Harvests from forests, fisheries, and farm fields are the primary source of income for the rural poor worldwide. Yet the full potential of ecosystems as a wealth-creating asset for the poor has yet to be effectively tapped.

CHAPTER 2

ECOSYSTEMS AND THE LIVELIHOODS OF THE POOR

ECOSYSTEMS PROVIDE THE FOUNDATION FOR ALL HUMAN survival, since they produce the food, air, soil, and other material supports for life. Everyone, rich and poor, urban and rural, depends on the goods and services that ecosystems provide.

But the rural poor have a unique and special relationship with ecosystems that revolves around the importance of these natural systems to rural livelihoods. By *livelihoods*, we mean the whole complex of factors that allow families to sustain themselves materially, emotionally, spiritually, and socially. Central to this is *income*, whether in the form of cash, or in the form of natural products directly consumed for subsistence, such as fish, fuel, or building materials.

As this chapter will show, the rural poor derive a significant fraction of their total income from ecosystem goods and services. We refer to such nature-based income as *environmental income*. Because of their dependence on environmental income, the poor are especially vulnerable to ecosystem degradation.

Of course, environmental income is not the only important component in rural livelihoods. A poor family's total income is generally derived from at least four different sources:

- environmental income (including small-scale agriculture),
- income from wage labor (such as agricultural labor) and home businesses,
- remittances (money or goods sent from relatives outside the community), and
- other transfer payments, such as assistance from state agencies.

WHAT ARE ECOSYSTEM GOODS AND SERVICES?

Just as the physical forms of ecosystems vary widely—from delicate coral reefs to arid deserts—so do the array of goods and services available to local communities. The benefits that humans obtain from ecosystems fall into four main categories (MA 2003:53-60):

Provisioning services comprise the production of basic goods such as crops and livestock, drinking and irrigation water, fodder, timber, biomass fuels, and fiber such as cotton and wool.

Regulating services are the benefits obtained as ecosystem processes affect the physical and biological world around them. These services include flood protection and coastal protection by mangroves and reefs; pollination; regulation of water and air quality; the modulation of disease vectors; the absorption of wastes; and the regulation of climate.

Cultural services are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences. These provide the basis for cultural diversity, spiritual and religious values, as well as the more prosaic experience of tourism.

Supporting services are those that are necessary for the production of all other ecosystem services. Their impacts are indirect or extend over long time-scales. They include primary production of biomass through photosynthesis, soil formation, production of atmospheric oxygen, and nutrient cycling.

All these sources are important, and none can be ignored without losing sight of the reality of the rural economy. However, this chapter's primary concern is exploring how environmental income fits into rural livelihoods. This includes asking how important it is compared to other types of income, where it comes from, how it is obtained, and what role it plays in the total livelihoods of the poor. Even though this chapter dwells primarily on income, it does so with the cognizance that maximizing income is only one component of a total *livelihoods approach* to development.

How Important is Environmental Income?

Environmental income—the income generated from ecosystem goods and services—is a major constituent of the household incomes of the rural poor. It includes income from natural systems such as forests, grasslands, lakes, and marine waters. It also includes agricultural income—the output of agroecosystems.

Researchers often make a distinction between agricultural income and what in this report we term "wild income"—that is, income from less manipulated natural systems like forests and fisheries. This distinction means that these two income streams are often counted and analyzed separately. Wild income deserves special attention, since it is often the element that is not accurately accounted for in most considerations of rural livelihoods. But both agricultural and wild income are important to an accurate assessment of the dependence of the poor on ecosystems for income. In addition, there is overlap between the two, as in the use of forest grasses for livestock forage, or forest leaf litter as a soil amendment or crop mulch.

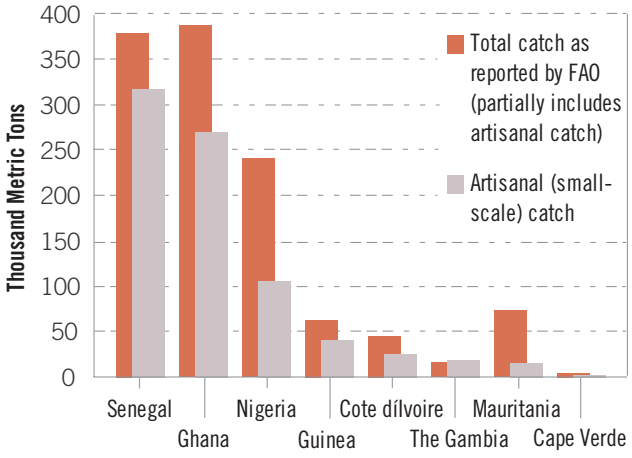
Environmental income can be derived in several distinct ways. Income might accrue to households through direct use of ecosystem services, for instance, by consuming bushmeat and other wild foods, cutting fodder for livestock, using wood products in home construction, or eating produce grown in a home garden. Where markets exist, goods harvested from ecosystems, such as fish, herbs, or fuelwood, can be sold for cash or exchanged for services like school tuition. In addition, communities may charge stumpage fees for providing loggers

TABLE 2.1 NUMBER OF PEOPLE DEPENDENT ON ECOSYSTEMS

Dependent on forests in some way	**1.6 billion**
■ Smallholder farmers who grow farm trees or manage remnant forests for subsistence and income	500 million to 1 billion
■ Indigenous people wholly dependent on forests	$60 million
Poor dependent on agriculture in Sub-Saharan Africa	**>500 million**
Rural poor who keep livestock	**600 million**
■ Landless rural poor who keep livestock	150 million
Fishers and fish-farmers in the Lower Mekong River basin	**40 million**

Source: Angelsen and Wunder 2003; IFAD et al. 2004; Kura et al. 2004; Haggblade et al. 2004

FIGURE 2.1 ARTISANAL AND TOTAL CATCH FOR SELECTED WEST AFRICAN COUNTRIES, 1996



Source: Horemans 1998; FAO 2004

access to timber, or they may collect taxes or levees from hunters or tourists, or royalties for access to minerals or the use of local species for pharmaceutical research. The income benefits of these public revenues may then be passed on to households in the form of public infrastructure like roads, schools, and clinics, or public services like agricultural extension programs.

Ecosystems have several characteristics that make them attractive as a source of income. Environmental resources are renewable, widespread, and they are often found in common property areas where the poor can access them without owning the land (Cavendish 2000:1980). In addition, exploiting natural systems often can be done with little need for investment or expensive equipment, making the cost of entry low—an important consideration for poor families with limited assets.

Important at Every Scale

The importance of environmental income to the poor can be judged at different scales. At the global scale, estimates of nature's contribution to livelihoods are impressive. For example, the World Bank estimates that 90 percent of the world's 1.1 billion poor—those living on $1 per day or less—depend on forests for at least some of their income (World Bank 2002:1). Agriculture is likewise essential to poor families. Small-scale agriculture—the kind the poor practice—accounts for more than 90 percent of Africa's agricultural production (Spencer 2001:1). In addition, over 600 million of the world's poor keep livestock, a critical cash asset for many (IFAD et al. 2004:1).

The Food and Agriculture Organization estimates that over 90 percent of the 15 million people working the world's coastal waters are small-scale fishers, most of them poor. That does not count the tens of millions of the poor who fish inland rivers, lakes, ponds, and even rice paddies (FAO 2002 in Kura et al. 2004:35). *(See Table 2.1.)*

At the national level, environmental income is also important, not only to the poor, but to national economies. Small-scale fisheries, for example, are not only common sources of income for the impoverished but are major contributors to the economies of many nations. In Asia small-scale fisheries contributed 25 percent of the total fisheries production of Malaysia, the Philippines, Thailand, and Taiwan for the decade ending in 1997 (Kura et al. 2004:38). In West Africa the importance of small-scale fishing is greater still, constituting three-fourths of the region's total fish catch (Kura et al. 2004:39). In Indonesia, small-scale fishers are responsible for almost 95 percent of the total marine catch (FAO 2000a:2). *(See Figure 2.1.)*

At the same time, export revenues from small-scale agriculture are vital to many poor nations. In Mali, cotton grown by small-holder farmers generates 8 percent of the nation's GDP and 15 percent of all government revenues. Some 30 percent of all Malian households grow cotton on small plots, and it is second only to gold as the nation's most important export (Tefft 2004:1).

THE COMPONENTS OF ENVIRONMENTAL INCOME

Environmental Income *is the value derived—in cash or direct use—from ecosystem goods and services.* As we use the term in this report, environmental income is the sum of two important income streams.

- **Wild Income:** Income from wild or uncultivated natural systems, such as forests, marine and inland fisheries, reefs, wetlands, and grasslands. This includes commodities such as fish, timber, and nontimber forest products such as fuelwood, game, medicinals, fruits and other foods, and materials for handicrafts or art. It also includes income from nature-based tourism, as well as payments that rural landowners might receive for environmental services such as carbon storage or preservation of watershed functions.

- **Agricultural Income:** Income from agroecosystems—all agricultural lands, such as croplands, pastures, or orchards. In the context of the poor, agricultural income is mostly generated through small-scale agriculture, including commodity crops, home gardens, and large and small livestock. Income from aquaculture would also fit in this category.

Environmental income could also reasonably include a third component:

- **Mineral and Energy Income:** Income from mining or extraction of oil, gas, hydrothermal energy, or hydroelectric energy. Large-scale mineral and energy exploitation is not usually a direct source of income for poor rural households, so in this report we do not consider this income stream as part of rural livelihoods.

We should note that other definitions of environmental income exist that are not as broad-reaching as ours (see Vedeld et al. 2004:5-6). Our aim is to account for all sources of income based on nature that figure into the household budgets of the poor or can be tapped by them for sustainable wealth creation.

