

Environment

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Summary

In the context of a PRSP, environment and poverty are linked in two major ways. One is that poverty alleviation should not damage the environment of the poor, which would only undercut gains in one area with losses in another. The other main link is that **improving environmental conditions can help to reduce poverty**. It is that link which 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 resources interventions in their poverty reduction strategies. The scope of environmental concerns is quite broad, and includes water supply and wastewater disposal, solid waste removal, indoor and urban air pollution, and natural resources issues such as land degradation, deforestation, 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.

The perspective of this chapter is a multi-sectoral one. However, while analysis needs to be multi-sectoral, many of the resulting interventions can be implemented by agencies responsible for sectoral programs (health, infrastructure, public works, agriculture), and are not exclusive to environment institutions.

This chapter suggests that teams working at the country or sub-national level begin by a participatory analysis of the linkages between poverty and environment. Second, desirable but realistic targets need to be set with focus on the main priority 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 need to be put in place. The results are fed back into the next stage analysis, and so on.

Section 2.1 on Environmental Health provides a working definition of Environmental Health (EH) and Disability Adjusted Life Years (DALYs); sketches a developing country panorama of the overall Burden of Disease (BOD) showing the considerable significance of environmental factors; and makes a case for a multi-sectoral approach to EH.

Environment and Economic Opportunity is the theme of Section 2.2, which makes the point 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 not be seen only in the context of limiting access and exploitation, but should be viewed from the perspective of sustainable opportunities for poverty reduction.

Section 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 due to such disasters.

Environment and Empowerment is the theme of Section 2.4. That section argues that when communities are empowered, natural resources can serve as platform of economic opportunity onto 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 considerable differences in interests and attitudes.

In the third section, 3.1 deals with understanding the relationship between environment and poverty. This section raises a set of issues that need to be considered when mapping out this relationship.

Section 3.2 is dedicated to Choosing 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 3.3. The approach taken is one of integration with the overall M&E framework for the PRS. However, careful attention needs to be paid to the selection of indicators to capture changes in the environmental conditions that most impact the poor. Specific suggestions are presented for the selection of indicators, and examples of choices for environmental health and natural resources management are given.

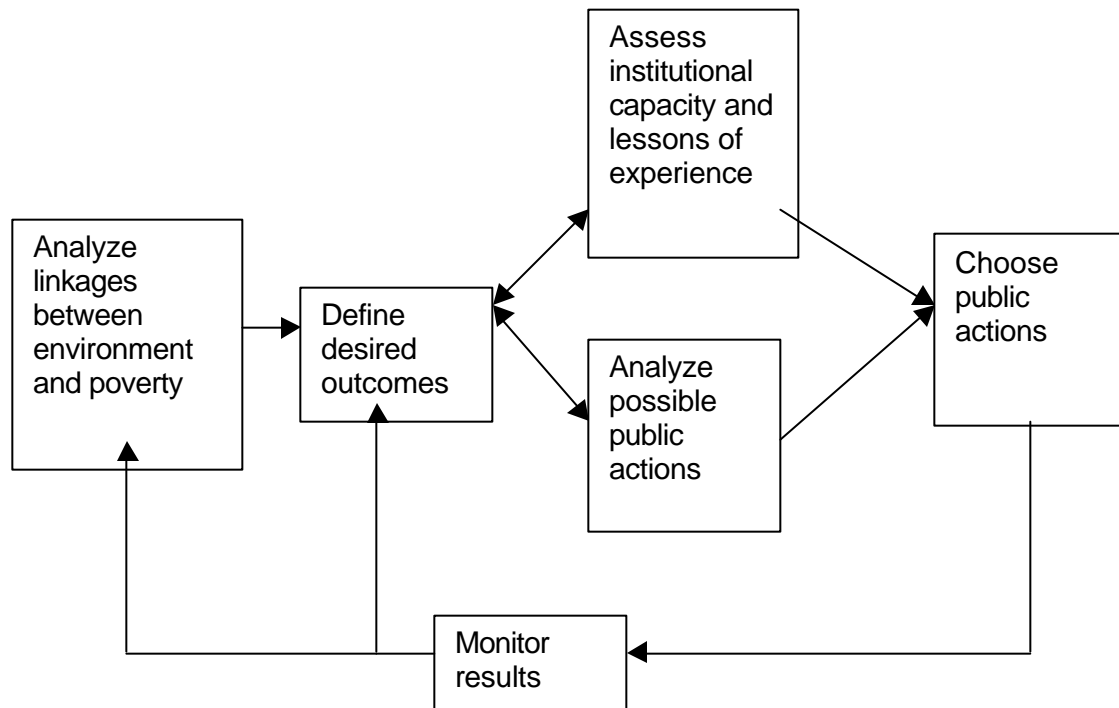
Section 4 presents good practice in mainstreaming environment from a review of 25 IPRSPs and PRSPs. While many PRSPs have paid little attention to environmental matters and links to poverty, it is encouraging to note that the full PRSPs tend to score better in this respect.

1 Introduction

The chapter follows the basic stages of the approach embodied in the Poverty Reduction Strategy initiative: developing a comprehensive understanding of poverty; choosing the most effective public actions to reduce poverty; and monitoring outcomes and impacts (see figure 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.

Here we attempt to 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

Figure 1. Process for Preparing Environmental Sections of a Poverty Reduction Strategy



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 positive poverty side benefits are possible. E.g., several programs in Southern Africa give local communities a stake in conserving wildlife by sharing tourist revenues. Costa Rica’s Certifiable Tradable Offsets provide revenues to smallholders in return for conserving forest cover and thereby sequestering carbon. The clearing of alien invading species in South Africa provides both environmental benefits and poverty alleviation at the same time.

¹ See the World Bank’s set of 10 Safeguard Policies, pertaining to Environmental and Social Assessment.

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 both to increase incomes for the poor and to 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 terms of 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 what the right tradeoff should be in a particular situation.

Market failures and policy distortions often bias exploitation decisions against consideration of environmental values. Poorly defined or enforced property rights creates an incentive for quick exploitation and disregard for external impacts. Subsidies of natural resources 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.

The rest of the chapter is organized as follows. The next section provides an overview of the ways in which environmental conditions can contribute to different kinds of poverty. The third section outlines an approach to analyzing these links in order to define priorities both between sectors and within the environmental field. This is broken down into understanding the links, choosing targets for improvement, choosing the most effective public action, and monitoring and evaluation. The fourth section summarizes an approach to “mainstreaming” of environment in PRSPs” that has been developed within the World Bank. It also provides summary lessons from a systematic review of 25 Interim and full PRSPs. The references and technical notes provide more details on particular topics.

