WORLD RESOURCES 2005

ECOSYSTEMS ARE—OR CAN BE—THE WEALTH OF THE POOR. For many of the 1.1 billion people living in severe poverty, nature is a daily lifeline—an asset for those with few other material means. This is especially true for the rural poor, who comprise three-quarters of all poor households worldwide. Harvests from forests, fisheries, and farm fields are a primary source of rural income, and a fall-back when other sources of employment falter. But programs to reduce poverty often fail to account for the important link between environment and the livelihoods of the rural poor. As a consequence, the full potential of ecosystems as a wealth-creating asset for the poor—not just a survival mechanism—has yet to be effectively tapped.

The thesis of *World Resources 2005* is that income from ecosystems—what we call environmental income—can act as a fundamental stepping stone in the economic empowerment of the rural poor. This requires that the poor manage ecosystems so that they support stable productivity over time. Productive ecosystems are the basis of a sustainable income stream from nature.

But for the poor to tap that income, they must be able to reap the benefits of their good stewardship. Unfortunately, the poor are rarely in such a position of power over natural resources. An array of governance failures typically intervene: lack of legal ownership and access to ecosystems, political marginalization, and exclusion from the decisions that affect how these ecosystems are managed. Without addressing these failures, there is little chance of using the economic potential of ecosystems to reduce rural poverty.

World Resources 2005 details the steps necessary to empower the poor to use ecosystems both wisely and for wealth. Using examples and case studies, the report traces a route to greater environmental income. Working at the cutting edge of sustainable development, it lays out the governance changes necessary to give the poor the legal, financial, and management capacity to use nature for wealth creation without depleting their fragile resource base.

Eleventh in the World Resources series, *World Resources 2005* also presents a wealth of statistics on current environmental, social, and economic trends in more than 150 countries. It makes the full World Resources database accessible and searchable online in the companion website Earth Trends, at **http://earthtrends.wri.org**.

To order, please visit the WRI web site at http://www.wristore.com.

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WORLD RESOURCES 2005 The Wealth of the Poor

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The Wealth of the Poor

Managing Ecosystems to Fight Poverty

UNDP

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World leaders have pledged to achieve the Millennium Development Goals, including the overarching goal of cutting poverty in half by 2015 and doing so with full commitment to environmental sustainability. UNDP's network links and coordinates global and national efforts to reach these Goals.

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- Investing in people, particularly through basic health and education
- Protecting the environment
- Supporting and encouraging private business development
- Strengthening the ability of the governments to deliver quality services, efficiently and transparently
- Promoting reforms to create a stable macroeconomic environment, conducive to investment and long-term planning
- Focusing on social development, inclusion, governance, and institution building as key elements of poverty reduction.

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WORLD RESOURCES INSTITUTE

The World Resources Institute goes beyond research to create practical ways to protect the Earth and improve people's lives. Its mission is to move human society to live in ways that protect Earth's environment and its capacity to provide for the needs and aspirations of current and future generations.

For more than 20 years, WRI has demonstrated its commitment to helping find solutions to these enormous global environmental challenges. WRI's work is concentrated on making progress toward four goals:

- Healthy Ecosystems: Reverse rapid degradation of ecosystems and assure their capacity to provide humans with needed goods and services.
- Stable Climate: Protect the global climate system from further harm due to emissions of greenhouse gases and help humanity and the natural world adapt to unavoidable climate change.
- Sustainable Enterprise: Harness markets and enterprise to expand economic opportunity and protect the environment.
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WORLD RESOURCES 2005

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WORLD RESOURCES 2005

CONTENTS

MAKING THE WEALTH OF NATURE WORK FOR THE POOR

PROFOUND POVERTY IS A FUNDAMENTAL OBSTACLE TO THE dreams and aspirations of people in every nation. Even after five decades of effort to support development and growth, the dimensions of poverty still stagger us. Almost half the world's population lives on less than $2 per day; more than a billion live on $1 or less. Poverty at this scale ripples beyond the boundaries of any particular country or region and affects the well-being of us all.

The publication of *World Resources 2005* comes at a particularly critical time. Economies in many developing countries have been growing at a rapid pace for several years. That growth has made us aware of two stark realities: in the largest of those countries it has lifted millions out of extreme poverty; but the price these nations are paying in accelerated degradation of their natural resources is alarming.

At the same time, there have been a number of key events this year, 2005, that provide a clearer focus on the future. At the G-8 Summit in Scotland, attention to the problems of global poverty, especially in Africa, was unusual for its single-mindedness and for the acknowledgment of poverty's far-reaching consequences.

In the spring of this year, the Millennium Ecosystem Assessment (MA), an international appraisal of the health of the world's ecosystems, published the first of its series of reports after five years of intensive study. The MA findings sound an alarm bell for the future, but they also contain within them a framework to address the challenges we have created for ourselves.

The MA has shown beyond any question the degradation we have caused to the ecosystems of the earth. At the same time, the MA has demonstrated unequivocally that we can better manage these assets, and, by so doing, secure their benefits for the future.

World Resources 2005 is about simple propositions:

- Economic growth is the only realistic means to lift the poor out of extreme poverty in the developing world; but the capacity of the poor to participate in economic growth must be enhanced if they are to share in its benefits.

- The building blocks of a pro-poor growth strategy begin with natural resources. These provide the base upon which the vast majority of the poor now depend for their fragile existence, but over which they exercise little control, and therefore can't exercise full stewardship.

- The role of governance—transparent and accountable governance—is critical to fostering pro-poor growth and essential to ensuring that the engine of that growth, natural resource wealth, is managed wisely.

There are some things we know for sure. We know that the great majority of the world's poor are concentrated in rural areas. They depend on fields, forests, and waters—the bounty of ecosystems—for their livelihood. These ecosystems provide a natural asset base that the rural poor can use to begin a process of wealth creation that will boost them beyond subsistence and into the mainstream of national economies—but only under the right circumstances.

If the natural resource base is not managed for the long term, if it is exploited and polluted for short-term gain, it will never provide the fuel for economic development on the scale demanded to relieve poverty.

And that is what is happening today, as the Millennium Ecosystem Assessment has dramatically shown. If the ecosystems of the world represent the natural capital stock of the planet, we have drawn down that account at an alarming pace in the past decades. Over the last 50 years, we have changed ecosystems more rapidly than at any time in human history, largely to meet growing demands for food, freshwater, timber, and fiber.

The changes have not been without benefit. The resulting increase in food, fiber, and other services has contributed to improved human well-being. However, the gains are unevenly distributed, and the poor have more often borne the associated costs.

As populations and economies grow, the pressures on ecosystems will inexorably increase. Yet thanks to the MA, we finally understand, in terms even the most hard-bitten economist or banker can appreciate, the economic value of our natural capital account. And like the banker or economist, we now understand that we must manage that capital account—a trust fund, if you will—so that it not only provides for our needs today but also for the needs of future generations.