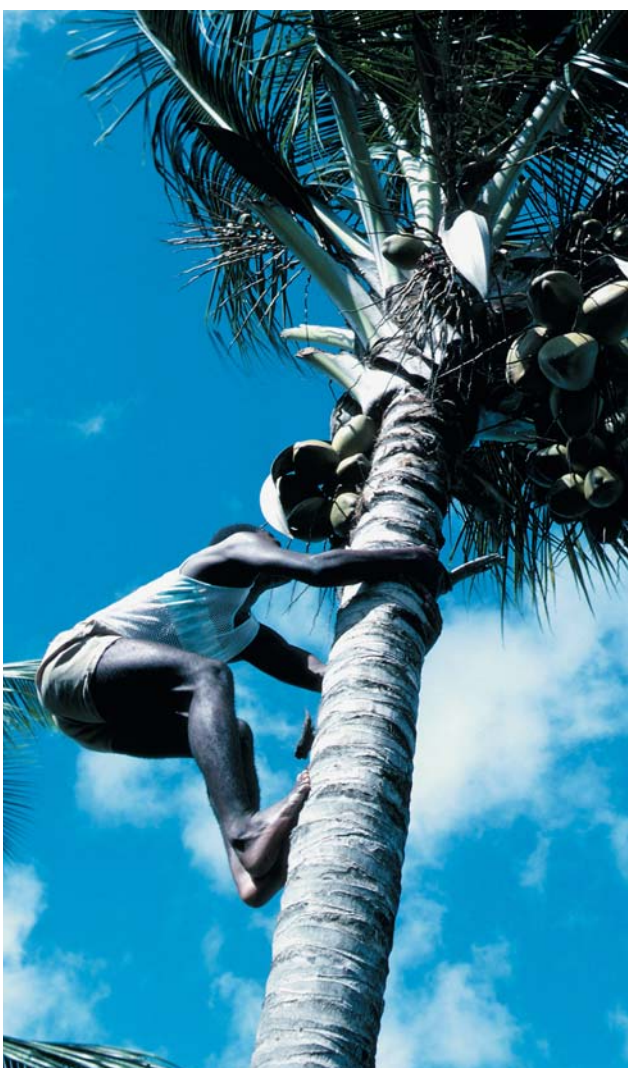
ADOPTING A *LIVELIHOODS APPROACH* TO DEVELOPMENT

Livelihoods are our means of everyday support and subsistence. As commonly conceived, a livelihood generates financial resources that come from employment or subsistence activities. But livelihoods also draw on other resources: human and social resources that give structure and context to our daily lives, as well as the natural and physical resources that underpin our work. In the 1990s, development agencies began to adopt this more holistic view of livelihoods, with the goal of focusing development activities more effectively. The UN Development Programme's *Human Development Reports* in particular drew attention to human well-being—defined by health, education, opportunity, a healthy environment, and a decent standard of living—as the core of development practice (Solesbury 2003:vii).

The United Kingdom's Department for International Development (DFID) made the "sustainable livelihoods approach" a core principle of its development strategy in 1997 (Solesbury 2003:vi). Building in part from the *Human Development Reports* and the 1987 Brundtland Commission Report, *Our Common Future,* DFID's approach assesses the strengths and vulnerabilities of poor people in terms of five types of capital: human, social, natural, physical, and financial (UK DFID 1999:2.3). As opposed to the more traditional focus on macroeconomic policies, this approach puts people at the center of development and is inherently nonsectoral. It also explicitly concerns itself with the condition of the natural resource base.

The "sustainability" element of the livelihoods approach is achieved by helping people to build resistance to external shocks and stresses, maintain the long-term productivity of natural resources, move away from dependence on unsustainable outside support, and avoid undermining the livelihood options of others. Addressing these challenges requires that development agencies view the poor as a mixed, rather than a homogenous, group, and tailor policies to the various sub-groups. Listening to the poor and involving them in the policy process is a key part of this approach (UK DFID 1999:5, 7; Chambers and Conway 1991:6).

The sustainable livelihoods approach has been recognized and adopted to varying degrees by a number of development agencies. One of the challenges of its application is finding ways to match such a dynamic framework to existing policies and institutions (Hussein 2002:55). That is why an emphasis on governance—dealing with who wields power and how decisions are made—has become a key element in modern development practice.



HOW IS ENVIRONMENTAL INCOME CALCULATED?

Environmental Income of a Small-Scale Fisher

Gross Value of Natural Resource

- Value of fish consumed by producer (subsistence income)
- Sales at market* (cash income)

Labor and Materials Costs

- Labor Costs: fishing, repairing equipment, etc
- Capital Costs: purchase or rental of nets, fishing rods, boats, etc.

TOTAL ENVIRONMENTAL INCOME =
Gross Value of Resource – Labor and Materials Costs

* Includes value added by producer through preparation such as smoking, preserving, etc.

Environmental income—the value of goods and services from ecosystems—can be difficult to measure. Typically, it is calculated as the gross value of natural resource goods minus the cost of labor and materials needed to collect and sell these goods (Vedeld et al. 2004:6). The environmental income for a family dependent on fisheries is illustrated above. The gross value of the natural resource (fish) would include both the value of the fish consumed by the household and the price of any fish sold at market. The total environmental income is calculated by subtracting from the gross value any labor and materials costs, such as rental fees for boats or the purchase price of fishing rods and nets.

Assessing environmental income at the household level is the most difficult, but also the most valuable in judging how much of a factor nature-based income is in the lives of the poor and whether it can be increased or at least made more secure. Household surveys have been used for decades to measure income and consumption patterns, but they have not traditionally assessed what portion of this income was from natural resources (Cavendish 2000:1980). As a result, the kind of comprehensive data needed to quantify the dependence of the poor on environmental income has been scarce, increasing the tendency of policymakers to minimize the environment in their poverty prescriptions.

In recent years, researchers have begun to fill this breach with quantitative studies of environmental income at the village and household level. While the amount and dependence on environmental income differs depending on the ecosystem, the community, and other social and economic factors, these studies have confirmed that environmental income is near-universally important to poor households.

Estimating the Importance of Wild Income

William Cavendish's study of 30 villages in the Shindi ward of Zimbabwe in the late 1990s provides a careful look at how the poor make use of nature-based income. Cavendish's survey of nearly 200 households excluded farm income, concentrating on wild income from forests and other natural sources, particularly common areas in the public domain. He found that this kind of environmental income constituted over 35 percent of total household income. It was not usually obtained from one source, but many small sources combined. Households derived direct subsistence value from collecting firewood, consuming fruits and berries, and browsing their livestock. They received cash income from the sale of materials, fruits, medicines, or meat they had collected or hunted. They even derived some income from small-scale gold panning. Cavendish also found that the dependence of households on environmental income decreased as their average incomes rose. Although the poor tended to get more of their total income from the environment, the rich still made heavy use of natural products for income (Cavendish 2000:1979, 1990, 1991).

TABLE 2.2 DIVERSE USES OF ENVIRONMENTAL INCOME

Location	Ecosystem	Goods or Services Used	Benefit to Households
Shindi Ward, Southern Zimbabwe	Forests and grasslands	Wild fruits, timber, thatching grass, livestock fodder	Ecosystems contribute an average of 35% of total income. Cavendish 2000
Southern Malawi	Forest	Firewood, fruit, mushrooms, bushmeat, insects, honey	Forest income contributes up to 30% of total income. Fisher 2004
Gulf of Mannar, India	Reefs	Seaweed, shellfish, sea cucumber, medicines, lobster	Reefs are often the only source of cash income for poor families, providing up to $199 of income annually. Whittingham et al. 2003
Coquimbo Region, Chile	Semi-Arid	Pasture, fodder	80–90% of poor households use common pool resources. Bahamondes 2003
Iquitos, Peru	Tropical forest	Non-timber forest products, including fruits, latexes, medicines, tourism and carbon sequestration	Forests provide $422 of potential sustainable income per hectare annually. Lampietti and Dixon 1995
Budongo Forest, Uganda	Semi-deciduous tropical forest	Fuel wood, building materials, wood for furniture, food, medicinal plants	Biomass provides 90% of the energy needs for the country and between 6% and 25% of household income in Bundongo village. Aryal 2002
Bushbuckridge District, South Africa	Agriculture	All crops including maize, cassava, morogo, various fruits	Total value of wild and crop plants was US$269 per household per year. High and Shackleton 2000
Chimaliro Forest Reserve, Malawi	Agriculture	Maize, cassava, ground nuts, pulses, soy beans, potatoes	Food crops contributed between 45% and 55% of household income. Botha et al. 2004
Jhabua, Madhya Pradesh, India	Agriculture	Agriculture, fuelwood, timber, fodder for livestock	Environmental income (including agriculture and resource collection) was the largest household income source for the poorest 25%. Narain et al. 2005

MISUNDERSTANDING THE WEALTH OF THE POOR

It is often difficult to assign a monetary value to the ecosystem goods and services on which the poor rely. Some have a market value when sold, but many are consumed locally or at home, and do not enter into the formal economy. In effect, the poor exist in an informal, and often unrecognized, economy. This has led to the systematic undervaluation of the assets of the poor and the underestimation of the potential benefits of sound ecosystem management.

Several studies have tried to delineate this "other economy" of the rural poor. A recent World Bank analysis, for example, found that the poor derive, on average, one-fifth of their household income from forests, mostly from nontimber products like wild foods, fuel, fodder, and thatch grass (Vedeld et al. 2004:27-29). Regretfully, much of the economic value of forests to the poor is missed in official state accountings of the forest economy.

