrition. They find the effects larger and more significant among older children. The effects are larger for children with families in which the heads of families and their spouses have low levels of education.

*Listorti, James, and Fadi Doumani. 2001. "Environmental Health: Bridging the Gaps." Discussion Paper No. 433. World Bank, Washington, D.C.

*Lvovsky, Kseniya, Gordon Hughes, David Maddison, Bart Ostro, and David Pearce. Forthcoming. "Air Pollution and the Social Costs of Fuels." World Bank Technical Paper, Washington, D.C.

This paper provides a model for assessing the likely health damages attributable to air pollution in an urban area. The model requires simple data on fuel use, types of sources, wind directions, and population patterns, and enables the user to estimate quickly the likely health costs of air pollution, its most important sources, the likely costs of reducing the pollution, and the expected benefits.

*Lvovsky, Kseniya, Maureen Cropper, James Listorti, A. Edward Elmendorf, Candace Chandra, Julian Lampietti, Ronald Subida, and Meghan Dunleavy. 1999. "Environmental Health Background Paper to World Bank Environment Strategy." Draft. World Bank, Washington, D.C.

This paper gives an overview of the literature and current thinking on environmental health issues in developing countries. It includes estimates of the total burden of disease attributable to environment for different regions of the world. It then outlines typical environmental health interventions, best practices, and indicators.

Murray, Christopher J. L., and Alan D. Lopez. 1996. *Global Health Statistics: A compendium of Incidence, Prevalence and Mortality Estimates for Over 200 Conditions*. Cambridge, Ma.: Harvard University Press.

Songsore, J., and G. McGranahan. 1993. "Environment, Wealth and Health: Towards an Analysis of Intra-urban Differentials Within the Greater Accra Metropolitan Area, Ghana." *Environment and Urbanization* 5(2):10–34.

Economic opportunity and sustainable livelihoods

*Cavendish, William. 1999. "Empirical Regularities in the Poverty-Environment Relationship of African Rural Households." Center for the Studies of African Economies. Working Paper Series 99–21. London.

*Chambers, Robert, and Gordon Conway. 1992. "Sustainable Rural Livelihoods: Practical Concepts for the 21st Century." IDS Discussion Paper No. 296. Institute of Development Studies, University of Sussex, Brighton, U.K.

*Christie, Ian T., and Doreen E. Compton. 2001. "Tourism in Africa." Africa Region Working Paper Series No. 12. World Bank, Washington, D.C.

*DFID (Department for International Development). 1999. Sustainable Livelihoods Guidance Sheets. Available at http://www.livelihoods.org/info/guidance_sheets_pdfs/section1.pdf.

*FAO (Food and Agriculture Organization of the United Nations). 1999. *The State of World Fisheries and Aquaculture 1998*. Rome: FAO.

*Heath, J., and Binswanger, Hans. 1996. "Natural Resource Degradation Effects of Poverty and Population Growth Are Largely Policy Induced: The Case of Columbia." *Environment and Development Economics*. Vol. 1, part 1, 65–83.

*Jodha, N. S. 1986. "Common Property Resources and Rural Poor in Dry Regions of India." *Economic and Political Weekly* 21(27):1169–81.

In his now classic study, Jodha quantifies the extent to which the rural poor benefit from common property resources (CPRs). His argument is that the decline of CPRs, in part a consequence of their privatization, results in the subsequent pauperization of the poor. The study, based on data from 80 villages in 21 districts in dry regions of seven states in India, shows that poor households ("poor" refers to landless laborers and small farmers with less than 2 hectares of dry land) are much more dependent on CPRs than larger farm households. For instance, while 95 percent of the poor households in Andhra Pradesh were dependent on CPRs for food items, only 10 percent of the larger farm households were dependent on CPRs for food. Furthermore, Jodha's study shows that income from CPRs accounts for a larger percentage of income for poor households than for better-off households.

Kepe, Thembela. 1997. *Environmental Entitlements in Mkambati: Livelihoods, Social Institutions, and Environmental Change on the Wild Coast of the Eastern Cape*. Research Report No. 1. Sussex University, Institute for Development Studies and Program for Land and Agrarian Studies.