This volume documents that such stewardship of nature is also an effective means to fight poverty. When poor households improve their management of local ecosystems—whether pastures, forests, or fishing grounds—the productivity of these systems rises. When this is combined with greater control over these natural assets, through stronger ownership rights, and greater inclusion in local institutions, the poor can capture the rise in productivity as increased income. With greater income from the environment—what we refer to as *environmental income*—poor families experience better nutrition and health and begin to accumulate assets. In other words, they begin the journey out of poverty.

For some time now we have known that economic growth, growth that expands the availability of opportunities, is necessary to any permanent effort to alleviate poverty. But the quality of that growth is crucial if its economic benefits are truly to extend to the poor. Pro-poor growth based on the sustainable use of natural resource capital requires a fundamental change in governance. *World Resources 2002-2004* demonstrated that the wisest and most equitable decisions about the use of natural resources are made openly and transparently. Those most affected by such decisions must have full access to information and the ability to participate.

Change in governance must necessarily include reforms that give the poorest a real stake in their future. The issues of land tenure, of responsibility for resources held in common, of control, and of accountability must be addressed in a way that acknowledges and catalyzes the role of individual and community self-interest in managing natural resources as a long-term asset.

Included in these reforms must be a clear mandate to end corruption, which particularly oppresses the poor. The graft of government officials, the inside deals of vested interests, and the exploitation of natural resources for the immediate gain of a few creates an environment where the resource rights of the poor are violated and pro-poor growth cannot flourish.

The growth of free and uncorrupt institutions in developing countries provides the catalyst that will help us solve these two inextricably linked challenges: the eradication of extreme

poverty and the management of our natural capital to provide for future needs.

Access to the natural capital to create wealth, control and responsibility for that capital, information and basic technology to make that control useful and productive, and the ability to reach markets that bring the poor into the global economy are the tools at hand. The pay-off for countries that take up these tools is the prospect of a far better future than what they face today, and a social stability based on choice, access, and economic opportunity.

Achieving these goals will not come without a price for the developed world, but it is one developed countries should be eager to pay, given the return. Aid programs will have to become more targeted and accountable. Free trade will have to mean just that. Tariffs, import quotas, and crop subsidies will have to be modified, minimized, or eliminated so that the promise of a better life that starts on a farm in central Africa is not dashed on the docks of Europe, Japan, or the United States.

Consider the consequences of inaction or misguided action: continued poverty. The unchecked ravages of preventable diseases. Lost generations whose talent and promise are denied to us. Depletion of resources vital to our future. And the social corrosion born of inequality and political instability that national boundaries can no longer contain.

Much of what we call for in this latest Report is captured in the Millennium Development Goals, adopted by the United Nations in 2000, and committed to by the wealthiest nations of the world. *World Resources 2005* shows us how important pro-poor management of ecosystems is to attaining these goals

What *World Resources 2005* argues eloquently and unequivocally is that the path forward is clearer now than at any time. The Report presents a wealth of examples to adopt and replicate, demonstrating how nations can support a bottom-up approach to rural growth that begins naturally with the assets that the poor already possess. We know so much more than we did at Rio in 1992. We know the folly of extending aid without the tools to make use of it, of granting debt relief without improved governance, of stimulating production without access to markets. And we know the promise of ecosystems for poverty reduction. Delivering on that promise can allow the bounty of nature to become the wealth of the poor. At no time has so much been at stake, and at no time are we better able to respond.

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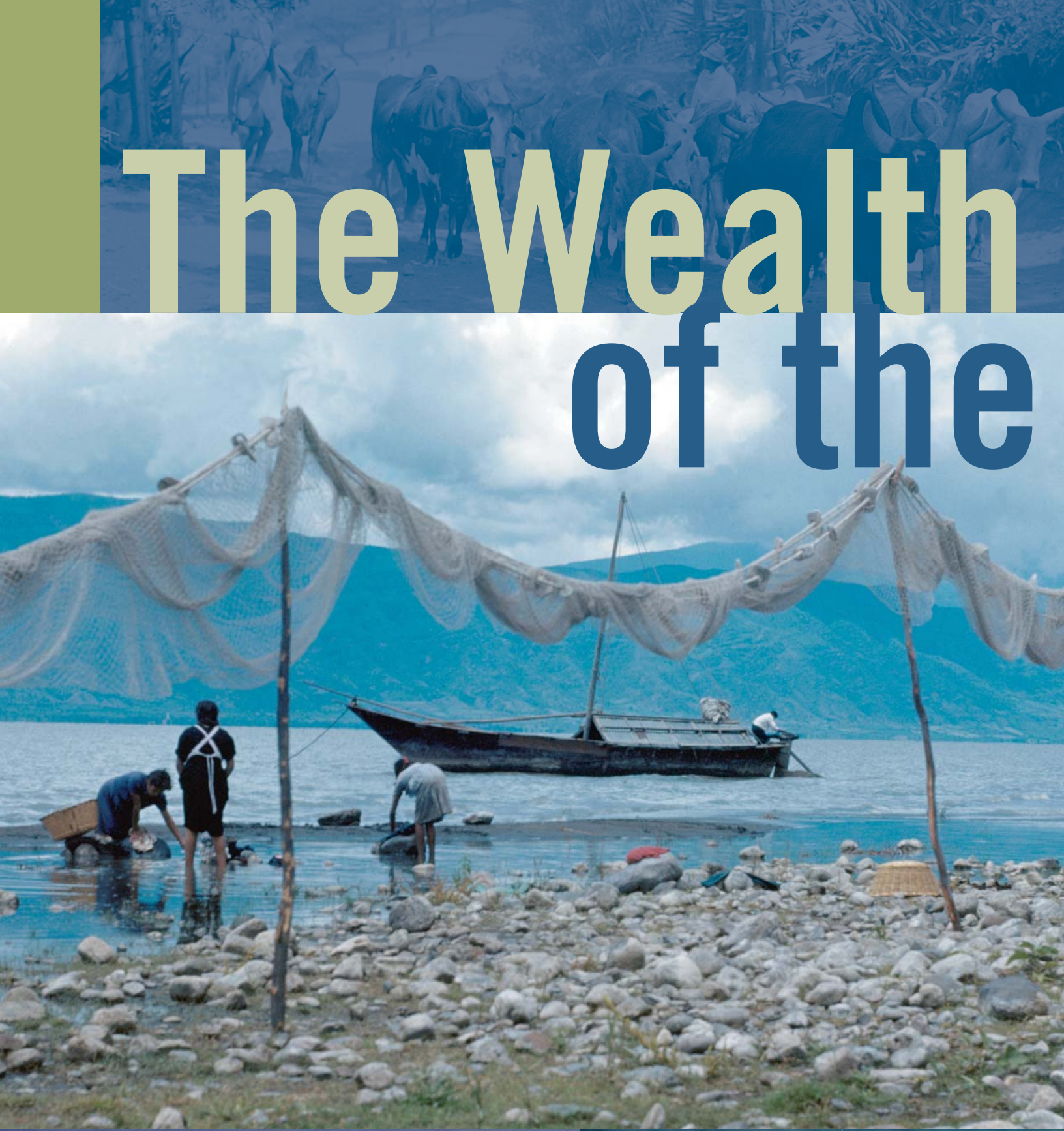
The Wealth of the



PART I

Poor

For many of the 1.2 billion people living in severe poverty, nature has always been a daily lifeline—an asset for those with few other material assets.