Kenya is a typical example. By official estimate, the formal forest sector only generates about $2 million in earnings per year for sawn timber, pulp, and other industrial wood products. This is dwarfed by the value of the informal forestry sector, which contributes some $94 million in value to rural households in the form of charcoal, fuelwood, and the panoply of other forest products. And this does not include the recreational value of forests for leisure and tourism, which could come to $30 million or so. Since so much of this forest value accrues to the informal sector, most of its value is missed (Mogaka et al. 2001:17).

This undervaluation causes decision-makers to assign a lower priority to intact forest ecosystems as an economic asset than they should. For example, in spite of their place in rural livelihoods, woodfuels are generally not seriously considered in rural development plans and poverty reduction strategies, even though they provide the majority of the energy requirements of poor families on every continent (Arnold et al. 2003:25; IEA 2002:27).

A similar situation exists with small-scale fisheries. Despite the unquestioned importance of coastal and inland fisheries to the poor, small-scale fisheries are also an overlooked resource in most poverty alleviation strategies (Béné 2003:949). Again, this reflects the fact that fisheries income for the poor frequently escapes official notice, since fish are often locally consumed, and often at home. A survey in four rural Cambodian provinces found that, even though three-fourths of households engage in fishing as a primary or secondary occupation, fully half of them never sell any fish in the open market (Degen et al. 2000:1, 20).

If programs to alleviate poverty continue to undervalue the assets of the poor and misunderstand the dynamics of the informal economy, they will remain only partially effective. Better valuation and accounting of wild income, as well as income from home-based agriculture, is part of any sensible strategy to incorporate environmental income into poverty reduction programs.

Other studies confirm Cavendish's general findings. Research in South Africa found communities regularly using between 18 and 27 wild products, the most valuable again being fuelwood, construction wood, wild fruits and herbs, and fodder (Shackleton et al. 2000a:2). Quantities consumed per household can be substantial. Average annual usage figures of 5.3 metric tons of fuelwood, 104 kg of edible fruits, 58 kg of wild vegetables, and 185 large poles for house construction and fencing are typical in rural South Africa (Shackleton and Shackleton 2004:658; Shackleton et al. 2000a:2).

Subsistence use represents the greater part of the value of these natural products to households. Home use of wild products brings a direct reduction in cash expenditures of households—a form of income that is essential to the survival of the very poor. Estimated cash equivalents for subsistence use of wild products ranged from US$194 to US$1,114 per year over a series of seven studies in South Africa—a significant income fraction (Shackleton et al. 2000a:2).

But wild products can be a considerable source of cash income. In the Indian state of Kerala, residents in the Wayanand district sell wild foods such as honey and mushrooms, along with coveted gooseberries and other medicinal plants, earning an annual average of Rs. 3,500 (US$75) per household (Shylajan and Mythili 2003:109, 112-113). Likewise, medicinal-plant vendors in rural South Africa bring in significant cash, with a mean annual income of 16,700 rand (US$2,680) (Botha et al. 2004). At the other end of the scale, rural charcoal makers in Kenya sell a 30-35 kilogram bag of charcoal for a mere 280 Ksh (US$3.50) to middle men who transport it to Nairobi for cooking fuel (Kantai 2002:16). *(See Table 2.2.)*

Gauging the importance of wild income to a poor family's total income is difficult, of course, because the amount of such income is highly variable across families and across the seasons. In general, however, wild income tends to be more an auxiliary source rather than the main income source for most poor families. But there are many exceptions to this rule. For example, in some alpine villages in the Western Himalayas, wild income provides around 70 percent of household income, mostly from grazing of sheep and goats and the collection of medicines and herbs (Asher et al. 2002: 20). If markets—such as tourists—are handy, wild income can be impressive. A skilled wood carver using native materials in Namibia, for example, can earn as much as US$1,800 per year by plying the tourist trade. In general, however, wild income contributes more modestly to total income, providing perhaps 15-40 percent of family income, if current studies are any guide (Shylajan and Mythili 2003:100-102; Cavendish 2000; Beck and Nesmith 2001).

Although the value of many wild products seems small when considered in isolation, their aggregate value can be

substantial, and their contribution to rural economies crucial. In South Africa, Shackleton has estimated the value of wild products extracted by households in the savanna biome alone at 8 billion rand (US$1.3 billion) per year—a figure that works out to about R750-1,000 (US$120-160) per hectare of accessible land. That compares favorably with the economic productivity of cattle ranching and plantation forestry in these areas. In fact, when collection and sale of wild products is compared head to head with other rural employment options, it often proves to be more lucrative. In Nigeria, research shows that returns on labor are 3-4 times higher for harvesting and selling woodland products than for agricultural wage labor (Shackleton et al. 2001:583; Shackleton and Shackleton 2004).

Unfortunately, the size and importance of these economic contributions often goes unnoticed. Such transactions belong to the informal economy, and are generally unaccounted for in official economic statistics.

Adding in Agricultural Income

Income from wild products is only a part of the environmental income equation. Agricultural income is just as crucial. Only when income from agriculture is combined with the income from wild products do we begin to get a clear idea of how important ecosystem goods and services are as a source of rural livelihoods.

A study of households (rich and poor) in the Masvingo Province in southeastern Zimbabwe provides a good example of how agricultural income complements wild income and how it compares with other income sources such as wages and remittances. As Figure 2.2 shows, agricultural income—from crops and home gardens—contributed 30 percent of total household income (cash and subsistence income combined). Livestock rearing—a modified form of agriculture that relies on wild forage—contributed another 21 percent. Wild products from woodlands contributed 15 percent. Together, these elements of environmental income sum to 66 percent of total income. In other words, *goods and services from ecosystems contribute two-thirds of family incomes in rural Zimbabwe.* The remaining 34 percent came from wage labor, income from home industries, and remittances. For the poorest of these rural households, dependence on these different kinds of environmental income is even higher, providing a full 70 percent of total income when combined (Campbell et al. 2002:89-95).

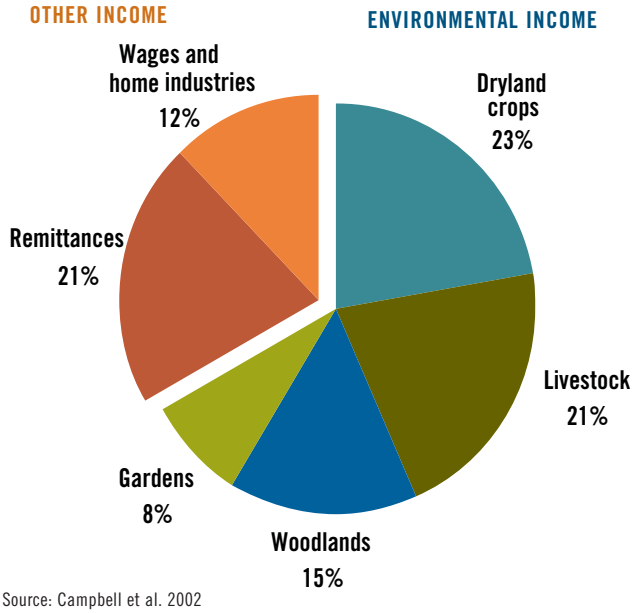
The balance between agricultural income and wild income varies by location, with agriculture supplying more income in some areas, and wild income more in others. For example, a recent survey in the Jhabua district of Madhya Pradesh, India, found that agriculture provided 58 percent of total income of the poorest families, with livestock and wild income providing another 12 percent. In this district, farming is the main occupation, with over 90 percent of the workforce employed in agriculture. But families in Jhabua also supplement their incomes with livestock-rearing and collection of various forest products, such as wood fuel, fodder, tendu leaves, and mahua flowers (Narain et al. 2005:6, 14). *(See Figure 2.3.)*

Common Pool Resources as a Source of Environmental Income

Much of the environmental income earned in the developing world comes from common pool resources (CPRs). Common pool resources are forests, fisheries, reefs, waterways, pastures, agricultural lands, and mineral resources that no individual has exclusive rights to. They are typically owned and administered by the state, a village, a tribe, or other social grouping, with the idea that the benefits will accrue to many people rather than one person or family. Local and distant residents go there to collect fire wood, graze their cattle, gather nontimber forest products like medicinal herbs or mushrooms, hunt, fish, collect water, or make use of a variety of other services such as visiting sacred groves. Because these "commons" or "public domain" lands are such a rich source of environmental income, they are a crucial element in the livelihood strategies of the poor, particularly those who do not own land themselves (Jodha 1986:1169).

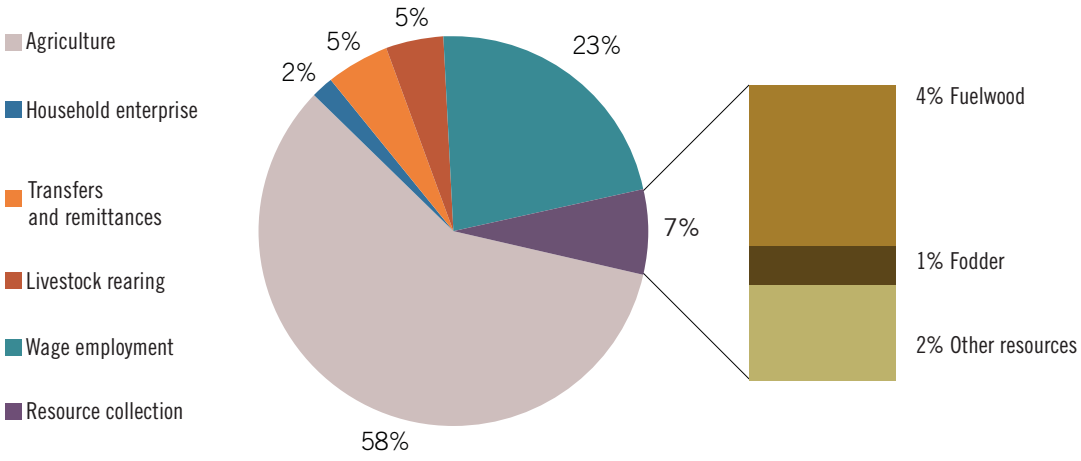
Just how important are they? Research over the past two decades has amassed a fair amount of evidence on this topic, particularly in India. N.S Jodha, in his pioneering study of 80 villages across seven semi-arid states in India, found that the poor make extensive use of common areas, with CPRs contributing 15-25 percent of household income (Jodha 1986:1177). Other studies from different states in India have found that CPRs contribute up to 29 percent of the income of poorer households (Adhikari 2003:5). Altogether, CPRs contribute some US$5 billion a year to the incomes of India's rural poor, according to one estimate (Beck and Nesmith 2001:119).