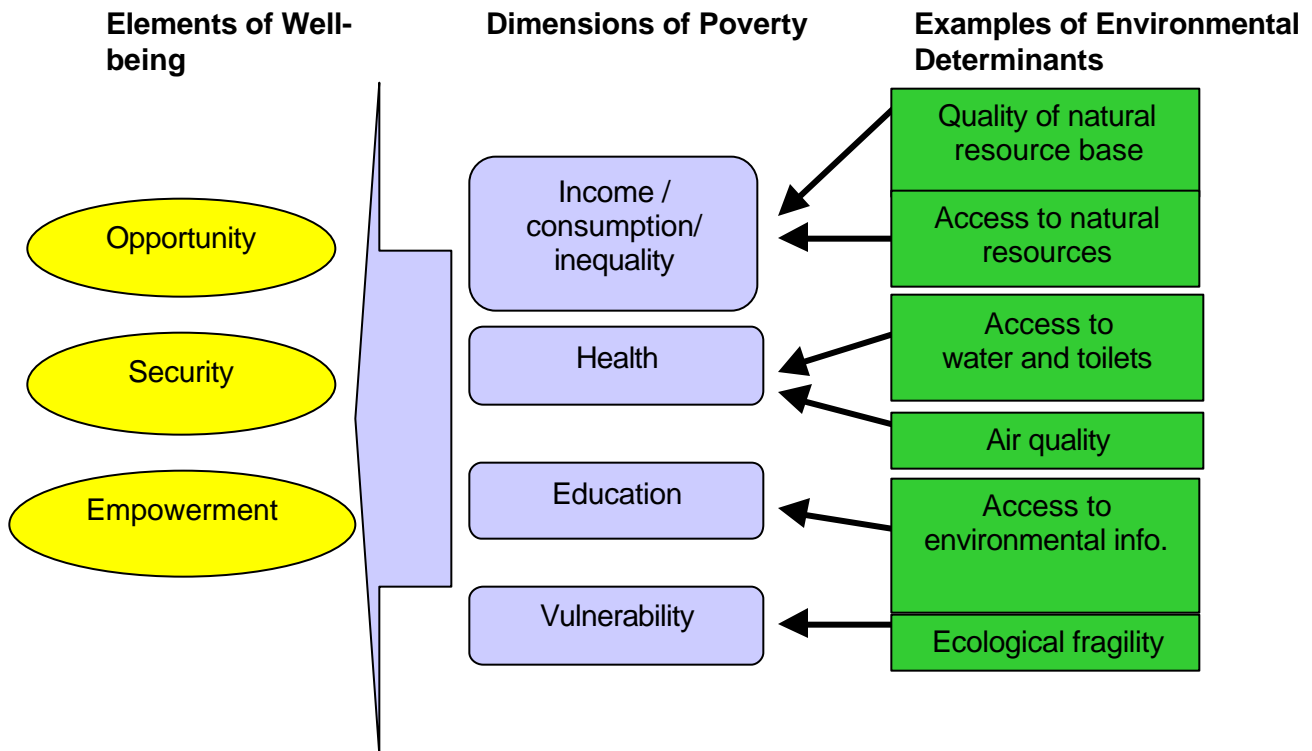
2 Setting the Stage

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

² Fisheries provide an illustration of this: 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 dollar each year. In a study for the US Commerce Department in 1997, Milazzo estimated the subsidies to range from \$11 billion to \$54 billion (quoted in Lutz 1998).

Figure 2 gives a schema of 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 their security). We have focused 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.

Figure 2. Schematic Representation of Dimensions and Determinants of Poverty



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

2.1 Environment and health

This section will:

- provide a working definition of Environmental Health (EH) and Disability Adjusted Life Years (DALYs);
- sketch a developing country panorama of the overall Burden of Disease (BOD), showing the considerable significance of environmental factors;
- make a case for a multi-sectoral approach to EH.³

³ Cost-efficient choices for public health interventions are deferred to section 3.

The World Bank's Africa Environmental Health Team defines EH as to cover all activities to prevent health risks through control of human exposure to: (i) *biological agents*, such as bacteria, viruses, and parasites; (ii) *chemical agents*, such as heavy metals, particulate matter, pesticides, and fertilizers; (iii) *disease vectors*, such as mosquitoes and snails; and (iv) *physical and safety hazards*, such as traffic accidents, fire, extremes of heat and cold, noise, and radiation." In comparison, the World Health Organization does not include traffic accidents and insect vectors in its definition, but 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, but also a tool to measure the level of improvement from interventions. The use of **Disability-Adjusted Life Years (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 1. DALYs as a Measure of the Burden of Disease

DALYs are a standard measure of the burden of disease. DALYs combines life years lost due to 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 that are 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 & Lopez (1996) quoted in Lvovsky et al (1999).

The table below gives us a sense of the magnitude of the health impacts of various environmental problems. The sum of all causes is less than 100 percent, as only DALYs related to environmental causes are considered here. Particularly in Sub-Saharan Africa, the impact of a poor environment on health is quite significant.

Table 1. Burden of Disease from Major Environmental Risks

<i>Environmental Health Group</i>	Percent of all DALYs in each country group							
	<i>Sub-Saharan Africa</i>	<i>India</i>	<i>Asia & Pacific</i>	<i>China</i>	<i>Middle East & North Africa</i>	<i>Latin-America</i>	<i>Former Socialist Economies</i>	<i>All LDCs</i>
Water supply & 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 environment causes	26.5	18.5	17.5	13	14	11	6.5	18

Source: Adapted from Listorti and Doumani (2001).

While countries differ considerably, poor water supply and sanitation stands out as the top global concern. The World Health Organization (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 much less highlighted problem—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 survival and child malnutrition (Hammer 1997). 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 the **Health, Nutrition, and Population Chapter**.)

It is important to remember the complex interactions between health outcomes and factors such as water supply, as illustrated by the box below. For example, access to safe water may affect mothers' choices about breastfeeding. If 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.

Box 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 clean drinking water are less pronounced than those from sanitation (Klees et al., 1999). Benefits from water occur only when sanitation is improved and when 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 (cited in Klees et al., 1999).

Handwashing is very important in reducing water-related diseases. A study of 144 water and sanitation interventions worldwide 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, reduce cases of schistosomiasis by 77 percent, intestinal worms by 29 percent, and trachoma by 27–50 percent. (Esrey et al 1991).