CHAPTER 1

NATURE, POWER, AND POVERTY

ECOSYSTEMS ARE—OR CAN BE—THE WEALTH OF THE POOR. For many of the 1.1 billion people living in severe poverty, nature is a daily lifeline—an asset for those with few other material means. This is especially true for the rural poor, who comprise three-quarters of all poor households worldwide. Harvests from forests, fisheries, and farm fields are a primary source of rural income, and a fall-back when other sources of employment falter. But programs to reduce poverty often fail to account for the important link between environment and the livelihoods of the rural poor. As a consequence, the full potential of ecosystems as a wealth-creating asset for the poor—not just a survival mechanism—has yet to be effectively tapped.

The thesis of *World Resources 2005* is that income from ecosystems—what we call *environmental income*—can act as a fundamental stepping stone in the economic empowerment of the rural poor. This requires that the poor manage ecosystems so that they support stable productivity over time. Productive ecosystems are the basis of a sustainable income stream from nature.

But for the poor to tap that income, they must be able to reap the benefits of their good stewardship. Unfortunately, the poor are rarely in such a position of power over natural resources. An array of governance failures typically intervene: lack of legal ownership and access to ecosystems, political marginalization, and exclusion from the decisions that affect how these ecosystems are managed. Without addressing these failures, there is little chance of using the economic potential of ecosystems to reduce rural poverty.

Making governance more friendly to the poor means tackling issues of property rights, access to information and decision-making, adequate representation, institutional transparency, and fairness in sharing the costs and benefits of resource management. These are all aspects of *democratic governance*—decision-making that respects the rights and needs of those who depend on resources. For the poor, democratic governance is the door to equity and one of the building blocks of sustainability.

This fusion of ecosystem management and good governance is also necessary to achieve the Millennium Development Goals, the set of eight goals adopted by the international community in 2000 to address world poverty. As the foundation of rural livelihoods, ecosystems are central to real progress toward the health, nutrition, sanitation, and environmental targets embedded in the Millennium Development Goals. Indeed, without empowering the poor to responsibly manage their environment for economic gain, we cannot effectively attend to rural poverty in its many dimensions. *(See Box 1.1.)*

The goal of this report is to highlight the vital role of ecosystems and their governance—of nature and power—in poverty reduction. The report's central question is: Who controls ecosystems, and how can this control be reconfigured to allow the poor to use their natural assets as sustainable sources of wealth creation, vehicles of political empowerment, and avenues of integration into the national and global economies?

Linking Ecosystems, Governance, and Poverty

Ecosystem management, democratic governance, and poverty reduction are each essential elements of sustainable economic growth. Moreover, these elements are inextricably linked. More than 1.3 billion people depend on fisheries, forests, and agriculture for employment—close to half of all jobs worldwide (FAO 2004:169-174). This dependence of livelihoods on natural systems is nowhere more important than among the rural poor (MA 2005:7, 48). *(See Table 1.1.)* In Africa, more than seven in ten poor people live in rural regions, with most engaged in resource-dependent activities, such as small-scale farming, livestock production, fishing, hunting, artisanal mining, and logging (IFAD 2001:15). This small-scale production accounts for a significant percentage of the GDP of many African nations (Kura et al. 2004:36-39; IFPRI 2004:2).

Making wise choices about the use of natural resources and the distribution of environmental benefits and costs is central to maximizing the contribution that a nation's resource endowment makes to social and economic development. Many of the poorest regions of the world are, however, also the least democratic. That means much of their resource wealth is typically diverted from the public good through corruption, mismanagement, and political patronage. It is no coincidence that fundamental democratic principles such as transparency, public participation, accountability, and the separation of legislative, judicial, and executive powers are often absent in developing countries where poverty is greatest.

Many people in developing countries are thus not only poor, they are voiceless. Dependent directly on natural resources, they have little say in how those resources are used, but suffer the consequences when the decisions are corrupt and the use is destructive. For example, rural peoples' livelihoods are often in direct conflict with extractive industries such as large-scale fishing, logging, or mining, but they have little say in resolving that conflict. Access to decision-makers—government bureaucrats, lawmakers, or the courts—is typically for the powerful, not the poor.

Rectifying this imbalance means supporting democratic practices. History shows, however, that efforts to promote democratic principles in a vacuum rarely succeed. To take root, they must engage citizens, and they must deliver on matters that are immediate and important to citizens. As the source of livelihoods, the environment is arguably the most

DEFINING ECOSYSTEMS AND GOVERNANCE

An ecosystem is a community of interacting organisms and the physical environment they live in. We know ecosystems as the forests, grasslands, wetlands, deserts, coral reefs, rivers, estuaries, and other living environments that surround us. They also include the farms, pastures, and rangelands—collectively known as agroecosystems—that feed us. They are the earth's living engines of production, providing the goods and services—air, food, fiber, water, aesthetics, and spiritual values—that make life possible for rich and poor alike.

In *World Resources 2000-2001: People and Ecosystems—The Fraying Web of Life,* we explored the threats to global ecosystems and stressed the need to adopt an "ecosystem approach" to environmental management. *View the report online at http://www.wri.org*

Governance is the exercise of authority—the decisions, regulations, and enforcement that determine how we will act and who will benefit. It encompasses the laws, institutions (such as government agencies or village councils), and decision-making processes that embody this authority. **Democratic governance** implies the participation of those who are governed in the decision-making process—either directly, through representatives, or both.

In *World Resources 2002-2004: Decisions for the Earth—Balance, Voice, and Power,* we showed how the conditions and quality of governance influence our environmental decisions, and stressed that good governance that ensures adequate representation, access to information, and public participation is crucial to the sustainable and equitable management of ecosystems. *View the report online at http://www.wri.org*

In *World Resources 2005,* we argue that prudent ecosystem management, enabled by pro-poor governance, can reduce poverty. Without attention to poverty, the goal of sustainable development recedes beyond reach.

important issue that democracy must deliver on in the developing world. Put differently, the environment is not only a powerful tool for promoting democratic reform, but good environmental governance is fundamental to strengthening and consolidating democracy. Democratic institutions, in turn, are an important factor supporting strong economic growth (Kaufmann et al. 1999:18).

This emphasis on good governance and environment is particularly relevant when addressing poverty. The case studies in this report and the experiences of an increasing number of villages and communities in many nations suggest that efforts to promote sustainable livelihoods among the poor are more successful when they simultaneously promote ecosystem stewardship and democratic governance. For that reason, a number of development agencies and nongovernmental organizations (NGOs) are beginning to focus on this integration of environment and governance.