FIGURE 2.2 HOUSEHOLD INCOME BY SOURCE, MASVINGO PROVINCE, ZIMBABWE



Source: Campbell et al. 2002

FIGURE 2.3 SOURCES OF INCOME FOR POOR HOUSEHOLDS IN JHABUA, INDIA



Source: Narain 2005

Fewer studies have been done in other parts of the world, but there are indications that many of the rural poor derive a similar or higher percentage of their income from the commons (Beck and Nesmith 2001:119). In Botswana, researchers found that the poorest 20 percent of the population earn 51 percent of their household income from CPRs (Kerapeletswe and Lovett 2001:1). In southeastern Zimbabwe, households (both rich and poor) get 35 to 40 percent of their income from the commons (Cavendish 1998:7). Over 90 percent of Cambodians reported they make use of common property fish resources from lakes, rivers, flooded ricefields, and even flooded forests (Ahmed et al. 1998 in UK DFID 2000:31).

Without access to these resources, poor families would be virtually unable to support themselves. For example, poor households in Jodha's study met 66-80 percent of their fuel requirements from CPRs. Common areas also contribute a great deal of fodder, allowing poorer families to raise more livestock than they would otherwise be able to support (Jodha 1986:1173).

The Commons as a Safety Net and Employment Source

Even where dependence is not as high, CPRs function as an irreplaceable safety net for the poor. When farm and financial assets are scarce, the commons can provide secondary income and sources of food and fuel for basic survival. Researchers in western Africa have found that common pool resources are of particular importance to the poor during seasonal food shortages and times of crisis. According to one study, the poorest households rely on "bush" sources to supply 20 percent of their food requirements during the lean time before harvest, when food supplies are low. Wealthier families relied on the bush for only two percent of their food during this period (Dei 1992:67).

The dependence of poor households on the commons is typically highest after crop production has finished and when other alternatives for wage labor are unavailable (Jodha 1986:1177). Indeed, CPRs can generate significant self-employment opportunities, and often serve as an important and flexible source of secondary income for poor households. Jodha found that collection activities alone provided 36-64 days of work annually per worker in poor households in his study area (Jodha 1986:1175). In Haryana, India, collection of foods and other products, stone quarrying, and livestock grazing in common areas generate an annual average of 88 days of employment per household. Importantly, the numbers break down very differently by socio-economic class, with wage laborers working an average of 213 days per year in the commons, and higher-class households only 25 (Quereshi and Kumar 1998:350).

Gender also strongly influences reliance on the commons. Women head a disproportionate number of poor households, and their reliance on wild income is higher than men, who often have more schooling and greater wage-earning capacity. Studies show that women are often the primary gatherers and sellers of non-timber products such as fruits, medicinals, and handicraft materials (Shackleton et al. 2001:583; Shackleton et al. 2002:135; Shackleton 2005).

The Commons in Decline

A combination of factors, including privatization, agricultural intensification, population growth, and ecosystem degradation have caused common property areas to dwindle in size, quality, and availability to the poor in much of the world (Beck and Nesmith 2001:123). In some areas, common lands are converted to private parcels as a form of land reform or decentralization, or to spur development. Or common property resources may be leased out to private enterprises in the form of fishing or timber concessions. In either case, the poor may lose access to resources they once relied on.

Jodha estimates that in the areas covered by his study the extent of common lands has declined by 31 to 55 percent since

the 1950s, mainly because of privatization through land reform (Jodha 1995:23). He estimates that in 1951 the average number of persons per 10 hectares of CPRs ranged from 13 to 101; by 1982, that number had risen to over 47,000 per 10 hectares in some villages. The increased pressure this has put on the remaining commons has led to overexploitation and a decline in the quality and quantity of services they yield (Jodha 1995:23). Degraded common lands undoubtedly make up a large part of the 75-130 million hectares of India's land that has been classed as "wasteland"—land that is both unproductive and ecologically depleted (Chopra 2001:25, 29).

Such declines in the ecosystem quality of public-domain lands are increasingly hard on rural livelihoods. A recent study in Ethiopia found most of the commons there in a state of either exhaustion or stress. Depleted grazing lands there have led to ethnic clashes and a decline in total livestock numbers, while the growing scarcity of woodfuel from common areas has forced more households to depend on purchased fuel (Kebede 2002:133-134). *(See Box 2.1.)*

Degradation from overuse is not inevitable, however, and examples of collective action to manage the commons are growing in number. In Caprivi, Namibia, good management and sustainable harvesting techniques of palm fronds from common areas have enabled local women to supplement household incomes by selling woven palm baskets to tourists. As one of the few sources of cash income for women, the market has grown from 70 producers in the 1980s to more than 650 by the end of 2001, a jump that the resource has been able to sustain thus far (Murphy and Suich 2004:8-9). In another example, rural harvesters of marula fruits in Bushbuckridge district of South Africa have planted marula trees in their home gardens and fields and selected for those with greater yields in the face of the dwindling number of marula trees in the communal lands (Shackleton et al. 2003:12, 13). *(For more examples of sustainable use of the commons by poor households, see Chapters 4 and 5.)*

Who Gets More Environmental Income: Rich or Poor?

Environmental income is not only important to the poor. Richer families also make extensive use of income from ecosystem goods and services. ("Rich" here does not necessarily imply high income by developed-world standards, but a greater relative level of wealth and opportunity compared to lower-income households within the same community.) In fact, several recent studies have shown that the rich commonly derive more environmental income, in absolute terms, than the poor do (Cavendish 2000:1990-1991; Fisher 2004; Narain et al. 2005:10,14; Twine et al. 2003:472). This generally reflects the fact that they have greater ability to exploit what ecosystems can provide. For example, higher-income families may have more livestock and can therefore make better use of forage resources in common areas, whereas a poor family's forage demand may be more limited due to their smaller herd size.

A study in the Jhabua district in the Indian state of Madhya Pradesh showed wealthier families using more fodder resources to feed their larger herds (Narain et al. 2005:5). In addition, the rich frequently have greater access to hired labor, transportation, credit, arable land, or other factors needed to maximize harvest of natural products or agriculture and bring

Continues on page 44

BOX 2.1 FINDINGS OF THE MILLENNIUM ECOSYSTEM ASSESSMENT: HOW DO THE POOR FARE?

THE MILLENNIUM ECOSYSTEM ASSESSMENT (MA) was a four-year, international effort to document the contribution of ecosystems to human well-being, assay the current state of ecosystem health, and offer a prognosis for how the capacity of ecosystems to support human needs may change under different management scenarios. The intent was to provide decision-makers scientifically credible information to help them manage ecosystems more sustainably while meeting human development goals.

The MA was a remarkably broad-based effort. Completed in 2005, it involved over 1300 scientists from 95 countries. It found that humans have altered the structure and functioning of the world's ecosystems more substantially in the second half of the twentieth century than at any time in human history. As a result, 15 of the 24 ecosystem services the MA assessed are now being degraded or used unsustainably (MA 2005a:viii, 1, 6).

This unsustainable use stems from the fact that humans often favor some kinds of ecosystem production—such as the provisioning services of food and fiber production—at the expense of other services that ecosystems can render, such as biodiversity, water purification, or natural pest control. The MA showed that such trade-offs among different ecosystem services are the norm. Particularly over the past hundred years, human management of provisioning services (food, timber, water, and other commodities) has degraded the ability of ecosystems to provide regulating services, such as flood control or pollination. Cultural services such as recreation and the aesthetic and spiritual appreciation of nature have also suffered.

At the same time, the findings of the MA have shed new light on the importance of ecosystems to the poor and how ecosystem degradation impairs the livelihoods of the poor. Poor people, particularly those in rural areas in developing countries, are more directly dependent on ecosystem services and more vulnerable when those services are degraded or lost (MA 2005a:2-14).

The MA findings document many examples of the human toll on ecosystems. Approximately 35 percent of mangroves have disappeared in the last two decades. Twenty percent of the world's coral reefs have been lost and an additional 20 percent are degraded. Water withdrawals from rivers and lakes have doubled since 1960. Nitrogen flows to the environment have also doubled, while phosphorous flows have tripled between 1960 and 1990. Landings from inland and marine fisheries have declined due to overexploitation. Fuelwood used for energy is scarce in many parts of the world. Some 10-20 percent of drylands are degraded (MA 2005a:2, 26, 31, 34).

Ecosystem Degradation and the Poor

The MA highlights the relationship between the poor and ecosystem goods and services. While everyone is affected by ecosystem degradation, the poor suffer the harmful effects disproportionately. In fact, the disparities between the poor and rich have grown in recent decades. For instance, despite global increases in the amount of food available per capita, over 800 million people remain undernourished, and food production per capita has actually decreased in Sub-Saharan Africa. While water availability has increased in many regions of the world, half of the urban population in Africa, Asia, Latin America, and the Caribbean suffer from contaminated water and its burden of disease. Ecosystem degradation has very real human and financial costs. The burning of 10 million hectares of Indonesia's forests in 1997-8 resulted in additional health care costs of US$9.3 billion and affected some 20 million people (MA 2005a:2, 13, 51, 57, 62).