This case study calculates the importance of natural resources on the incomes of poor people.

*Lutz, Ernst, ed. 1998. "Agriculture and the Environment: Perspectives on Sustainable Rural Development." A World Bank Symposium. World Bank, Washington, D.C.

McDowell, Christopher, and Arjan de Haan. 1997. "Migration and Sustainable Livelihoods: A Critical Review of the Literature." IDS Working Paper 65. Sussex University, Institute of Development Studies.

Drawing on evidence from Ethiopia, Bangladesh, and Mali, the author argues that migration is more often the rule rather than the exception. The paper critiques theories of migration that focus only on macroeconomic or political factors to explain migration.

Scoones, Ian. 1998. "Sustainable Rural Livelihoods: A Framework for Analysis." IDS Working Paper No. 72. Sussex University, Institute of Development Studies.

This paper discusses the concept of sustainable livelihoods. The framework of sustainable livelihoods shows how within a particular (policy, historical, agro-ecological) context, certain combinations of livelihood resources or capital are used to follow different livelihood strategies. These strategies include agricultural intensification or extensification, livelihood diversification, and migration. The paper further discusses five indicators of sustainable livelihoods, poverty reduction being one of them.

*World Bank. 1995. "Rural Fuelwood Markets and Village Management of Natural Woodlands in Niger." Processed. Washington, D.C.

*World Bank. 2000. *A Review of the World Bank's 1991 Forest Strategy and Its Implementation*. Operations and Evaluation Department, Washington, D.C.

Vulnerability to natural disasters

Albala-Bertrand, J. M. 1993. *The Political Economy of Large Natural Disasters with Special Reference to Developing Countries*. Oxford: Clarendon Press.

Albala-Bertrand's study finds that the magnitude of the negative effect of disasters declines with development, although vulnerability increases during the transition period from simple to diversified economies. People most affected by natural disasters are those belonging to the poorest and most powerless social sectors in less developed countries.

Benson, C., and E. Clay. 1994. "The Impact of Drought on Sub-Saharan African Economies: A Preliminary Examination." World Bank Technical Paper No. 401. Washington, D.C.

This paper looks at economy-wide, macroeconomic impacts of droughts in Sub-Saharan Africa. The authors' empirical work suggests that the correlation between the level of economic development and the magnitude of the impact of a drought is not linear. The relationship turns out as one of an inverted U shape. Furthermore, the authors find that droughts exacerbate income inequalities.

*Datt, G., and H. Hoogeveen. 2000. "El Niño or El Peso? Crisis, Poverty and Income Distribution in the Philippines." Policy Research Working Paper No. 2466. World Bank, Washington, D.C.

Enarson, E., and B. Hearn Morrow. 1998. *The Gendered Terrain of Disasters*. Westport, Conn.: Praeger.

This collection brings together current knowledge about gender and disaster. Seventeen case studies are complemented by a survey of existing work, an assessment of the need for work on this topic, and a study on how neglect of gender issues has misdirected efforts of disaster prevention and relief. Poor families around the world suffer the greatest losses and have access to the least public or private recovery assets. Among the poor, women are most at risk when hazardous conditions become disastrous events.

Kreimer, A., and M. Munasinghe. 1990. *Managing Natural Disasters and the Environment: Selected Materials from the Colloquium on the Environment and Natural Disaster Management*. Environmental Policy and Research Division, Environment Department. World Bank: Washington, D.C.

This volume explores the relationship of environmental degradation and vulnerability to disasters and their combined effects on both natural and man-made habitats. It is organized around four themes: implications of strategic global, systemic, and survival issues; development from vulnerability to resilience; risk management; and the coordination of local, national, and international efforts to reduce vulnerability to disasters by prevention, mitigation, and recovery.

Mitchell, J. 1999. *Crucibles of Hazard: Mega-Cities and Disasters in Transition*. Tokyo and New York: United Nations University Press.