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 as well;
- Natural resource utilization should not be seen only in the context of limiting access and exploitation, but should be viewed 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** that a number of development agencies are adopting. The UK 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).

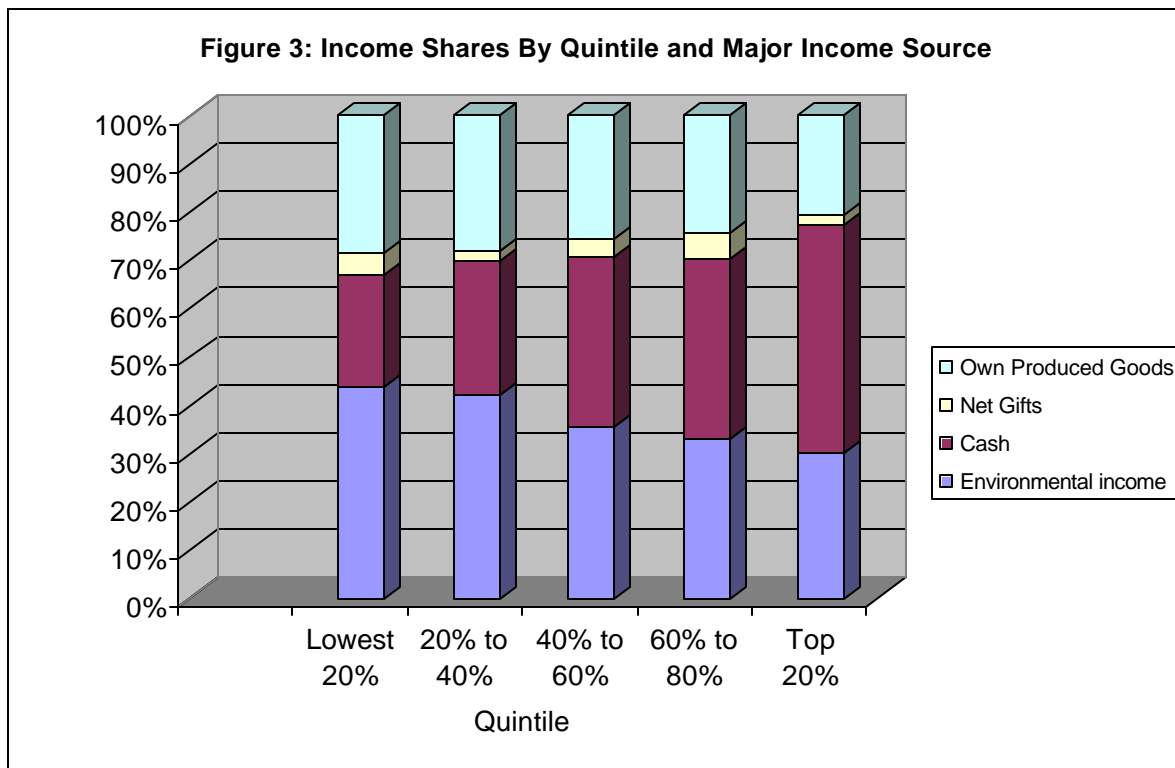
Environmental conditions contribute to people’s economic opportunities in many ways, particularly in rural areas.⁴ The relationships are site-specific and often difficult to quantify: the extent of soil erosion may have no immediate effect on people’s well-being, or it may reduce their economic opportunity considerably. Institutions, policies, characteristics of the community, gender relations, and other factors will mediate the effects. Hence, detailed qualitative

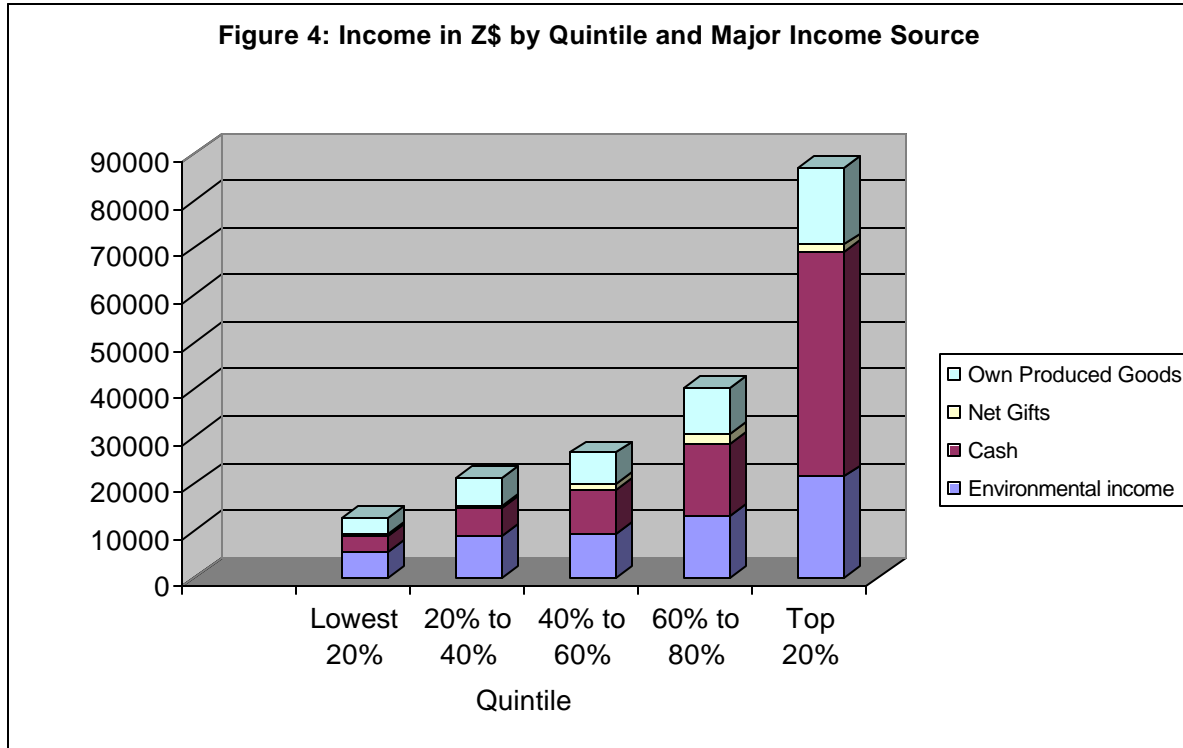
⁴ See also the **Rural Development Chapter**.

information is needed in addition to available quantitative studies and surveys to assess who the poor are, what the character of poverty in a given context is, and the extent to which environmental factors contribute to (or detract from) people's livelihoods.