The poor have also suffered from loss of access to ecosystems through privatization of what were formerly common pool resources. Examples include inland and coastal fisheries, which the MA findings reveal to be in steep decline. Small-scale fisheries are of great value to the poor, providing an inexpensive source of protein and supplemental income. Increasingly, coastal areas that were once open fishing grounds are being converted for use in shrimp farming and other forms of aquaculture. The harvest from aquaculture ponds or cages is typically exported, and both the income and the protein bypass the local poor. Countries where extensive conversion of coastal habitats for aquaculture is taking place include Ecuador, Thailand, Vietnam, Honduras, Chile, Indonesia, the Philippines, Bangladesh, and India (MA 2005b:25.13).

The MA findings also confirm that the substantial degradation of ecosystems that is now occurring is a barrier to achieving the Millennium Development Goals. For example, the MA warns that meeting the goals of eradicating hunger and reducing child mortality by 2015 will be unattainable if ecosystems continue to be used unsustainably. Soil degradation and water scarcity are two important sources of risk to the production of agroecosystems, and thus to the food supply, particularly as it affects the poor. The MA makes it clear that failure to tackle the current decline of ecosystem health will seriously erode efforts to reduce rural poverty (MA 2005a:61).

For more information on the Millennium Ecosystem Assessment and its findings, see: http://www.maweb.org.

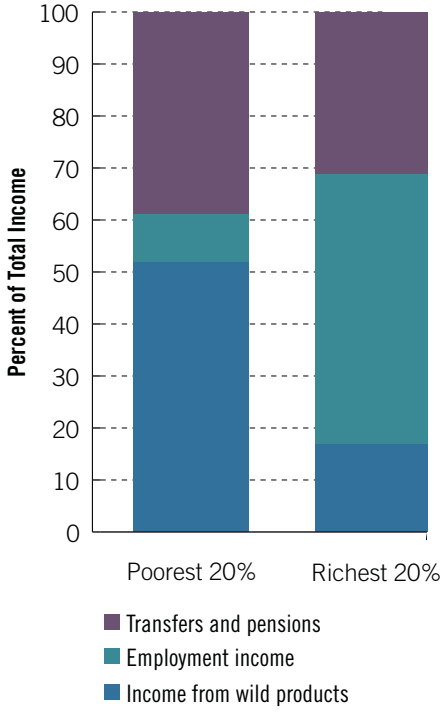
GLOBAL STATUS OF PROVISIONING, REGULATING, AND CULTURAL ECOSYSTEM SERVICES EVALUATED IN THE MILLENNIUM ASSESSMENT

The table below summarizes the MA's finding on ecosystem services. The "Status" column indicates whether in the recent past the condition of the service globally has been enhanced (▲) or degraded (▼) or whether there has been no consistent global pattern (▲+▼)

Service	Subcategory	Status	Notes
PROVISIONING SERVICES			
Food	crops	▲	Substantial production increase
	livestock	▲	Substantial production increase
	capture fisheries	▼	Declining production due to overharvest
	aquaculture	▲	Substantial production increase
	wild foods	▼	Declining production
Fiber	timber	▲+▼	Forest loss in some regions, growth in others
	cotton, hemp, silk	▲+▼	Declining production of some fibers, growth in others
	wood fuel	▼	Declining production
Genetic resources		▼	Lost through extinction and crop genetic resource loss
Biochemicals, natural medicines, pharmaceuticals		▼	Loss through extinction, overharvest
Fresh Water		▼	Unsustainable use for drinking, industry, and irrigation; amount of hydro energy unchanged, but damns increase ability to use that energy
REGULATING SERVICES			
Air quality regulation		▼	Declining ability of atmosphere to cleanse itself
Climate regulation	global	▲	Net source of carbon sequestration since mid-century
	regional and local	▼	Preponderance of negative impacts
Water regulation		▲+▼	Varies depending on ecosystem change and location
Erosion regulation		▼	Increased soil degradation
Water purification and waste treatment		▼	Declining water quality
Disease regulation		▲+▼	Varies depending on ecosystem change
Pest regulation		▼	Natural control degraded through pesticide use
Pollination		▼	Apparent global decline in abundance of pollinators
Natural hazard regulation		▼	Loss of natural buffers (wetlands, mangroves)
CULTURAL SERVICES			
Spiritual and religious values		▼	Rapid decline in sacred groves and species
Aesthetic values		▼	Decline in quantity and quality of natural lands
Recreation and ecotourism		▲+▼	More areas accessible but many degraded

Source: Millennium Ecosystem Assessment 2005a

FIGURE 2.4 DEPENDENCE ON NATURE FOR INCOME IN BOTSWANA



Source: Kerapeletswe and Lovett 2001

them to market. In the Jhabua study, these factors allowed rich families to earn nearly five times as much environmental income—from a combination of farming, livestock rearing, and collection of wild products—as the poorest families.

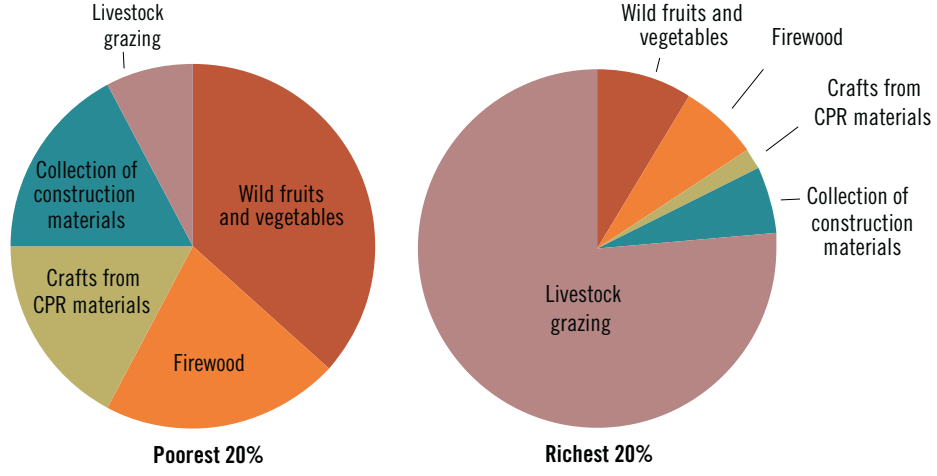
On the other hand, even if the rich capture greater environmental income, they tend not to be as dependent on such income as are the poor. Environmental dependency and poverty seem to go hand in hand. A 1999 study of 12 Himalayan villages found that the poor relied on natural resources for 23 percent of their income, compared to only 4 percent for the rich (Reddy and Chakravarty 1999:1145). In Botswana's Chobe region, the difference was even greater, with the poor depending on wild products from nearby common property lands for half their total income, while the rich depended far more on employment income and remittances, deriving less than 20 percent of their income from the nearby commons. *(See Figure 2.4.)* This was in spite of the fact that rich families in Chobe earned four times as much actual income as poor families from natural resources (Kerapeletswe and Lovett 2001:6-7).

The poor and the rich also tend to use natural resources differently to derive income. The poor tend to pursue a variety of different sources of environmental income, while the rich often concentrate on one or two that allow them to make use of their greater assets for agriculture or livestock rearing. In the Chobe example, three-fourths of the income that the rich derive from the commons comes from livestock rearing, while the poor diversify their efforts, spending time in at least five different activities, from collecting wild foods to making baskets and carvings from natural materials. *(See Figure 2.5.)*

The continued dependence of the poor on ecosystems for their livelihoods stems from several factors, but these generally reduce to the fact that nature is their best—and often only—option. The poor often lack the education and social access to find consistent wage labor. Without wage income, households lack the cash to purchase fuel, food, and services like health care. To substitute, they use small-scale agriculture and other forms of nature-based income, often collected from common areas. When given options for other forms of employment, the poor often reduce their dependence on environmental income.

In any case, the clear implication of most detailed studies of environmental income is that increasing the productivity of ecosystems, and therefore the potential to derive more income, would benefit all income classes in rural areas, not just the poor. Both the poor and the rich stand to gain more income, and rural economies more stability, if ecosystems are managed for greater productivity.

FIGURE 2.5 POOR VS. RICH: DIFFERENT STRATEGIES FOR ENVIRONMENTAL INCOME IN BOTSWANA



Source: Kerapeletswe and Lovett 2001

Environmental Income by Ecosystem

By looking directly at individual ecosystems and the value that they provide to the poor, their importance to livelihoods becomes more obvious.

Agroecosystems

The most important source of environmental income in the world is agriculture—the goods derived from agroecosystems. Agroecosystems differ from other types of ecosystems because of the high degree to which they have been modified by people. Large-scale agriculture, driven by expensive inputs and technology—fertilizer, pesticides, irrigation, tractors, and harvesters—is responsible for much of world food production and agricultural exports. But small-scale agriculture—the farming that the poor pursue—is the silent giant that supports the great majority of the rural residents in poor nations.

This kind of farming looks much different than large-scale farming. While most farms in developed countries are owned by corporations and dominated by physical rather than human capital, in the developing world farms are still largely family-owned and operated. Small-scale farming remains labor-intensive and often lacks access to irrigation, fertilizer, or other inputs that raise productivity. The producer and consumer is frequently the same household. Despite the successes of the Green Revolution, this characterization still describes the majority of the agriculture practiced in the world today (FAO 2000b).