The study covers environmental risks in 10 of the world's major cities, some of which have already repeatedly experienced devastating earthquakes, storms, floods, and wildfires. The authors conclude that the natural disaster potential of the biggest cities is expanding at a pace that far exceeds the rate of urbanization.

*Sharma, Mahesh, Ian Burton, Maarten van Aalst, Maxx Dilley, and Gayatri Acharya. 2000. "Reducing Vulnerability to Environmental Variability." Background Paper for the World Bank's Environment Strategy. World Bank, Washington, D.C.

Twigg, J., and M. R. Bhatt, eds. 1998. *Understanding Vulnerability: South Asian Perspectives*. London: Intermediate Technology on behalf of Duryog Nivaran.

This book contains three case studies of South Asian people and areas vulnerable to natural and man-made hazards. E. Bhatt writes about poor women in the towns and countryside of the Indian state of Gujarat who face a wide range of natural and man-made hazards. The studies of Nepali villagers by N. Dahal reveal that they live under the permanent threat of mountain floods and landslides. S. Arachchi also looks at a village society in Sri Lanka's dry zone, which endures drought as a persistent hazard. The final essay by M. Bhatt discusses ways of understanding vulnerability by learning from vulnerable people.

Environment and empowerment

*Africa Resources Trust and the Campfire Association. 1996. *Zimbabwe's CAMPFIRE: Empowering Rural Communities for Conservation and Development*. Harare, Zimbabwe.

*Devasia, L. 1998. "Safe Drinking Water and Its Acquisition: Rural Women's Participation in Water Management in Maharashtra, India." *Water Resources Development* 14(4):537-46.

Feder, Gershon. 1987. "Land Ownership, Productivity and Farm Productivity: Evidence from Rural Thailand." *Journal of Development Studies* 24(1):16-30.

This classic study tests the impact of empowerment through ownership and titling on resource management. Feder finds that titled farmers invested more in their land and had a higher productivity than the untitled ones.

*IIED (International Institute for Environment and Development). 1994. *Whose Eden? An Overview of Community Approaches to Wildlife Management*. London: IIED.

Lynch, Owen J., and Kirk Talbott. 1995. *Balancing Acts: Community-Based Forest Management in Asia and the Pacific*. Washington, D.C.: World Resources Institute.

Forest lands in Nepal were turned over to the communities to develop management plans and administer them after approval. This has apparently been quite successful, leading to extensive regeneration and equitable sharing of benefits. Other communities are queuing up to get their own management plans approved.

Mahapatra, R. 2000. "A Quiet Revolution." *Down to Earth* 8(21):24.

*Muir, Kay, and Jan Bojöö. 1996. "Economic Policy, Wildlife and Land Use in Zimbabwe." In Jan Bojöö, ed., *The Economics of Wildlife: Case Studies from Ghana, Kenya, Namibia and Zimbabwe*. Washington, D.C.: World Bank.

*Murombedzi, J. C. 1999. "Devolution and Stewardship in Zimbabwe's Campfire Programme." *Journal of International Development* 11, 287-93.

*Roe, D., J. Mayers, M. Grieg-Gran, A. Kothari, C. Fabricius, and R. Hughes. 2000. *Evaluating Eden: Exploring the Myths and Realities of Community-Based Wildlife Management*. Evaluating Eden Series No. 8. IIED, London.

*Stalker, Linda. 2001. "Why Some Village Water and Sanitation Committees Are Better Than Others: A Study of Karnataka and Uttar Pradesh (India)." World Bank Water and Sanitation Program Field Note. Washington, D.C.

Analyzing costs and benefits of environmental interventions

*Bojöö, Jan. 1992. "Cost-Benefit Analysis of Soil and Water Conservation Projects: A Review of 20 Empirical Studies." In K. Tato and H. Hurni, eds., *Soil Conservation for Survival*. Ankeny, Iowa: Soil and Water Conservation Society.

*Convery, Frank. 1991. "Applying Environmental Economics in Africa." World Bank Technical Paper No. 277. Africa Technical Series, World Bank, Washington, D.C.