In spite of increasing interest in this integration, its application to the alleviation of poverty is still new. Success will demand a new openness to go beyond traditional economic development strategies, or at least to add a more deliberate recognition of the linkages among nature, power, and poverty.

The Persistence of Poverty

The persistence of global poverty is both disturbing and humbling. Policymakers have long recognized the moral and practical need to address the substantial number of people who lack basic amenities such as adequate nutrition, housing, education, or opportunity. But decades of piecemeal efforts have brought only limited success. *(See Box 1.1.)*

More than a half century of persistent efforts by the World Bank and others have not altered the stubborn reality of rural poverty, and the gap between rich and poor is widening.

—World Bank Strategy for Rural Development, 2003

Ending world poverty first become a stated goal of politicians from industrialized countries in the 1940s, when U.S. President Franklin Roosevelt stated his desire to extend "freedom from want" not only to the people of the United States, but to people in every nation (Roosevelt 1941). The United Nations Charter, crafted in the same era, explicitly acknowledged the need to promote "social progress and better standards of life" across the globe (UN 1945). Almost 60 years later, at the United Nations Millennium Summit in 2000, more than 100 heads of state committed to reach the eight Millennium Development Goals (UN General Assembly 2001:55).

These commitments confirm the simple fact that poverty remains an obstacle to the development aspirations of most

Continues on page 10

BOX 1.1 THE DIMENSIONS OF POVERTY

What is Poverty?

DEFINING AND MEASURING POVERTY ARE essential to any discussion of poverty reduction. Definitions of poverty have traditionally focused only on material—and specifically monetary—measures of well-being. But key concepts behind poverty have evolved considerably in recent years. Today, a more holistic, multi-dimensional perception of poverty has emerged, drawn from interviews with the poor themselves. Definitions of poverty have expanded to include the social and psychological burdens of daily survival on the bottom rungs of society. This broader conception is described by Amartya Sen as a lack of capabilities that enable a person to live a life he or she values, encompassing such domains as income, health, education, empowerment, and human rights (Sen 1999:87-98).

As researchers and policymakers struggle to understand these complexities, they have begun to use "participatory assessments" to let the poor speak in their own voice and identify their own priorities. The authors of the *Voices of the Poor* series interviewed 60,000 poor people in 60 countries in one of the better-known assessments (Narayan et al. 2000a, 2000b, 2002). Complex descriptions of the "ill-being" associated with poverty emerged, with dimensions other than material deprivation given strong significance.

Such studies make it clear that, in addition to being without financial resources, being poor often means suffering sickness, chronic pain, or exhaustion. It means enduring difficult social relations, sometimes facing exclusion from the community or family. Poverty also translates into insecurity and powerlessness, a lack of access to information and institutions, and often a lack of self-confidence and voice. Psychological suffering is also associated, in the form of humiliation, anguish, grief, and worry (Narayan et al. 2000b:37-38).

These varying aspects of poverty tend to be self-reinforcing, making it all the more difficult to move out of poverty and construct a stable life. It is hard to plan ahead or to seize new opportunities when you are exhausted, stressed, or hungry. In addition, the poor often live in dangerous and degraded environments, since that is all they can afford. They are thus the most vulnerable to violence, crime, and natural and economic catastrophes (Narayan et al. 2000a:72, 84-88).

Finally, living in poverty often means facing a truncated view of the future. The poor are often averse to risk, having suffered from mistakes or false expectations in the past and lacking assets to fall back on. Whereas those with means can save for emergencies and plan for the future, the poor do not have that luxury. A poor person's planning horizon—how far ahead they can plan or foresee—is often determined by when food will run out. It may be as soon as the end of the day. This element of poverty—the lack of ability to reasonably plan for the long term—has real significance for anything related to ecosystem management, which works over extended periods of time, often yielding benefits in the future.

Quantifying Poverty

Poverty estimates are usually constructed from household survey data. The head of a household is typically asked about income and consumption levels, and these are used as the measure of well-being (World Bank 2001:17). Most governments have established national "poverty lines" by compiling and pricing a basket of goods meant to reflect the basic human necessities, such as food, clothing, and housing. Many countries have a "food" or "absolute" poverty line calculated from a food basket representing minimum nutritional requirements, and a "basic needs" line that is slightly higher (Deaton 2004:3-4; Coudouel et al. 2002:34).

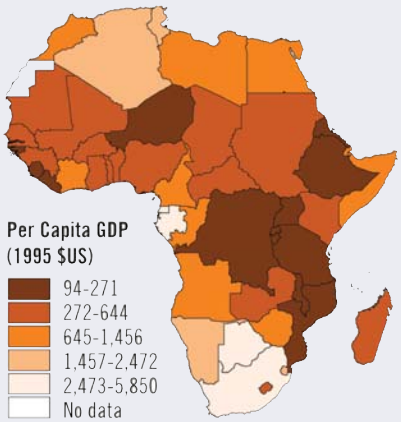
In 1990, the World Bank began using the measure of $1 per day as an official "international poverty line," meant to roughly approx-

PROFILING HOUSEHOLDS IN BOLIVIA, 1999-2003	
Population of Bolivia	8.8 million
Number of Bolivians Living on Less than $1 a Day	1.3 million
Number of Bolivians Living Below the Basic Needs Poverty Line	5.1 million
Percent of Urban Population Living Below the Poverty Line	39
Percent of Rural Population Living Below the Poverty Line	91
Percent of Poor Bolivians Living in Rural Areas	59
Percent of Total Spending Accounted for by the Poorest 20%	4
Percent of Total Spending Accounted for by the Richest 20%	49
Percent of Rural Households in Lowest Income Decile with Electricity	5
Percent of Rural Households in Highest Income Decile with Electricity	46
Percent of Rural Households Using Dung for Cooking	6
Percent of Adults Who Are Literate	87
Percent of Poor Rural Children Attending School	83
Percent of Poor Rural Children Working	51

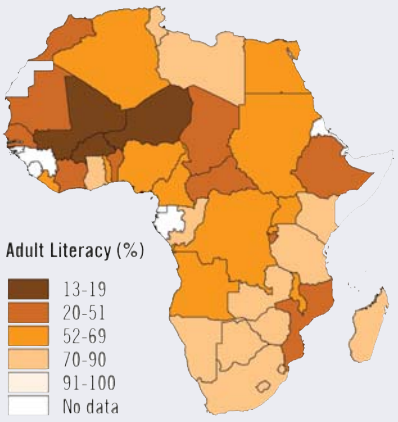
Sources: Demographic and Health Surveys, 2005; UNESCO 2004; World Bank 2002, 2004a

THE MANY MEASURES OF POVERTY

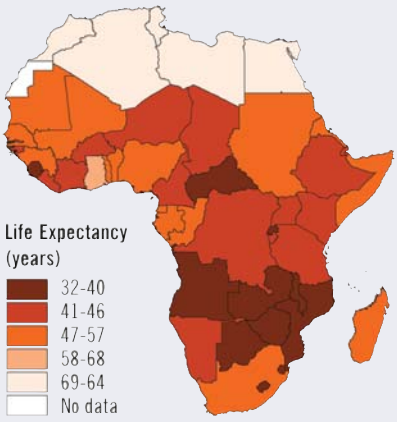
Per Capita GDP



Adult Literacy Rate



Life Expectancy



Well-being can be measured using indicators other than income poverty. Three maps of Africa show country-by-country variations in the three indicators used by the United Nations Development Programme to annually measure human development: adult literacy, life expectancy at birth, and gross domestic product per capita.