The poor depend on natural resources, which they may own, which the community owns, or which 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. An excellent study from Zimbabwe (Cavendish 1999) illustrates these general statements in hard figures. 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, all of which added up to about 100 items in total: Cavendish collected his data during two separate agricultural years and in four villages in Zimbabwe. The numbers of households interviewed was close to 200 in 29 villages.

The level of dependence on environmental income is illustrated by the graphs below. Two facts stand out: (i) the poorest are most dependent on environmental income in **relative** terms, but (ii) the somewhat better off make more use of natural resources in **absolute** terms. These findings pose a dilemma for policy-makers: interventions to enhance NRM are of great importance to the poor, but may in fact 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 further 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. One 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.

Poor rural women in developing countries are disproportionately affected by the degradation of natural resources. This is because they tend to be primarily involved in the collection of fuel, fodder, and water. Depending upon the availability of biomass resources, collection of biomass fuel and fodder may take up anywhere between two to nine hours. In Lombok, Indonesia, and in some areas of Kenya, women spend 7 hours each day on cooking and collecting dead wood or agricultural residues as fuel (Aristanti 1997). Often they 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, household responsibilities and may also have a negative impact on health.

Prolonged searching for ever more scarce fuelwood eats up women's time, taking away time and energy from productive activities, from childcare and so on. It can also have direct effects on their health. For example, a 1996–97 study involving over 1,000 fuelwood carrying women in ten locations across 12 districts in Uttaranchal, India, found that the proportion of miscarriages was 30%, that is 5 times higher than the average rate reported in the National Family Health Survey of

1992-1993. During pregnancy the women carry heavy loads of wood, manure and grass, a factor contributing to the high rate of miscarriages. (Dasgupta & Das 1998)⁵

Property rights that govern access to these resources play an important role in maintaining the productivity and enabling equitable use of natural resources. The 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 utilization will influence how people make decisions about exploitation and investment in natural resources. Nor is privatization of property rights a guarantee for sound environmental stewardship; the owner may choose to deplete the resources and move elsewhere with his 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 often leads to erosion and declining yields over time. But increasing income can also lead to over-exploitation, for example, by allowing the poor to buy chainsaws 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, e.g. 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 what links 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. Reforms can change both relative prices and rates of growth in the economy, which are likely to affect the environment (through changes in resource extraction or pollution emissions, for instance). 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 & 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, with deforestation and erosion as a result. Poverty and environmental degradation went hand in hand, as enhanced profitability for large livestock farmers made the best land unaffordable to the poor. The authors concluded that the impact of policies is to “constrain the poor’s access to land and encourage environmental degradation.”

It should not be forgotten that environment does not only represent 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 constitute the second largest source of foreign exchange, and most of that is based on the attraction that natural resources such as

⁵ See also **the Gender Chapter**.

⁶ Munasinghe and Cruz 1995 contains a number of case studies that illustrate the links between economic policies and environmental impacts.

pristine beaches and charismatic wildlife can offer. For some groups of poor, even small groups of tourism can bring in considerable resources in a local perspective. The CAMPFIRE project in Zimbabwe, the Lupande project in Zambia, and the Herero Community Guards project in Namibia, are examples of projects that aim to provide local groups with an economic rationale for conservation.⁷

A recent World Bank study (Christie and Compton 2001) notes that 80% of the world's poor live in 12 countries, and that in 11 of these, tourism is significant and/or growing. Of the 100 poorest countries, tourism is significant in almost half the low income countries and virtually all the lower-middle income countries. "Significance" is defined as accounting for over 2% of GDP or over 5% of exports. Much of this tourism is dependent on an attractive natural environment. It also offers a considerable number of job opportunities for people without much formal training.

2.3 Environment and security

This section will highlight:

- the very significant cost of damage inflicted by natural disasters;
- how poor people face a relatively higher degree of insecurity due to 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 least ability to cope. This section focuses on the vulnerability of the poor to severe environmental changes. This is a major issue for developing countries. In 1998, the total losses from natural disasters in developing countries amounted to about \$40 billion. Put differently, these losses amounted to about 70 percent of net Official Development Assistance. (Sharma et al 2000). Poor countries suffer more from environmental shocks than do 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 two different kinds of environmental shocks : macro and micro level. Macro level shocks affect a whole 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 GDP. Hurricane Mitch in 1998 is estimated to have caused total damages to the capital stock, valued at replacement cost, equivalent to the size of one year's GDP. Honduras poverty rate also increased. (Government of Honduras 2000). The poor have less ability to cope with environmental shocks than do the non-poor. They are often dependent on more marginal areas, they have fewer assets to sell which would enable them to smooth their consumption, they have fewer options for gaining income elsewhere and they often have less information about impending disasters or 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 Nino was responsible for a greater share of the

⁷ There is a large, and partially controversial, literature on CAMPFIRE. See e.g. Africa Resources Trust & the Campfire Association (1996) for a presentation of the program concept; Muir & 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 *et al* 2000.

overall increase in poverty (47-57% 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% of the total poverty impact. The labor market shock reduced inequality, but the El Nino shock increased inequality. The ability of the poor to protect their consumption was more limited than that of the non-poor. (Datt & Hoogeveen 2000).

Micro 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 impacts of poor people's vulnerability to micro level environmental shocks. Women are often particularly vulnerable and most likely to bear the consequences of reduce food consumption, disease and 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.

2.4 Environment and empowerment

This section points out that:

- When communities are empowered, natural resources can serve as platform of economic opportunity onto 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 considerable differences in interests and attitudes.

Environmental activities can contribute to the empowerment of local people. Local communities that are empowered to participate in decision-making 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.

Box 3. Empowerment: Joint forest management in Andhra Pradesh, India

Since 1992 Andhra Pradesh (AP) has embarked on an ambitious program of joint forest management (JFM). 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 NGOs are associated with the implementation of JFM in AP.

The World Bank is already involved in forest rehabilitation and conservation through the Andhra Pradesh Forestry Project, with an IDA credit of \$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, research and protected areas management. After reconstruction in early 1997, it has achieved good results in terms of regeneration of degraded forests and JFM support.

Source: World Bank project documents and staff.

Another example of empowerment in NRM is the Niger Household Energy Project, launched in 1989 with the aim to (i) manage the fuelwood supply around main urban centers rationally to both secure sustainable income for poor people and protect the environment, and (ii) conserve fuelwood and improve environmental health by introduction of more efficient stoves and fuel substitution. The project introduced a differential tax on fuelwood: higher for unmanaged natural woodlands, and lower for the 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 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 and are marked by social differences and relations of power and inequality around factors such as gender, race, caste, class, and so on. It is also 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 relations of inequality, but also the interest of different segments of the community. The example below from India illustrates this.