- *Dixon, J. A., L. F. Scura, R. A. Carpenter, and P. B. Sherman 1986. *Economic Analysis of Environmental Impacts*. London: Earthscan.
- Freeman, A. M. 1994. *The Measurement of Environmental and Resource Values: Theory and Methods*. Washington, D.C.: Resources for the Future.
- *Gittinger, J. P. 1982. *Economic Analysis of Agricultural Projects*. 2d ed. Baltimore and London: Johns Hopkins University Press.
- *Helmert, F. L. C. H. 1979. *Project Planning and Income Distribution*. Boston and London: Martinus Nijhoff Publishing.
- *Kramer, Randall, Narendra Sharma, and Mohan Munasinghe. 1995. "Valuing Tropical Forests: Methodology and Case Study of Madagascar." World Bank Environment Paper No. 13. Washington, D.C.
- *Lampietti, Julian A., and John A. Dixon. 1995. "To See the Forest for the Trees: A Guide to Non-Timber Forest Benefits." World Bank Environment Paper No. 13. Washington, D.C.
- *Lutz, Ernst, Stefano Pagiola, and Carlos Reich, eds. 1994. "Economic and Institutional Analysis of Soil Conservation Project in Central America and the Caribbean." World Bank Environment Paper No. 8. Washington, D.C.
- *Shiferaw, B, and S. Holden. 1999. "Soil Erosion and Smallholder's Conservation Decisions in the Highlands of Ethiopia." *World Development* 27(4):739–52.
- *Squire, Lyn, and H. G. van der Tak. 1975. *Economic Analysis of Projects*. Baltimore and London: The Johns Hopkins University Press.
- *Toma Enterprises Ltd. 1996. *Willingness to Pay for Water in Wellington and Tombo (Western Sierra Leone): Strategies for Cost Recovery*. Prepared for the Department of Lands, Housing and the Environment, Government of Sierra Leone. Freetown.
- *Whittington, Dale, Apia Okorafor, Augustine Okore, and Alexander McPhail. 1993. "Strategy for Cost Recovery in the Rural Water Sector: A Case Study of Nsukka District, Anambra State, Nigeria." *Water Resources Research* 26(9):1899–913.
- *Whittington, Dale, Donald T. Lauria, Albert M. Wright, Kyengoae Choe, Jeffrey A. Hughes, and Venkateswarlu Swarna. 1993. "Household Demand for Improved Sanitation Services: A Case Study of Kumasi, Ghana: A Contingent Valuation Study." *Water Resources Research* 29(6):1539–60.

Household survey analysis (see also chapter 1, "Poverty Measurement and Analysis")

- Grosh, Margaret E. 1997. "The Policymaking Uses of Multitopic Household Survey Data: A Primer." *World Bank Research Observer* 12(2):137–60.

This paper discusses the benefits and limitations of national survey data, reviews those topics suitable for policy analysis, illustrates the kinds of issues typically addressed through the Living Standard Measurement Study surveys, and examines how analysis of survey data can inform the decisionmaking process. Some examples discussed in the paper include benefits of the food stamp program in Jamaica, impact on the poor of an increase in taxes on petroleum products in Ghana, characteristics of poverty in Ecuador, streamlining food subsidies in Tunisia, and efficient provision of public services (roads, public transport, electricity, pipe-borne water, dispensary, and so forth) in Vietnam.

- Grosh, Margaret, and Paul Glewwe, eds. 1999. *Designing Household Survey Questionnaires for Developing Countries: Lessons from Ten Years of LSMS Experience*. Development Research Group, World Bank, Washington, D.C.

This book provides detailed advice on how to design a multi-topic household survey and set realistic objectives, identify tradeoffs, and design a survey that best meets those objectives. The book is divided into three parts: (1) The Overall Design of the Survey, (2) The Design of Modules and Questionnaires, and (3) General Methodological Issues. Chapter 14 covers environmental issues, stating that "to date, very few LSMS surveys have collected data that can be used to examine environmental issues." There are, however, lengthy submodules on water, sanitation, and fuel, and also contingent valuation models to measure household willingness to pay for improvements in rural and urban water quality, urban air quality, and urban sanitation.