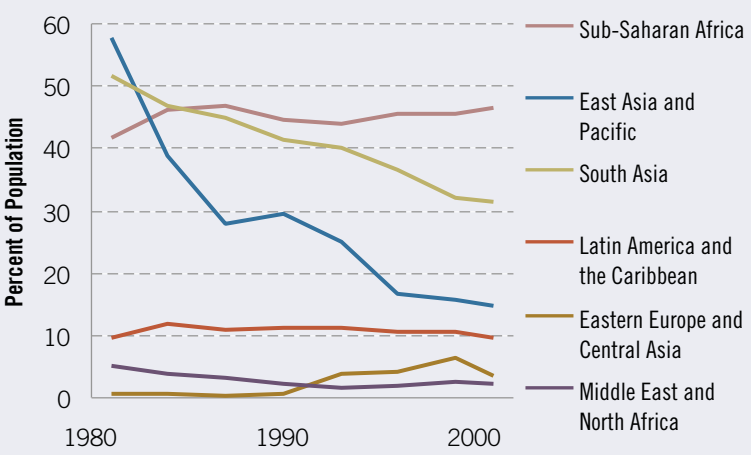
Sources: World Bank 2004a; United Nations Population Division 2003; UNESCO 2004

imate the poverty lines of low-income countries (Ravallion et al. 1991; World Bank 1990:27). This measure remains controversial, but has provided a starting point for international comparison and for important poverty initiatives, including the United Nations' Millennium Development Goals.

The World Bank's most recent estimate is that some 1.1 billion people lived below the $1 per day line in 2001. About 46 percent of the population of Sub-Saharan Africa and 31 percent of South Asians live on less than a dollar a day (Chen and Ravallion 2004:1, 30). These numbers have not been static; the distribution of world poverty has changed significantly over the last quarter-century, due in large part to a dramatic drop in the number of poor people in East Asia. Chen and Ravallion broadly estimate that between 1981 and 2001, the number of people living below $1 per day in China declined by over 400 million, while in the rest of the world, the number rose from 850 to 880 million. The number of poor in Sub-Saharan Africa almost doubled over this period (Chen and Ravallion 2004:17, 20). In addition, many more people around the world live only slightly above the $1 per day line, suffering many of the symptoms of $1 per day poverty. Some 2.7 billion—almost half the world population—live on less than $2 per day (Chen and Ravallion 2004:16).

As useful as these aggregate numbers are, they tend to mask some important elements of the poverty landscape. For example, not all the poor fall into a single category—some are poorer than others. The depth and distribution of material poverty in different countries can be extremely varied. Weighing how far below the poverty line households fall—their "poverty gap," or gap between household income and the national poverty line—offers a useful measure of the depth of a nation's poverty (World Bank 2001:320).

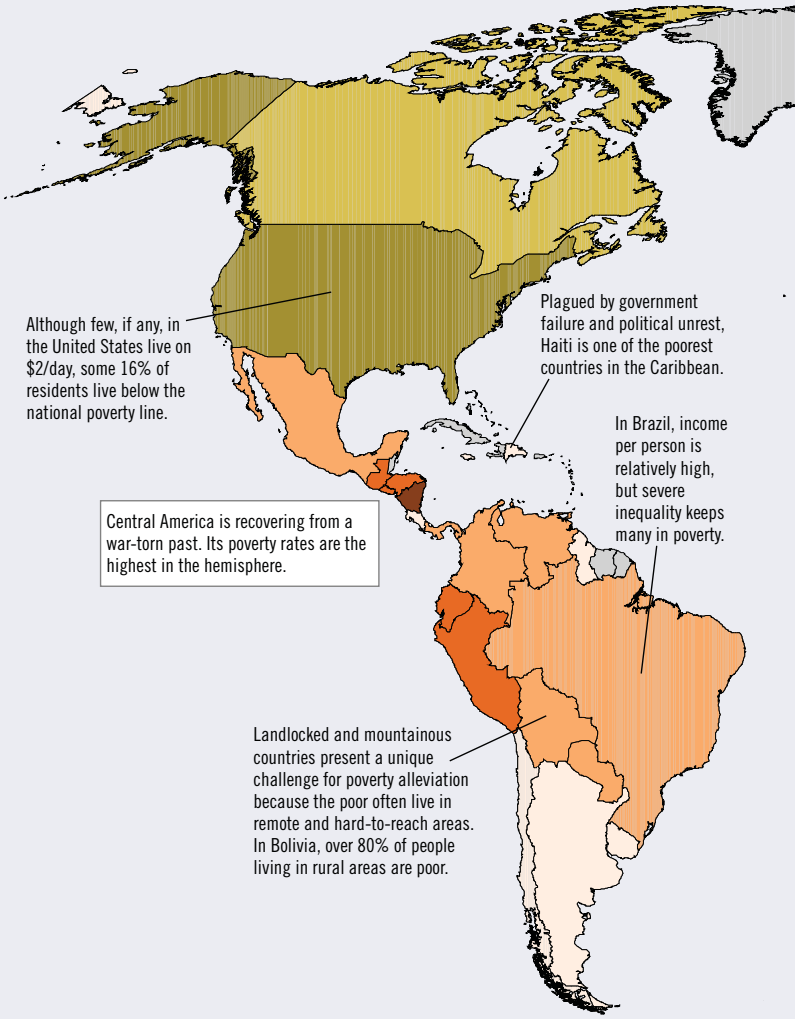
PERCENT OF POPULATION LIVING ON $1 PER DAY, 1981-2001