Box 4 Women's Empowerment and Village Water Supply

In villages in the arid region of Vidarbha, Maharashtra, India, women and girls walk spend much of the day walking to fetch the water required for a household. The village recently formed women's organizations (*mahila mandals*), which allowed them to share knowledge about the time they spent fetching water, 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, in 8 villages, 17 community wells were deepened, and pipelines were laid for drinking water in 2 villages. The women also initiated programs for social forestry and rain water 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. (Devasia 1998).

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? Research (Stalker 2001) shows 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, should divide the benefits to include different community groups and should allow different groups opportunities to influence decision-making.
- **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.

Decentralization and local empowerment is not a **guarantee** for environmental stewardship. In fact, the opposite may result as is noted in an assessment of the World Bank's 1991 Forest Strategy: "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 "silver bullet" of poverty alleviation and environmental protection. The approach to "joint" forest management in India (see the example from Andhra Pradesh above) is an attempt to balance the short-term and long-term needs.

It can be added that globalization and liberalization of markets have 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. The first is that local resource control also means that the fruits of sustainable management and re-investment in natural resources will accrue locally. The second mitigating factor is that financial transfers from the outside can make a big difference as to how these tradeoffs are resolved, especially in critical ecosystem areas.

3 Environmental Contributions to the PRSP

This section has three main components:

- understanding the links between environment and poverty in its different dimensions as to identify the best points of intervention;
- choosing the most effective and efficient public actions to address the identified problems; and
- monitoring and evaluating the outcomes of the strategy implementation.

3.1 Understanding the environmental contribution to poverty reduction

This section raises a set of issues that need to be considered when mapping out the relationship between poverty and environment. Teams should survey already 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 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 to the poor.

3.1.1 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 (l/per capita/day)
- Water uses.
- Transport of water.
- Time spent collecting water.
- Who collects water?
- What are typical practices for hand washing?

- Coverage of sanitation.
- What kind of toilets/latrines does the community have?

- 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.

3.1.2 Environment and economic opportunity

- Percent 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 NR.
- Changes in NR quality such as soil quality, vegetation, availability of game, fish and other important sources of nutrition in nature.
- Conflicts in use of NR.

- Time spent collecting fuelwood and trend over time.
- Relationship between population growth and resource degradation.

3.1.3 Environment and security

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

3.1.4 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 greater voice than others?
- To what extent are poor people aware of their rights, 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?

⁸ See also the **Participation Chapter**.

- Are NGOs effective?

3.1.5 Collecting and analyzing information

The relationship between environmental degradation and poverty can never be completely characterized by the available data. The table in **Technical Note 4** gives examples of useful data sources. Particularly important are the data measured in Demographic and Health Surveys, which typically measure under-5 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, for example, by adapting ongoing survey instruments, coordinating ongoing research, or commissioning new studies. In addition, the HNP Poverty Information Sheets can provide valuable information on many environmental features related to poverty (See the **Health, Nutrition, and Population Chapter**).

The questions and relationships we highlight in this section are complex and vary by circumstances and over time. Therefore it would be wise to quantify when possible and rely upon 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.

3.2 Choosing the most effective public action

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;
- cost-benefit analysis of interventions; and
- cost-effectiveness analysis.

3.2.1 Prime areas of intervention

Public action broadly comprises policy reform and investments in projects. 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 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 will involve both modifying existing interventions and/or developing new ones.

⁹ See also **Technical Notes 1, 2 and 3** for more examples.

Interventions may aim to tackle the following, a number of which are also covered in other chapters

Reduce health damage related to environment by combining increased coverage of safe drinking water and latrines with education on sanitation; introduction of fuel-efficient stoves to reduce indoor air pollution, encourage 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; enhance the supply of fuelwood and non-timber forest products; reduce land degradation; and provide 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, access to insurance and micro-credit (see **the Social Protection Chapter**).
- 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.

3.2.2 Assessing expected costs and benefits

There is considerable literature on methodologies for calculating the costs and benefits of environmental changes (See References). While many costs, and particularly benefits, 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 into the debate, and pave the way for what must remain ultimately political decisions.

Actions to reduce health damage can be valued by (i) gains in productivity among the affected population; (ii) savings in medical cost; or (iii) by measuring the willingness to pay (WTP) for the improvements among the affected population. Examples of this analysis can be found for water supply (Toma 1996; Whittington 1990), for sanitation (Whittington et al 1992); for both water and sanitation (Hughes et al 1999); and for air pollution abatement (Lvovsky et al, forthcoming).

Public actions to enhance economic opportunity will often directly impact the productivity of natural resources, such as agricultural production or forestry products. A well-developed set of literature can support the necessary cost-benefit analysis.¹⁰

¹⁰ See e.g. Convery (1991) for an accessible introduction and Gittinger (1982) for the fundamentals of cost-benefit-analysis. See e.g. Dixon et al 1986; Bojö 1992; Lutz et al 1994; Kramer et al 1995; and Lampietti and Dixon 1995, and Shiferaw & Holden 1999, for case studies of economic analysis of changes in production.

The benefits of public interventions to reduce vulnerability can also, in principle, be valued by damage costs avoided. Kramer et al (1995) provide an example of analysis of the benefits of flood control.

With a few exceptions¹¹ not much consideration in cost-benefit analysis has gone into the principles of rigorously capturing the distributional consequences of interventions, i.e. exactly who wins and who loses. The reasons are primarily that it is often difficult to determine the distribution of benefits and costs among stakeholders, and that specific “weights” attached to these groups are politically delicate to determine. For the purposes of the PRSP, this “incidence analysis” becomes key. For each intervention, the expected poverty impact should be evaluated; (i) the percent of the benefits that accrue to the poor, and (iii) the value of the benefits to the poor relative to household income or consumption.¹²

Cost-benefit analysis of public actions needs to consider that there are important synergies between sectors. For example, better health outcomes may be achieved via public policy actions in several sectors ranging from education, to health (for example, improving access to health facilities) to environment (improving water quality and sanitation, reducing outdoor and indoor air pollution, for instance).

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 income overall 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.

3.2.3 Cost-efficiency analysis

Often, full assessment of the benefits of an intervention is not feasible, but giving consideration to cost-efficiency is possible and remains important. An example of this pertains to environmental health interventions, where it is 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, it is not a given that each problem should simply be allocated resources according to its size. Within the categories of major problems, we need to assess the cost-efficiency of interventions, i.e. how to get the most out of our limited resources. The DALY concept proves helpful again, as it allows us to compare the cost per DALY saved by different interventions. The table below provides some examples.