Smallholder farmers—those who own less than 5 hectares of land—cultivate lands in several ways: home gardens and small orchards that largely produce subsistence goods for home consumption; cultivation of commodity crops such as cotton or maize; and grazing of family-owned livestock. This can occur on very small parcels—sometimes on quite marginal land—and is often intermixed with other land uses like forestry. The goods which these small-scale "farms" produce can also be sold in local markets, sold to collectives that combine goods for resale, or even exported to other countries. Each of these modes of production plays a role in the household economy of the poor. Perhaps the most common and important benefit of these farms is that, combined with livestock, they meet a large portion of the nutritional requirements of many poor households.

Malawi, where small-scale farmers account for 70 percent of all farm production, provides a window onto the importance of such farming. Nearly eight of ten Malawians farm their own land—most cultivating less than a hectare (Fisher 2004:136). Maize is the staple crop, with cassava, sorghum, groundnuts, and beans also important. Nearly half of all households own chickens, and one-fifth own goats. Together these agricultural assets provide more than half of household income. Income from forests contributes another 30 percent. Only 10 percent of Malawi's population is engaged in wage employment, highlighting how critical environmental income—and particularly farm income—is to survival (Dorward 2002:9-24).

NATURE AS A DIVERSIFICATION STRATEGY

Why is it that environmental income is so important to the household economies of the poor? Environmental income comes from a variety of sources, each with a fairly low cost of investment. This allows poor households to pursue several different income-generating activities at once, diversifying their income sources and reducing their risk if any one activity fails. Specializing in a particular commodity or trade might be the most profitable, but poor households often lack the income buffer to take the chance. For example, if a household produces only maize, and the market for maize falls, or a pest or drought damages the crop, the family would lose its entire income. Or the household may simply lack the means to invest in the equipment, land, or training needed to specialize in a single trade or business.

Diversification is the answer. A poor family may raise rice for sale and home consumption, harvest fish cultured in the rice paddies for protein, collect wild materials for construction use and fuel, pursue home crafts such as basket making or wood carving for sale to tourists, and keep cattle for milk production and as a quickly saleable asset in time of need. All these are strategies for smoothing out the family-income stream over time and over a variety of sources of risk, such as weather, illness, or market downturns (Ellis 1998:17, 18).

An ecosystem, then, acts as a natural buffer to income shocks for a poor family (Campbell et al. 2002:102). Since it often provides some income even after wage income or remittances fall, it is where the poor often turn to in times of duress. But dependence on an array of low-income nature-based activities, while safest from a survival point of view, is often not a route to substantial wealth. For accumulating wealth, nature-based activities need to tap more lucrative markets, be supported with adequate financial, social, and physical infrastructure—credit, roads, training, marketing cooperatives, and the like—and be coupled with the development of a rural enterprise sector that gradually creates wage opportunities to supplement environmental income.

Understanding the role of small-scale agriculture in poor households requires an appreciation of the interplay between selling crops for cash and consuming them at home.

A study of home gardens in the Bushbuckridge district in South Africa exemplifies this interplay and the substantial contribution that home gardens often have in the livelihoods of the poor. In this district, households grow an average of four to five plant species on their residential plots. Households consume nearly three-quarters of the plants that they grow and sell the rest. The total cash value of all plants sold and consumed at home per year was US$266 per household—a sizable contribution to income in an area with few employment opportunities (High and Shackleton 2000: 148, 154). *(See Table 2.3.)*

Forests

After agriculture, forests are probably the greatest generators of environmental income for the poor. Rural communities are

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BOX 2.2 BRAZIL NUTS AND PALM HEARTS: BRINGING FOREST LIVELIHOODS TO THE CITY

IT IS NOT SURPRISING THAT POOR FAMILIES IN rural forested areas would draw upon the nearby trees for income from the use or sale of nontimber forest products (NTFPs) like wild fruits, construction materials, or medicinals. But the economic value of these forest products can be captured by the urban poor as well, particularly those who have recently migrated to the city.

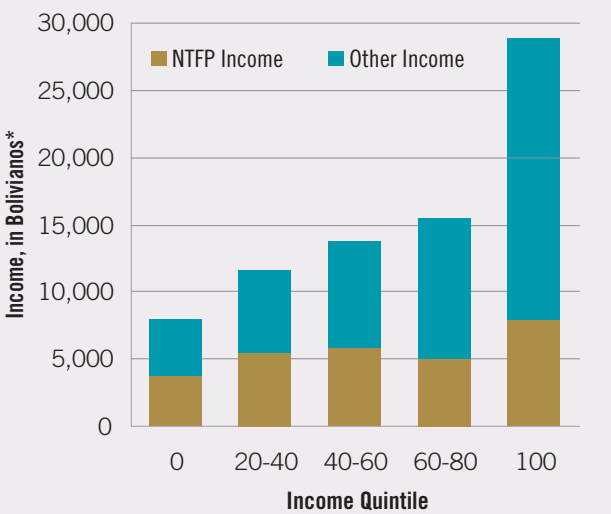
A study conducted between 1996 and 1999 in the outskirts of Riberalta, a rapidly growing city in northern Bolivia, showed that households gain a significant proportion of their income from the collection and processing of Brazil nuts and palm hearts. These peri-urban neighborhoods are peopled largely by poor families, many of them recent immigrants from rural areas. The study found that households benefited from NTFPs in two ways: some family members (men, mainly) go out to the forest for a few months each year to collect Brazil nuts and palm hearts to sell to processors; other family members (mostly women) work in the processing plants in and around Riberalta where Brazil nuts are graded, shelled, washed, and packaged.

Nearly 60 percent of the surveyed households participated in one form or another in the Brazil nut or palm heart industries (Stoian 2003:4, 11). The poorest income group was the most dependent on NTFP income, getting 47 percent of their income from it. Even the better-off families derived more than a quarter of their income from NTFPs (Stoian 2003:12).

Many recent immigrants were driven to the city in search of employment after the decline of the Bolivian rubber industry in the late 1980s. New arrivals found that their lack of education and formal training, as well as social stigmas, acted as barriers to entry into most sections of the urban labor force. For these migrants, as well as other marginalized sectors of the population, the Brazil nut industry serves as the largest employer because of its high demand for unskilled labor. For example, migrants with only primary school education or less relied on NTFPs for 60 percent of their income (Stoian 2003:10, 14, 16).

The dependence of the urban poor on forest-related income highlights the rural-urban continuum that exists in many nations, where environmental income continues to play an important role in the income profile of poor households even when these families leave the countryside (Stoian 2003:10, 14, 16).

HOUSEHOLD INCOME FROM NON-TIMBER FOREST PRODUCTS IN RIBERALTA, BOLIVIA, 1998



*At the time of the survey (1998), 1 Boliviano was equivalent to US$0.19.

Source: Stoian 2003

TABLE 2.3 THE VALUE OF HOME GARDENS TO HOUSEHOLDS IN BUSHBUCKRIDGE, SOUTH AFRICA, 1996

Crop	Cash Equivalent for Crops Consumed at Home (Rand)*	Cash Value of Crops Sold (Rand)*
Bean	57	4
Cabbage	445	46
Cassava	296	10
Cauliflower	100	0
Chili	48	13
Dintlo	124	109
Ground nut	184	41
Madanda	60	0
Maize	267	42
Onion	30	10
Pumpkin	52	0
Spinach	92	24
Sugar cane	277	217
Sweet potato	175	7
Tomato	126	0
Water melon	35	0

*Average income of households cultivating each crop

Source: High and Shackleton 2000

frequently found in or near forest areas, which vary widely in density and composition, from closed canopy rainforests to alpine coniferous forests to woody savannas. The productivity and variety of forest ecosystems, as well as their habitat value for game species, make them important contributors to the local subsistence and commercial economies.

Substantial research corroborates the importance of forests to the world's poor. In 2004 the World Bank completed a review of studies on the income that forests provide to those who live in or near them. The review examined cases from 17 countries on three continents, focusing especially on Africa. The results were striking: environmental income from forests was found to be important at every income level and on every continent, providing an average of 22 percent of total income—the equivalent of $678 per year (adjusted for purchasing power parity (PPP) worldwide)—in the households examined (Vedeld et al. 2004:28-29). (*See Table 2.4.*)

As many other studies have concluded, the Bank found that the most significant income from forests came from wild foods, fuel, fodder, and thatch grass. Timber and medicines were also found to be important to total income. Unfortunately, much of the economic value of forests to the poor is missed in the official state accounting of the forest economy (Mogaka et al. 2001:4).

Woodfuels

The poor rely overwhelmingly on woodfuels as their household energy source. In developing nations alone, some 2.4 billion people—more than a third of the world population—rely on wood or other biomass fuels for cooking and heating (IEA 2002:26). For example, nearly all rural households in Kenya, Tanzania, Mozambique, and Zambia use wood for cooking, and over 90 percent of urban households in these countries use charcoal imported from the countryside (IEA 2002:26). In India, 62 percent of rural households depend on woodfuels (Vadivelu 2004:5).

Wood used as fuel is fundamentally important in the household economies of the rural poor. It is not only a source of energy in the home, but a supplemental source of cash income through the collection, processing, and sale of firewood and charcoal. Charcoal in particular, due to its high energy content and easy portability, is an important income-producer and a sole source of employment for many. In Kenya alone, the charcoal economy is estimated at about 23 billion Kenyan shillings per year—on a par with tourism as an income generator (Kantai 2002:16).

Non-Timber Forest Products

The poor have traditionally not been able to capture much of the income generated from the harvest and sale of timber.