Sources: Chen and Ravallion 2004:30; World Bank 2004b

BOX 1.1 THE DIMENSIONS OF POVERTY

LIVING ON $2 PER DAY



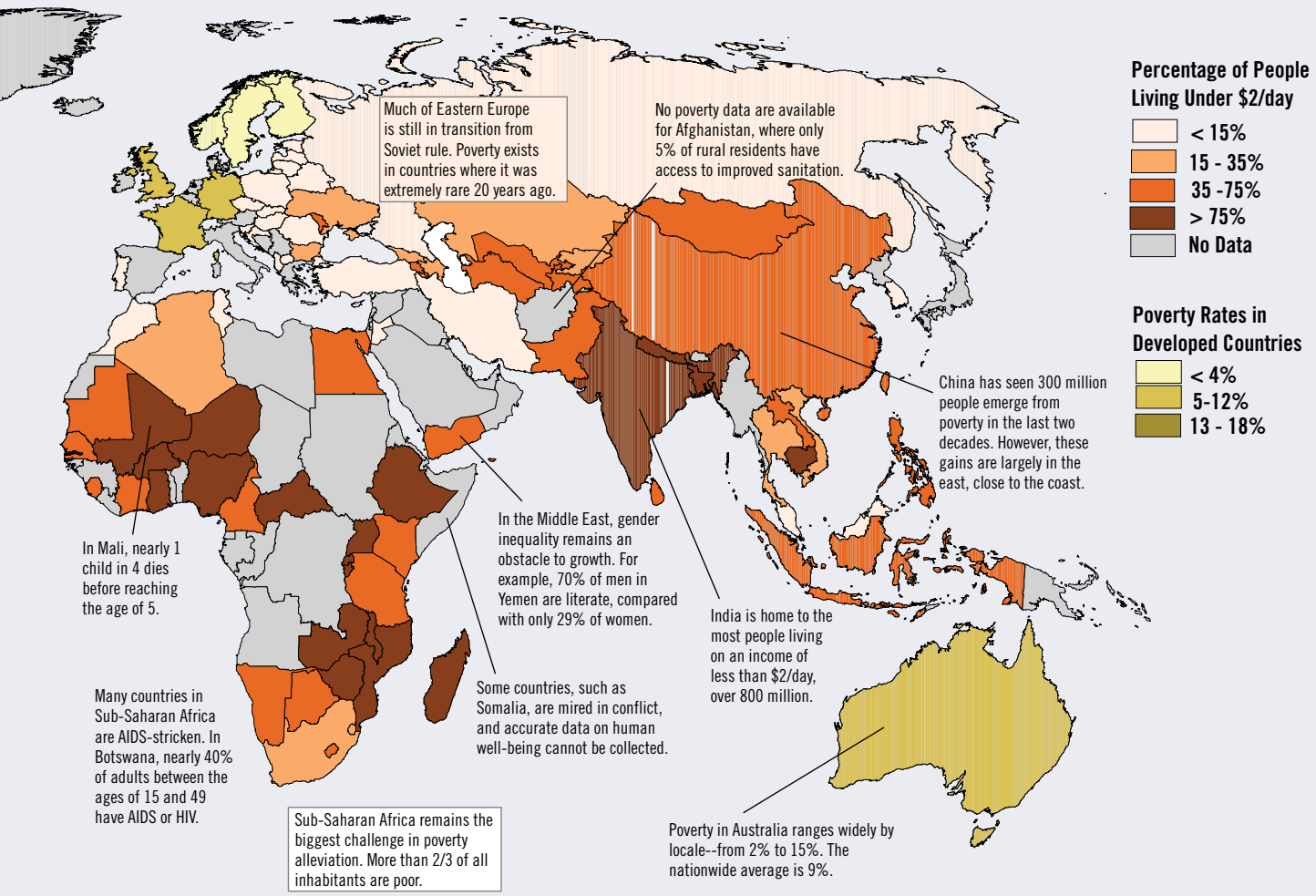
Sources: Chen and Ravallion 2004:29-30; Kryger 2005; Ritakallio 2002; UNAIDS 2004:191; UNESCO 2004; UNICEF 2004; UNICEF 2005:25; World Bank 2004a

Another variation on the standard poverty line looks at "relative poverty" by assessing the proportion of a country's population that lives at less than one-third the national consumption average. When this measure is applied, the poverty numbers for Sub-Saharan Africa and South Asia stay relatively similar to those calculated using national poverty lines. But the numbers in other regions soar, rising to 51 percent in Latin America and the Caribbean, and 26 percent in Europe and Central Asia (Hulme et al. 2001:18).

Still another way to measure poverty is to assess whether a household's total assets—cash, property, livestock, transport, and other possessions—fall below a critical level (Barrett and Swallow 2003:9). This approach is consistent with the perceptions of the poor themselves. When poor people are asked about their material concerns, they tend to focus not just on income, but on their lack of assets in general and the insecurity this brings (Narayan et al. 2000b:49).

Because poverty has so many dimensions, monetary measures are not the only, nor necessarily the best, way to count the poor. For example, the conventional household survey approach does not reveal disparities within households, and hence has no way of measuring income or consumption poverty among women, who often hold lower status. Education and health statistics, on the other hand, can be used to get a better perspective on many aspects of poverty, including those that are gender-related (World Bank 2001:27). Life expectancy, child mortality, the incidence of child stunting, literacy rates, and school enrollment are some of the more commonly used nonmonetary indicators. In an effort to address some of the gaps left by money-based assessments, analysts have developed a number of indices that measure multiple dimensions of poverty.The best known is the UN Development Programme's Human Development Index (HDI), a weighted index that includes education, life expectancy, and per-capita GDP (UNDP 2004:139).

For more information, see Data Table 4, "Income Distribution and Poverty."



$1 AND $2 PER DAY POVERTY TRENDS, 1981-2001

	NUMBER OF PEOPLE (MILLIONS)						REGIONAL
	LIVING ON $1 PER DAY			LIVING ON $2 PER DAY			POPULATION 2001
	1981	2001	Change since 1981	1981	2001	Change since 1981	(MILLIONS)
East Asia and Pacific	796	271	-66%	1,170	864	-26%	1,823
Eastern Europe and Central Asia	3	18	468%	20	94	363%	474
Latin America and the Caribbean	36	50	40%	99	128	30%	518
Middle East and North Africa	9	7	-22%	52	70	35%	300
South Asia	475	431	-9%	821	1,064	30%	1,378
Sub-Saharan Africa	164	316	93%	288	516	79%	673
Global Total	**1,482**	**1,093**	**-26%**	**2,450**	**2,736**	**12%**	**6,127**

Sources: Chen and Ravallion 2004.

nations. It goes without saying that poverty levies heavy personal costs on the poor themselves. It robs families of security, opportunity, and health. In so doing, it also robs nations of the potential contributions these families could make to economic growth, social well-being, and political stability. Poverty thus squanders a nation's human capital. It acts as a drag on economic development, requiring substantial state expenditures to address (UNDP 1996:5). Poverty also undermines national security by promoting disaffection and magnifying class and political divisions within society, increasing migration, and potentially contributing to international terrorism (Sachs 2003:27). When combined with other driving forces, it also can exacerbate local and global environmental problems, contributing to unsustainable land and resource use (ASB 2003:2; Duraiappah 1998:2177). Given this list of ills, it is clearly in the self-interest of every nation to confront poverty.