¹¹ See Squire & van der Tak (1975); Helmers (1979).

¹² The **Chapter on Public Spending** provides a complementary perspective on the analysis of public spending.

Table 2. Cost-efficiency of Environmental Health Interventions

Measure	US\$ per DALY Saved
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 et al (1999)

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

3.3 Monitoring outcomes and evaluating interventions

The general framework for monitoring and evaluation of the Poverty Reduction Strategy is given in the **Monitoring and Evaluation Chapter** of this Sourcebook. This section is written in consistency with the terminology and approach used there, and will not unnecessarily repeat what has already been well elaborated. However, this section extends that general framework 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.¹³

For the sake of cost-effectiveness and consistency, it is recommended that monitoring and evaluation from an environmental perspective be closely integrated with the overall M&E of the entire PRS. The use of key terms used in the Sourcebook bears brief rehearsal:

Intermediate indicators comprise:

- Input indicators: measure the quantity/quality of resources used for an intervention
- Output indicators: measures the quantity/quality of works, goods and services produced as a result of the inputs;

Final indicators comprise:

- Outcome indicators: measure the quantity/quality of the results achieved through the use of outputs;
- Impact indicators: measure the longer-term changes in living conditions among the beneficiaries.

¹³ See **Technical Note 5** for a examples of project-specific indicators.

Against that backdrop, the question arise how to best choose indicators. The points below provides some generic guidance for the selection of indicators, 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
- Appropriate spatial and temporal scale

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

Table 3: Selected Environmental Health Indicators

Environment Related Illness	Intermediate Indicator	Final Indicators
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 anti-malarial drugs (as specified by national health policy) for more than one week during the previous 3 months 	<ul style="list-style-type: none"> ▪ Malaria death rate (probable and confirmed) among target groups (under 5 and others) ▪ Number of Malaria cases, severe and uncomplicated (probable and confirmed) among target groups ▪ % 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 / improved stoves 	<ul style="list-style-type: none"> ▪ Prevalence of ARI /CRI ▪ Prevalence of chronic lung disease (COPD)

¹⁴ The list is adapted from Segnestam (1999).

Diarrhea	<ul style="list-style-type: none"> ▪ Access to safe water (private/public) ▪ Access to sanitation (private/public) ▪ Hours/day of piped water ▪ Quantity of water p. c./day ▪ Time taken/ distance involved in collecting water ▪ Disposal practices of children's feces ▪ Percentage of child caregivers and food prepares with appropriate hand washing ▪ E. coli/ 100 ml of water consumed by source ▪ Persons per room of housing 	<ul style="list-style-type: none"> • Prevalence of Diarrhea
Broad Indicators	Public Health Expenditures	<ul style="list-style-type: none"> ▪ Infant mortality rate ▪ Under 5 mortality rate ▪ DALYs

Source: Adapted from Shyamsundar (2001).

Appropriate design of output, intermediate, and outcome indicators can help to guide specific interventions. To take an example referring to **air pollution**: if reducing acute respiratory infections (ARI) 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, and in poor neighborhoods in particular.

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 redesign of interventions.

However, it is also possible 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 ARI 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.

The intricacies of choosing indicators in the related area of water and sanitation are illustrated in the box below. Further suggestions are contained in **Technical Note 2** which deals with project-specific indicators.

Box 5: Choosing Good Indicators: Water & Sanitation

Rural water and sanitation (RWS) 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 et al. 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 time period. It is often either beyond the capacity 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 ideally would like to measure. Such data are often collected through the regular LSMS surveys.

Another major area of interventions discussed in this chapter concerns **natural resources management (NRM)**. Such interventions aim to enhance economic opportunities, reduce vulnerability and enhance security. Some suggestions for indicators are collected in the table below.

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.

Table 4: Selected Indicators Related to NRM Interventions

	Poverty Issue	Poverty-Environment Indicator	Natural Resource problems
1	Income and Opportunity	Time to collect water and fuel wood	Deforestation Water scarcity Over-fishing Lack of clear or enforced property rights
2		Distance to collect water and fuel wood	
3		% of annual household consumption from CPRs	
4		% of annual hh. Consumption from forest products and fisheries	

5	Insurance	% of hh. Consumption from forest products and fisheries when crops fail	Deforestation Land Degradation Over-fishing
6	Vulnerability	People affected by floods/hurricanes/cyclones/year	Natural disasters Deforestation Lack of information
7		People affected by landslides per year	
8		Number of deaths from natural disasters	
9		% of people living in areas prone to flooding/landslides etc.	
10		% of farmers with land on slopes	
11		Stunting before/after disasters	
12	Food Security	% of farmers without access to cultivable land	Soil fertility loss Water logging and salinization Water scarcity
13		% of farmers without access to irrigation	
14		Falling crop yield trends	
15		% of farmers who know about drought resistant crops	
16		% of dried wells	

Source: Adapted from Shyamsundar (2001).

4 Lessons from Early Interim and Full PRSP

This chapter argues that environment should be integrated into the PRSP because the quality of the environment is so 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 Poverty Reduction Strategy Papers. A total of 25 Interim and full PRSPs in countries in the Africa, Latin America and Eastern Europe & Central Asia are reviewed. (Bojő & Reddy 2001).

The review attempts to address four major questions:

- (i) What issues of environmental concerns and opportunities are identified in the PRSPs?
- (ii) To what extent are poverty-environment causal links analyzed?;
- (iii) To what extent are environmental management responses and indicators put in place as part of the poverty reduction efforts?; and
- (iv) To what extent has the design and documentation of the process allowed for mainstreaming of environment?

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.

4.1.1 Issues in focus

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

The **Kenya** IPRSP presents a description of 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 IPRSP is also sensitive to loss of biodiversity.

Pollution resulting from the lack of environmental regulation is well illustrated by the **Honduras** PRSP. The document 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** IPRSP notes that the major portion of the energy consumed by poor 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 non-agricultural activities, compromising the prospect of economic diversification. In the sector of water supply, access to potable water in rural areas fell from 64 percent in 1984 to 50 percent in 1996. A 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.”

4.1.2 Poverty-environment links

Some of the issues examined by PRSPs and their perspective of poverty-environment links that provide useful insights into policy analysis and implementation are as follows.

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 impacts of policy and management interventions relating to poverty reduction.