TABLE 2.4 ANNUAL HOUSEHOLD INCOME FROM FORESTS

Source	Average Forest Income* (US$)	Share of Forest Income (% of total)
Wild Foods	287	38.3
Fuelwood	216	31.7
Fodder	124	5.8
Timber	28	2.3
Grass/Thatch	83	5
Wild Medicine	47	3.7
Gold Panning	6	0.2
Others	129	13
Total	**678****	**100**

* Average amount of environmental income based on 54 empirical studies, reported in Purchasing Power Parity (PPP) dollars.
**Average total forest income is less than the sum of all sources because many studies do not measure income from every source.

Source: Vedeld et al. 2004

Because of its high value, more powerful interests—in private commerce and in the state bureaucracy—have generally dominated this resource. For the poor to reap greater benefits from timber production, forest ownership and governance regimes would have to change substantially.

TABLE 2.5 USES OF SELECTED NON-TIMBER FOREST PRODUCTS (NTFPS)

Product	Primary Use	Location
Ant Larvae	Bird food	Banten, Indonesia
Bamboo (Moso)	Bamboo mats and handicrafts	Zhejiang, China
Bark (Cape Onionwood)	Medicine	Eastern Cape, South Africa
Resin (Benzoin)	Incense	North Sumatra, Indonesia
Brazil Nuts	Food	Vaca Díez and Iturralde, Bolivia
Cardamom	Food, medicine	Bac Kan, Vietnam
Woody Vine (Cat's Claw)	Medicine	Puerto Inca, Peru
Fruit (Allspice)	Spice	Puebla, Mexico
Garcinia Fruit	Medicine	Karnataka, India
Hearts of Palm	Food	São Paulo, Brazil
Marula Trees	Fruit, beer, livestock feed, medicine, woodcarvings	Bushbuckridge district, South Africa
Mulberry Bark	Paper	Sayaboury and Luang Prabang, Laos
Pine Resin	Turpentine	Pinar del Río, Cuba
Rattan (African Rattan Palm)	Rattan furniture	Central Cameroon
Rattan (Calamus)	Rattan handicrafts and mats	East Kalimantan, Indonesia
Roots (Fáfia)	Medicine	Paraná, Brazil
Rubber	Rubber handicrafts	Acre, Brazil
Sandalwood	Essential oils for perfume	East Nusa Tenggara, Indonesia
Tendu Leaves	Cigarette wrappers	Madya Pradesh, India
Wood (Silver Oak)	Woodcarvings	Coastal Kenya
Wood (Parasol Tree)	Woodcarvings	Mpigi, Uganda

Source: Ruiz-Pérez et al. 2004; Shackleton et al. 2000b

But forests produce many other goods and services—collectively known as "nontimber forest products (NTFPs)—that are critical income sources for the poor. Typical NTFPs include various foods, fodder, fuel, medicines, and many other collectibles—literally every product derived from a forest besides timber (Wickens 1991:4). *(See Table 2.5.)* The variety can be staggering. Forest dwellers in the Brazilian Amazon, for example, regularly sell some 220 NTFPs at Belem's daily open market—140 of which are wild products, and the rest cultivated in the forest (Shanley et al. 2002, in Molnar et al. 2004:35). If harvested correctly, NTFPs can make not only a substantial, but a sustainable, contribution towards livelihoods. In addition to their market value, many NTFPs have social, cultural, or religious significance as well.

The use of NTFPs is quite varied, and it is well documented that they provide a wide range of subsistence and cash income to a large number of households in many nations (Neumann and Hirsch 2000:53-55). On Mexico's Yucatan peninsula, for example, the market value of palm thatch used or sold as roofing material is estimated at US$137 million per year (Bye 1993, in Molnar et al. 2004:35). In India, NTFP production contributes about 40 percent of total official forest revenues and 55 percent of forest-based employment. (Tewari and Campbell 1996:26). In Botswana, the government recently admitted the value of NTFPs exceeds that of timber (Taylor 1996:76-77).

As impressive as these national-scale estimates are, they tend to understate the importance of NTFPs to households. Since the values of NTFPs are generally difficult to calculate, they are often underestimated (Lampietti and Dixon:1995:1-2). This undervaluation causes decision-makers to assign a lower priority to intact forest ecosystems as an economic asset than they should.

Fisheries and Reefs

For those living near the coast, or near inland water bodies, fisheries are nearly always an important aspect of household income. Like forests, fisheries are generally accessible, in some form, by people of all income levels, making them a last refuge for many poor households. An estimated 250 million people in developing countries are directly dependent on small-scale fisheries for food and income. In Thailand, for example, 90 percent of the nation's fishers are still small-scale operators (World Bank 2004:17).

SMALL-SCALE FISHERIES IN RURAL THAILAND

The average small-scale fisher in rural coastal Thailand earns probably half of the income of the average Thai citizen. He is from one of the almost 50,000 households in Thailand fishing with a vessel that weighs less than 10 tons. He lives in one of the 2,500 rural fishing villages around the country, 80 percent of which are located beyond municipalities, without basic infrastructure such as roads and electricity (World Bank 2004:17).

The small-scale fishing that the poor do differs markedly from the industrial fishing of factory trawlers and long-line fishers. Small-scale fishing is usually a low-capital operation with owner-operated vessels, such as those using cast nets and small traps. Many times it is carried out from small non-mechanized canoes or rafts, or from small motorized boats and dinghies crewed by one or a few people. But sometimes it is done from the shore without even the use of a boat. In Indonesia, for example, half of the nation's 2 million ocean fishers use unmotorized canoes; another 25 percent use small boats with outboard engines; 80 percent live below the national poverty line (FAO 2000a:2-3).

Marine fisheries often contribute enormously to the livelihoods of the coastal poor. In coastal communities studied in Mozambique, fishing contributes 34-38 percent of cash income, with additional environmental income coming from the sale of mollusks, seaweed, and sea cucumbers (Wilson et al. 2003:96). Likewise, families in coastal Tanzania supplement subsistence agriculture and forestry with fishing, seaweed and shrimp farming, and salt production (Bayer 2003:1). Households living in coastal villages along Korangi Creek in Pakistan rely on mangroves as their primary source of woodfuel and animal fodder, and rely on the mangrove fisheries for both wage labor and food (Khalil 1999:9-10). For families too poor to own boats in Indiranagar, India, labor on the fishing boats of others provides a crucial source of income (Rengasamy et al. 2003:128).

Inland fisheries—in lakes, rivers, streams, rice paddies, and fish ponds—are just as important a resource for the poor as marine fisheries. In the Lower Mekong River basin, for example, a recent study found that 40 million rural farmers—many of them poor—engage in seasonal fishing activities. In Laos, where the incidence of rural poverty is quite high, 70 percent of all farm households augment their family food supplies and incomes with fish (Sverdrup-Jensen 2002:8).

These statistics make it clear that fisheries are a key—and often overlooked—aspect of food security for the poor. In East Asia and in Africa, fish provide more than 50 percent of the animal protein intake in the diet of 400 million people (World Bank 2004:18). In Liberia, Ghana, and Cambodia, fish and fish products constitute 65 to 70 percent of animal protein consumed (FAO and UK DFID 2002:20, 21; UK DFID 2000:18).

In areas of the world that support coral reefs, these systems also provide a crucial portion of people's livelihood. *(See Table 2.6.)* Reefs provide fish for daily consumption, shells and corals for use in house construction and for sale to tourists, and a variety of marine species for medicinal purposes (Rengasamy et al. 2003:130-133). Rural households in the Fiji Islands—a third of which are poor—routinely subsist on fish and shellfish such as *kaikoso* clams they catch themselves on

SMALL-SCALE CORAL REEF FISHERIES IN THE PHILIPPINES

Philippine coral reefs provide daily livelihoods for thousands of low-income fishers, but in recent years overexploitation and destructive fishing practices like the use of dynamite and cyanide have lowered reef productivity. A survey of 700 fishers conducted in 2000 in the Philippines revealed that 89 percent have to feed their families from their daily catch; 74 percent identified having enough to eat each day as their most pressing concern; and 67 percent said the decreasing fish catch was the most pressing problem in their community.

TABLE 2.6 NATURE-BASED LIVELIHOOD STRATEGIES BY INCOME LEVEL ON AGATTTI ISLAND, INDIA

	Poor	Lower Middle Class	Upper Middle Class	Rich
Annual Income	Below Rs 15,000 (<US$319)	Rs 15,000–60,000 (US$319–1,276)	Rs 60,001–250,000 (US$1,277–5,319)	Above Rs 250,000 (>US$5,319)
% of Population	10%	50%	39%	1%
Reef Use	Subsistence and survival	Supplementary income or subsistence during monsoon	Collecting bait fish, octopus, etc.	Pay others to collect building materials and fish
Selected Assets	No land or coconut trees	Few trees	Land, coconut trees	Land, coconut trees
	No livestock	Goats, chickens	Goats, chickens	Goats, chickens, calves
	Cast net	Small wooden boat *(thoni)* with outboard engine Fishing rod and various nets	Boat with outboard engine	Cargo vessel *(manju)*

Source: Hoon 2003

local beaches, reefs, and other inshore waters, and sell the remainder for cash. *(See Chapter 5 for a complete case study of Fiji's fisheries.)* In the Caribbean and parts of South East Asia, coral reefs play an important role in a growing ecotourism market, bringing money and jobs into these regions. The combined benefits of dive tourism, fisheries, and shoreline protection provided by reefs bring an estimated net value of US$3.1-3.6 billion to the Caribbean region every year (Burke and Maidens 2004:58).

Many fisheries—particularly marine fisheries—are dominated by large-scale fishing operations, and conflicts between local small-scale fishers and commercial operations are common. Often, poor communities operate at the margins, fishing what large-scale operators leave behind (Kura et al. 2004:87-88). In Chad's Chari delta and along the western shore of Lake Chad (Nigeria), a comparative analysis found that the poor have access only to marginalized fishing grounds, while the more well-to-do have access to all water bodies (Béné 2003:960). Even where the poor do have access, they often lose out to richer fishers when competing directly, due to inferior equipment.