And, indeed, nations have made some progress in combating poverty. The percentage of people suffering severe poverty—those who live on incomes of roughly $1 per day (1993 prices)—has fallen from 40 percent of the world's population in 1981 to 21 percent in 2001. This means that the number of impoverished people has dropped by an estimated 400 million—from roughly 1.5 to 1.1 billion—over 20 years, in spite of a 1.6 billion rise in world population during that period, most of which took place in poor nations (Chen and Ravallion 2004:31). *(See Box 1.1.)*

This positive development is, however, largely the result of rising incomes in China and India. The populations in these nations are so large that improvements in their poverty rates can easily influence world poverty totals. For example, China's robust economic growth, coupled with de-collectivization of agriculture, stronger property rights, and other policy changes, resulted in a substantial drop in the number of people in profound poverty, particularly in the early 1980s and mid-1990s. In fact, China's accomplishments alone accounted for much of the global progress against poverty in the last 20 years (Dollar 2004:31; Chen and Ravallion 2004:18).

There are other success stories as well. The poverty rate in Vietnam dropped sharply over five years—from 58 percent in 1992 to 37 percent in 1998—on the strength of its economic growth and pro-poor policies (Glewwe et al. 2000:39; Kakwani 2004:6). In just eleven years—from 1987 to 1998—Chile succeeded in cutting its poverty rate in half (World Bank 2001a:5). The rate of primary-school completion in the developing world rose from 73 percent to 81 percent during the 1990s (Bruns et al. 2003:3). Over the past 40 years, life expectancy in developing countries has increased by 20 years—about as much as was achieved in all of human history prior to the middle of the twentieth century, although this is being sharply eroded by the AIDS epidemic today (Goldin et al 2002:iii; WHO 2004:5).

These successes notwithstanding, poverty is very much present in the world today. In fact, in many countries poverty continues to worsen. Between 1981 and 2001, the number of people living on less than $1 per day in Sub-Saharan Africa doubled from 164 million to 313 million people. In Latin America and the Caribbean it climbed from 36 million to 50 million (Chen and Ravallion 2004:31). The percentage of people living on less than $2 per day in Eastern Europe and Central Asia rose from 2 percent in 1981 to 20 percent in 2001, largely as a result of the collapse of communism in those regions (Chen and Ravallion 2004:19). The scourge of AIDS adds to the problem, particularly in Africa, where the disease is wiping out many of the

TABLE 1.1 ECOSYSTEMS BRING JOBS

Percent of Global Workforce Employed in Agriculture, Fisheries, and Forestry, 2001

Region/Country	Percent of Active Workforce
WORLD	44
DEVELOPED COUNTRIES	7
DEVELOPING COUNTRIES	54
ASIA AND PACIFIC	60
Cambodia	70
China	67
India	59
Nepal	93
LATIN AMERICA AND THE CARIBBEAN	19
Bolivia	44
Guatemala	45
Haiti	62
NEAR EAST AND NORTH AFRICA	33
Afghanistan	67
Turkey	45
Yemen	50
SUB-SAHARAN AFRICA	62
Burkina Faso	92
Ethiopia	82
Niger	88
Tanzania	80
COUNTRIES IN TRANSITION	15
Albania	48
Azerbaijan	26
Tajikistan	33

Source: FAO 2004:169-174, Table A4

gains against poverty made over the last few decades (Wines and LaFraniere 2004:1; WHO 2004). Even in China, the incidence of poverty increased during the late 1990s as the nation's torrid pace of economic growth slowed for a few years (Kakwani 2004:6).

To be sure, progress against poverty has been held back in many poor nations by a lack of economic growth. Experience shows that such growth is an important component of large-scale poverty alleviation. Over the last two decades, however, economic growth has often not kept pace with population growth in the poorest countries. From 1981 to 2001, per capita GDP dropped in 43 percent of developing nations (Hufbauer 2003:31, 33, 35). This lack of economic growth is particularly acute in rural areas, compounded by the political weakness of these areas and consequent underinvestment in rural development. For example, from 1999-2002, the World Bank directed just 25 percent of its total lending toward rural areas, in spite of the predominance of poverty there (World Bank 2003:10-11).

Growth Alone is Not Enough

Even where there is economic growth, many poor people are left behind. Economic growth alone does not necessarily translate to poverty reduction. In Latin America, for instance, the number of people in poverty has increased in the last decade even as the GDP per capita has increased, indicating that economic inequality has intensified (Chen and Ravallion 2004:31; World Bank 2005:24).

We all know the basic facts. Half the people in the world live on less than $2 a day. A fifth live on less than $1 a day. Over the next three decades, two billion more people will be added to the global population—97 percent of them in developing countries, most of them born into poverty.

—James D. Wolfensohn, President, World Bank, Oct. 3, 2004

In China, too, the nation's growing wealth has by-passed many families, with the benefits often captured by rapidly industrializing regions and cities, and missing many rural residents. One result has been a widening of the income gap between urban and rural areas over the last two decades, as well as greater growth and poverty reduction in China's coastal provinces where the engine of economic growth runs hottest (Ravallion and Chen 2004:15-16, 25). Moreover, the rural poor often suffer the environmental costs of China's industrialization and rapid growth disproportionately. Highly polluting industries have routinely relocated from cities to China's rural areas to avoid clean-up costs, leaving a legacy of water and air pollution that many rural residents are too poor to escape (Yardley 2004:1). All too often, such inequalities in income and vulnerability among groups are exacerbated by rapid economic growth, with the poor falling further behind (Kakwani 2004:6).

Perhaps the most striking examples of the difficulty of spreading the benefits of growth equitably occur in the indus-

REDUCING INEQUALITIES REDUCES POVERTY

Working toward economic equity—toward a more equal distribution of economic benefits within a nation—is a powerful means to fight poverty. It is a necessary complement to strategies that expand the national economy, so that some of the benefits of growth make their way to those in the lowest income bracket. Even when economic growth is slow, policies that more equally distribute economic gains can help reduce poverty, as shown by the success of Jordan in lowering its poverty rate from 1992-1997.

In 1989, following a currency devaluation, Jordan suffered an economic crisis that increased the poverty rate sixfold. At the same time, the nation's level of economic inequality—the difference between the incomes of the rich and the poor—increased dramatically as well, prompting a significant rethinking of economic strategy among government policymakers (Shaban et al. 2001:iv).

Beginning in 1991, Jordan changed its spending policies to increase the proportion of economic benefits flowing to the lowest income sector. One of the most effective changes was the gradual replacement of general food subsides, from which richer families benefited most, with direct cash payments to poor families only (Shaban et al. 2001:iv, 15-20). This reprogramming reduced the nation's economic inequality, with the gap between the wealthiest segment of Jordanian society and the poorest narrowing over the next six years (Shaban et al. 2001:viii, 10-13).

Subsequent analysis showed that it was this reduction of inequality that helped Jordan reduce its poverty rate from 14.4 percent in 1992 to 11.7 percent in 1997, even though the nation experienced little or no economic growth during this period (Shaban et al. 2001:viii, 7). In addition, those who remained poor were not as far below the poverty line, and extreme poverty had declined (Shaban et al. 2001:8). The reduction in inequality was driven by a greater percentage of government expenditures being captured by the poor. Had this trend toward reduced inequality been accompanied by genuine economic growth, Jordan's poverty rate would likely have dropped even more.