The **Burkina Faso** PRSP notes that climatic conditions, 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** IPRSP 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 proposes *“to implement land law system 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 natural resources management, the **Ghana** PRSP highlights benefits accrued in terms of policy and funding during the period of Structural Adjustment. Community Water & Sanitation and urban water supply enjoyed 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 underway, and takes into account the ability to pay of poor households. Policy changes are underway 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 trade-off between cocoa bushes, which is a perennial tree crop with good ground cover, and alternative crops. Further study would be required to determine how this change in relative prices impacts 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 Soviet Union, Georgia did not have access to cheap energy resources of the erstwhile centralized economy. Privatization of electricity market raised the energy tariff by 2.4 times to reach about 1/5 of the average monthly family income. Inability of poor to use electricity also resulted in increased demand for wood. 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 poor to cover the household electricity expenditure. Georgia’s energy privatization experience shows the need for careful design of policy instruments in safeguarding the poor as well as their environment.

4.1.3 Response systems

As expected, the response systems of countries vary depending on their socio-economic conditions, the environmental challenges they face, their institutional framework, and previous measures undertaken. Good practice of investment and monitoring systems are summarized below.

The **Kenya** IPRSP 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 \$3 million. The Kenya PRSP also makes detailed proposals for restructuring forestry institutions and forest management. The proposals include full forest inventory; new licensing procedures;

improvement of wood recovery rates from 30% to 50%; promoting farm based wood production; 30% of women to be involved in forest-based activities; and collaborative agreements with rural communities at the cost of about \$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. Related to environmental management is the testing of ways to provide for more secure property rights to land under a national land management program. A cost assessment of programs relating to irrigation, measures to combat vulnerability, and projects for strengthening of institutional capacity is also presented.

Much inspired by the disastrous hurricane Mitch, the **Honduras** IPRSP 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 basic public services such 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, restoration of 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 the 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.

4.1.4 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 also score high on mainstreaming: Kenya, Rwanda and Nicaragua are such examples.

References and Suggested Reading

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*. Processed. *The World Bank*.

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.

Ekbohm, Anders and Jan Bojö. 1999. *Poverty and Environment: Evidence of Links and Integration into the Country Assistance Strategy Process*. Environment Group, The Africa Region, World Bank.

The authors discuss various hypotheses regarding these linkages and consider the evidence and counter evidence 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 (CASs) and Poverty Assessments.

Forsyth, Tim, and Melissa Leach with Ian Scoones 1998. *Poverty and Environment: Priorities for Research and Policy*. Prepared for UNDP and European Commission, Sussex University, Institute for Development Studies.

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 upon 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 in urban areas can lead to sustainable and equitable use of natural resources.

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

Munasinghe, Mohan and Wilfrido Cruz. 1995. *Economywide Policies and the Environment*. World Bank Environment Paper Number 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.

The focus of this paper is on how the poor can be included in poverty reduction and environmental protection. The author argues that the poor depend upon 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 upon which the poor depend, such as the flood control project in

Bangladesh and deforestation in Brazil to promote cattle ranches. The author's main point 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.

Shyamsundar, Priya. 2001. *Poverty-Environment Indicators*. Environment Department, World Bank. Draft. Processed.

Health and Environment

Akbar, S. and K. Lvovsky. 2000. *Indoor Air Pollution: Energy and Health for the Poor*. ESMAP Newsletter, No. 1, September 2000. The World Bank.

Aristanti, C. 1997. Gender, Biomass Energy and Health. *Wood Energy News*, Vol. 12, No. 1. pp 8-10.

Dasgupta & 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, Wellbeing : A Multi-Country Study. *American Journal of Epidemiology* 143:608-23.

Esrey, Steven A, James B. Potash, Leslie Roberts and Clive Shiff 1990. *Health benefits from Improvements in Water Wupply and Sanitation*. Water and Sanitation for Health technical report No 66. Washington DC.

This report reviews studies published in last forty years on relationship between water and sanitation and six diseases (diarrhea, ascariasis, trachoma, hookworm, schistosomiasis, guinea worm). The study found many of the reviews to be methodologically flawed but found widely differing results reported from those that followed sound methodologies. The study 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.

Esrey, Steven A, James B. Potash, Leslie Roberts and Clive Shiff 1991. Effects of Improved Water Supply and Sanitation on Ascariasis, Diarrhea, Dracunhliasis, Hookworm, Infectinary Schistosomiasis and Tracoma. *Bulletin of WHO* 6915.

Hughes, Gordon, Meghan Dunleavy and Kseniya Lvovsky. 1999. *The Health Benefits of Investments in Water and Sanitation: A Case Study of Andhra Pradesh, India*. 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 % of the total burden of disease and those relating to indoor air pollution responsible for a further six 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 policy makers to choose between different interventions aimed at reducing the total burden of disease related to poor water and sanitation.

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 Regional Studies Program. World Bank.

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 (1996) 333-357.

The authors take data from the LSMS 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 intra-household allocations. They also find that the quality of water and sanitation facilities significantly affect child survival and malnutrition. They find the effects larger and more significant among older children. The effects are larger for children with families where 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, DC.

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

This paper provides a methodology for assessing the likely health damages attributable to air pollution in an urban area. It requires simple data on fuel use, types of sources, wind directions and population patterns and enables the user quickly to estimate the likely health costs of air pollution, the 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.

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 practice and indicators.

Songsore, J. and McGranahan, G. 1993. Environment, Wealth and Health: Towards an Analysis of Intra-urban Differentials within the Greater Accra Metropolitan Area, Ghana. *Environment and Urbanization*. Vol. 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. Brighton: University of Sussex.

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. http://www.livelihoods.org/info/guidance_sheets_pdfs/section1.pdf

FAO (Food and Agriculture Organization). 1999. *The State of World Fisheries and Aquaculture 1998*. FAO, Rome.

Heath, J. & 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, pp. 65-83.

Jodha, N.S. 1986. Common Property Resources and Rural Poor in Dry Regions of India. *Economic and Political Weekly* Vol. XX1, No. 27, July 5, p. 1169-1181.

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 privatization of CPRs, 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 ha of dryland.) are much more dependent on CPRs than larger farm households. For instance, while 95% of the poor households in Andhra Pradesh were dependent on CPRs for food items, only 10% of the larger farm households were dependent on CPRs for food. Further, Jodha's study shows that income from CPRs account for a larger percentage of income for poor households than for better off households.

Kepe, Thembele. No date: *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 PLAAS (Program for Land and Agrarian Studies).

Case study that calculates the importance of natural resources to the incomes of poor people.