The Role of Livestock

Livestock are an important and sometimes overlooked element of the livelihood strategies of the poor. As much as 70 percent of the rural poor depend on livestock to some degree. Livestock holdings are diverse and include cattle, goats, sheep, pigs, poultry, horses, camels, yaks, and llamas. An estimated 600 million poor people, including 150 million landless poor, own livestock (Delgado et al. 1999; IFAD et al. 2004:9,10; Thornton et al. 2002).

Livestock are a crucial source of financial capital for the rural poor. For many, livestock ownership is the only form of savings available. In fact, for pastoralists and often for poor women, livestock are the most important fungible asset they own. Livestock provide a critical reserve against emergencies and decrease vulnerability to financial shocks from ill health, crop failures, and other risks. They yield direct benefits in the form of food, wool, or hides, and can raise farm productivity by providing manure and draught power (PPLPI 2003:1). In a comparative study of poor livestock keepers in Bolivia, India, and Kenya, households in all three countries ranked livestock above business and housing as their best investment (Heffernan et al. 2002 in IFAD et al. 2004:14).

In 40 percent of Kenya's districts, livestock represent more than a quarter of total household income (Thornton et al. 2002:75). In rural Nepal, they contribute 9-14 percent of production for home consumption, and are even more important as a source of cash income. For Nepal's isolated mountain communities, livestock are among the few items exchanged for cash, constituting nearly half of total farm cash income (Maltsoglou and Taniguchi 2004:24-25). Studies have found that livestock generally contribute significantly more to the income stream of poor households—particularly the income controlled by women—than to the incomes of those living above the poverty line (Thornton et al. 2002:75; Heffernan 2001:60; Delgado et al. 1999).

The benefits from livestock can even extend to those who don't own livestock—often the poorest members of the community. Non-owners are sometimes able to obtain milk, dung for fuel, or help with ploughing of fields. These may be given free of charge from livestock owners, or at greatly reduced prices (Shackleton et al. 2000b:53; Shackleton 2005).

Perhaps not surprisingly, livestock figure prominently in the movement of households into and out of poverty. In a study of household poverty dynamics in 20 communities in Kenya, researchers found that more than 40 percent of families that escaped poverty did so by diversifying their farm income, primarily by acquiring livestock (Kristjanson et al. 2004:12).

When the poor have access to markets, livestock can serve as a source of collateral, giving households access to other forms of capital and opening pathways for further income diversification (IFAD et al. 2004:3).

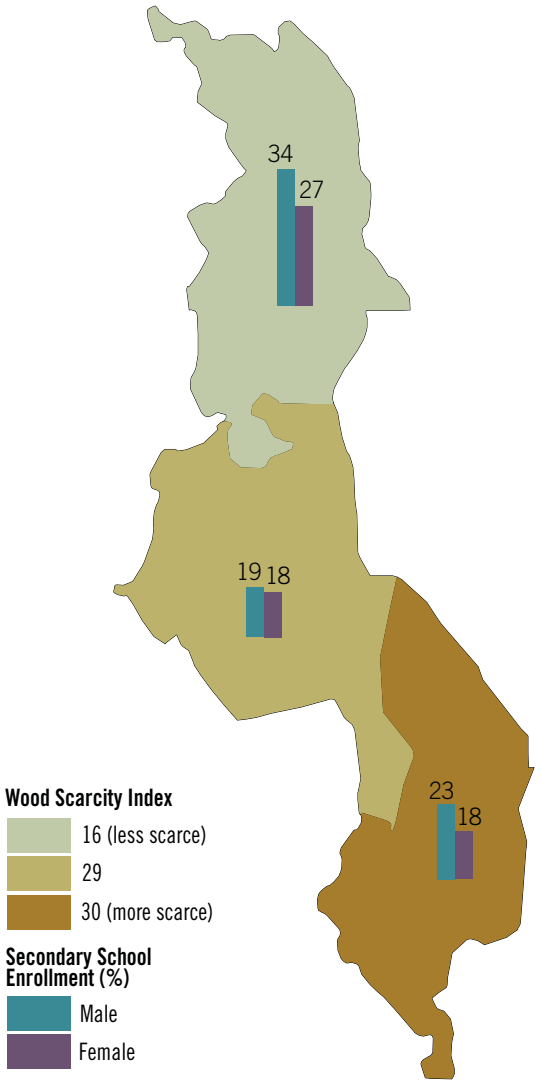
The role of livestock in rural communities extends significantly beyond their economic value. Most notably, livestock play a prominent role in social and cultural relationships. Loans and gifts of livestock contribute to family and community ties and often play a central role in cultural traditions such as weddings and funerals. Owning livestock can also bring better nutrition to some of the most vulnerable groups, including women and children (IFAD et al. 2004:19-20).

Despite the benefits, livestock rearing is also risky for the poor. Production risks—from harsh weather to predators to lack of proper veterinary care—are greater among low-income producers (IFAD et al. 2004:14). Loss of livestock holdings can have a long-term impact on a family far beyond the value of the individual animals, because herds generally take such a long time to build up. Catastrophic losses from natural disasters or having livestock stolen can therefore have a devastating effect on family finances. Even intentional loss, such as use of livestock for funeral feasts, can be hard on the poor. In western Kenya, slaughter of livestock for funerals has been identified as a major cause of falling into poverty (Kristjanson et al. 2004:iv).

The Social Benefits of Ecosystems

Deriving income from the environment is clearly a powerful tool for improving the lives and livelihoods of individual families, but it can also bring significant societal benefits by making the distribution of wealth in a community more equal. If environmental income is not counted, the income distribution in rural communities is often significantly skewed, with a large gap between rich and poor. However, if environmental income is included in the income profile, the gap between rich and poor shrinks somewhat (Vedeld et al. 2004:36-38; Jodha

FIGURE 2.6 WOOD FUEL SCARCITY AND SCHOOL ATTENDANCE IN MALAWI, 1998



Time spent collecting woodfuel is one factor that limits the social and educational development of children—particularly girls—in impoverished areas.

Source: Nankhuni and Findeis 2003

1986:1177). This supports the contention that ecosystem goods and services act as community assets, whose benefits reach beyond the individual household level. By providing an income source to those without other assets, ecosystems moderate and buffer the rural economy and increase economic equity. This provides another rationale for sound management of local ecosystems.

The use of natural resources and especially their degradation also has other implications for households and for communities. Rural communities are often bound together by shared professions based on nature—fisher, pastoralist, or farmer—or their use of a specific set of forest resources. In other words, natural resources are often a binding element of communities. Community-based resource management can increase this bond, fostering community cohesion and strengthening the social safety net for poor community members.

Conversely, degradation of resources can harm communities and poor households by increasing the effort and time required to meet basic needs. Deforestation and scarce or polluted water supplies can increase the amount of time required to collect adequate fuelwood and water for daily use. Since women are usually charged with providing wood and water, longer collection times usually translate to less time to prepare food, care for young children, and help with agricultural activities. In low-income households, this can translate into poorer nutritional status and can harm the general household welfare (Kumar and Hotchkiss 1988:55-56).

Often, a portion of the collecting burden falls on the children in a household. Greater collection times can reduce the chances that children, especially girls, will remain in school. In Malawi, where more than 90 percent of households use firewood as their main source of energy, children in fuelwood-scarce districts are 10 to 15 percent less likely to attend secondary school (Nankhuni and Findeis 2003:9). *(See Figure 2.6.)* A study in Nepal found that educational attainment of girls in poor households dropped as fodder and water availability decreased, suggesting that the additional labor fell to school-age girls in the household (Cooke 1998:19). On the other hand, restoration of traditional forest enclosures in the Shinyanga region of Tanzania has dramatically increased forest cover in the district and reduced collection times for fuelwood by several hours per day, on average—a direct benefit to poor families. *(See Chapter 5 case study, Regenerating Woodlands in Tanzania: The HASHI Project.)*

These social and community benefits of nature point to how intact ecosystems can support many non-income aspects of rural livelihoods, adding weight to the argument that better ecosystem management is a crucial element of rural poverty reduction.

Building on the Strength of Ecosystems

As this chapter demonstrates, environmental income is critical to the survival of the poor within the typical rural economy in developing countries. On average, income from small-scale agriculture and the collection of wild products such as nontimber forest products together account for some two-thirds of the household incomes of families in poverty. Without income from ecosystem goods and services, rural poverty would unquestionably be deeper and more widespread—a lesson to remember as the pace of ecosystem degradation picks up worldwide.

But as important as environmental income is to the poor today, it is typically not used as a route out of poverty. Usually, the poor use environmental income more as a support for current levels of consumption or as a safety net to keep from

falling further into poverty. They generally do not have the means or empowerment to use environmental income as a tool for true wealth creation. As Chapter 3 will show, behind this failure to capitalize on the potential of ecosystems for income is an array of governance failures. The challenge is to alter this state of affairs, increasing the access of the poor to local ecosystem potential and their capacity for managing this potential sustainably and profitably, with viable models for turning nature's productivity into income.

Essential to meeting this challenge is realizing that environmental income is not separate from but part and parcel of today's rural economies. It is intimately tied to other forms of income, such as wage labor and self-employment income. It is tied also to the urban economy through remittances as well as the inevitable reliance of cities on the environmental output of ecosystems. Helping the poor to increase their environmental income, then, must be seen as supporting rural economic growth more generally. It both widens and secures the range of income options available, and can support a transition to higher-paying employment that carries the poor beyond the subsistence level.