Lutz, Ernst (ed.). 1998. *Agriculture and the Environment: Perspectives on Sustainable Rural Development*. A World Bank Symposium. World Bank

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

Drawing upon evidence from Ethiopia, Bangladesh and Mali, the author argues that migration is more often the rule rather than an exception. The paper critiques theories of migration that focus only on macro-economic or political factors for explaining migration.

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

This paper is a discussion of 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 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.

World Bank. 2000. *A Review of the World Bank's 1991 Forest Strategy and its Implementation*. OED, Washington: World Bank.

Vulnerability to natural disasters

Albala—Bertrand, J.M. 1993. *The Political Economy of Large Natural Disasters*, Clarendon Press, Oxford.

Albala-Bertrand's 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. & Clay, E. 1994. *The Impact of Drought on Sub-Saharan African Economies: A Preliminary Examination*.

This paper looks at economy-wide macro-economic 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 that droughts exacerbate income inequalities.

Datt, G. & Hoogeveen, H. 2000. *El Nino or El Peso? Crisis, Poverty and Income Distribution in the Philippines*. Policy Research Working Paper No. 2466. The World Bank.

Enarson, E. & Hearn Morrow, B. 1998. *The Gendered Terrain of Disasters*. Praeger, Westport, Connecticut.

The goal of this collection is to bring together what is currently known 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 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, as well as private, recovery assets. Among the poor, women are most at risk when hazardous conditions become disastrous events.

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

The purpose of this volume is to explore 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, namely 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*. United Nations University Press, Tokyo.

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

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

Twigg, J. Bhatt, M. 1998. *Understanding Vulnerability—South Asian Perspectives*. Intermediate Technology Publications, London.

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 hazards, natural and man-made. The Nepali villagers studies by N. Dahal 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 & 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*. Volume 14, No. 4, pp. 537-546.

Feder, Gershon. 1987. Land Ownership, Productivity and Farm Productivity: Evidence from Rural Thailand. *Journal of Development Studies*, vol 24(1), pp16-30.

This is a classic study testing the impact of empowerment via ownership/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*. IIED, London:.

Lynch and Talbott. 1995. *Balancing Acts: Community-Based Forest Management in Asia and the Pacific*, World Resources Institute.

In case of Nepal, forest lands 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. There is a clamor from other communities who are queuing up to get their own management plans approved.

Mahapatra, R. 2000. A Quiet Revolution. *Down to Earth*. Vol. 8, No. 21, March 31, pp. 24.

Muir, Kay, and Jan Bojöö. 1996. Economic Policy, Wildlife and Landuse in Zimbabwe. in Bojöö, Jan (ed.), *The Economics of Wildlife: Case Studies from Ghana, Kenya, Namibia and Zimbabwe*. World Bank.

Murombedzi, J. C. 1999. Devolution and Stewardship in Zimbabwe's Campfire Programme. *Journal of International Development*. 11, 287-293.

Roe, D et al. 2000. *Evaluating Eden: Exploring the Myths and Realities of Community-Based Wildlife Management*. Evaluating Eden Series No. 8. IIED, London.

Stalker, Linda. "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. 2001.

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 Tato K. and H. Hurni (eds.) *Soil Conservation for Survival*. Soil and Water Conservation Society. Ankeny.

Convery, Frank.1991. *Applying Environmental Economics in Africa*. World Bank Technical Paper Number 277. Africa Technical Series. World Bank, Washington, D.C.

Dixon, J.A., L.F. Scura, R.A. Carpenter, 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 DC, Resources for the Future.

Gittinger, J.P. 1982. *Economic Analysis of Agricultural Projects*. 2nd ed. Johns Hopkins University Press. Baltimore and London.

Helmets. F.L.C.H. 1979. *Project Planning and Income Distribution*. Martinus Nijhof Publishing. Boston, The Hague and London.

Kramer, Randall, Narendra Sharma, and Mohan Munasinghe. 1995. *Valuing Tropical Forests: Methodology and Case Study of Madagascar*. World Bank Environment Paper No. 13. The World Bank.

Lampietti, Julian A. and John A. Dixon. 1995. *To See the Forest for the Trees: A Guide to Non-Timber Forest Benefits*. Environment Paper Number 13. World Bank, 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 Number 8. World Bank, Washington D.C.

Shiferaw, B & Holden, S. 1999. Soil Erosion and Smallholder's Conservation Decisions in the Highlands of Ethiopia. *World Development* Vol. 27, No. 4, pp. 739-752.

Squire, Lyn, and H.G. van der Tak 1975 *Economic Analysis of Projects*. World Bank and Johns Hopkins University Press. Baltimore and London.

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 on Sierra Leone. Freetown, Sierra Leone.

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*, Vol. 26, No. 9, pp.1899-1913.

Whittington, Dale, Donald T. Lauria, Albert M. Wright, Kyengoae Choe, Jeffrey A. Hughes, and Venkateswarlu Swarna. 1993. Household Demand for Improved Sanitation Services in Kumasi, Ghana: A Contingent Valuation Study. *Water Resources Research*, Vol. 29, No. 6, pp. 1539-1560.

Household survey analysis (see also the **Poverty Data and Measurement** chapter)

Grosh, Margaret E. 1997. *The Policymaking Uses of Multitopic Household Survey Data: A Primer*. The World Bank Research Observer, vol. 12 no. 2 (August 1997), pp. 137-160. The World Bank.

This paper discusses the benefits and limitations of national survey data; what topics are suitable for policy analysis; illustrates the kinds of issues typically addressed via LSMS surveys; and how analysis of survey data can inform the decision-making process. Some of the examples discussed in the paper are: benefits of the food stamp program in Jamaica, impact on the poor of an increase in taxes on petroleum products in Ghana, characteristic of poverty in Ecuador, streamlining food subsidies in Tunisia, efficient provision of public services (roads, public transport, electricity, pipe-borne water, dispensary, etc) in Vietnam.

Grosh Margaret and Paul Glewwe (editors) 1999. *Designing Household Survey Questionnaires for Developing Countries: Lessons from Ten Years of LSMS Experience*. Development Research Group, The World Bank.

The book provides detailed advice on how to design a multi-topic household survey--to set realistic objectives, identify tradeoffs and design a survey that best meets those objectives. The book is divided into three parts: (i) The Overall Design of the Survey; (ii) The Design of Modules and Questionnaires; and (iii) General Methodological Issues. Chapter 14 is on Environmental Issues. This section states 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 WTP for improvements in rural and urban water quality, urban air quality and urban sanitation.