JORDAN: LESS INEQUALITY, LESS POVERTY

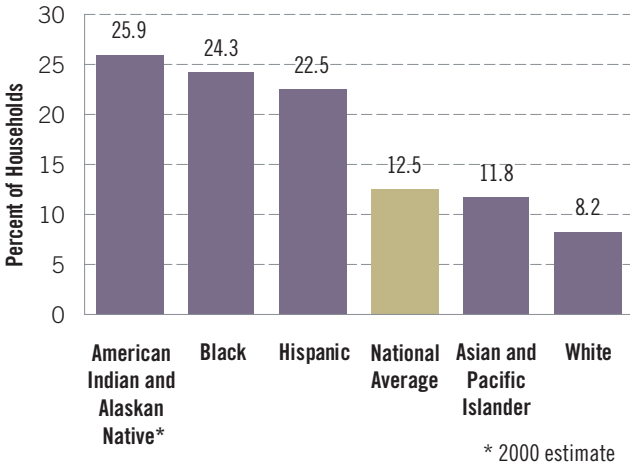
	1992	1997
Percent of Population in Poverty[1]:	14.4	11.7
Level of Inequality (Gini Index[2])	0.40	0.36

[1] Annual per capita consumption is below 314 JD or US $443 at 1997 prices.

[2] The Gini index is scaled between 0.0 and 1.0; 0.0 indicates perfect equality and 1.0 indicates perfect inequality.

Source: Shaban et al. 2001:10,12

FIGURE 1.1 UNITED STATES HOUSEHOLDS FALLING BELOW THE NATIONAL POVERTY LINE, 2003



Source: DeNavas-Walt et al. 2004:10; United States Census Bureau 2001:7

trialized world, where poverty persists in spite of the general affluence of the population. In the United States, the number of poor has risen steadily since 2000, reaching almost 36 million people in 2003—some 1.3 million more than in 2002. Historically marginalized groups such as Native Americans, African Americans, and Hispanics continue to suffer significantly higher rates of poverty. For example, 24.4 percent of African Americans fell below the poverty line in 2003, compared to the national rate of 12.5 percent. Among Native Americans and Hispanics, poverty rates were 23 percent and 22.5 percent, respectively (DeNavas-Walt et al. 2004:10). *(See Figure 1.1.)*

In general, research shows that to benefit the poor most, economic growth must be coupled with policies that reduce inequalities and improve how income is distributed in a society (Kakwani 2004:6). Where dependence of the poor on natural resources is high, as it is in most developing nations, these policies must necessarily involve the environment. And they must translate to governance practices that increase the poor's access to vital natural resources and their ability to govern those resources so that they share in the income from them.

Environment Matters to the Poor

The link between environment and poverty reduction is strong. Since the Rio Earth Summit in 1992, the importance of a sound environment to sustainable livelihoods has been widely acknowledged, particularly for the rural poor in Africa, Asia, and Latin America (UN 1992; UN 2002:2). Income derived

WHY FOCUS ON RURAL RATHER THAN URBAN POVERTY?

Although poverty in urban areas is substantial and increasing, global poverty is still predominantly a rural phenomenon. Some 75 percent of the poor live in rural areas despite the global trend toward urbanization. Even in 20 years, 60 percent of the poor are expected to live outside of cities (IFAD 2001:15). Providing a route out of poverty for these rural residents will remain a priority for national governments and the international community for decades to come (Reed 2001:13; World Bank 2003:1).

In addition, while urban ecosystems such as parks, waterways, and green spaces provide important services, it is rural ecosystems that provide the bulk of the goods and services on which humans depend for survival. The forest areas, fisheries, grasslands, agricultural fields, and rivers that provision both urban and rural residents, be they poor or rich, exist primarily in rural areas, and this is where most ecosystem governance and management occurs.

However, even as we focus on rural ecosystems and the rural poor, we recognize the intimate connection between the urban and rural spheres. Much urban poverty, for example, begins as rural poverty, exported from the countryside through rural-to-urban migration. Working for a healthier rural economy thus helps address urban poverty too, by lessening this migration. At the same time, the rural and urban economies are deeply intertwined, particularly through the flow of remittances from the city back to family members in the country. In fact, being able to tap into such remittances is often one of the dividing lines between poverty and sufficiency, and modern rural economies could hardly function without this net flow of income out of urban areas. In the end, then, we realize that addressing rural poverty has an important urban dimension as well. Urban and rural poverty can never be completely disentwined.

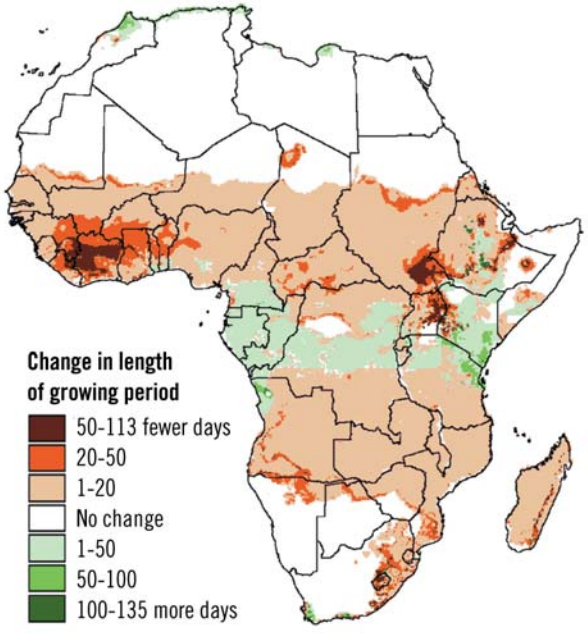
URBAN-RURAL COMPARISONS

	VIETNAM		INDIA		ZIMBABWE	
	Urban	Rural	Urban	Rural	Urban	Rural
Percent Below Poverty Line	7	36	25	30	8	48
Under-Five Mortality (per 1,000 live births)	16	36	63	104	69	100
Access to Improved Sanitation (percent of households)	84	26	58	18	69	51
Median Years of Schooling (men)	8.5	6	8.3	4.6	8.8	4.9

Sources: Macro International 2000; ORC Macro 2000; ORC Macro 2003; UNICEF 2005; World Bank 2004

FIGURE 1.2 CLIMATE CHANGE AND FOOD SECURITY

Changes in Projected Growing Season, 2000-2050



Source: Thornton et al. 2002:89

from the environment is a major constituent of the livelihoods of the rural poor, and this direct dependence on nature does not appear to be decreasing.

The environment is also a source of vulnerability. Environmental factors contribute substantially to the burden of ill-health the poor suffer. In addition, low-income families are especially vulnerable to natural disasters and environment-related risks such as the growing impacts of global climate change. As these environment-poverty links have become clear, major development institutions and donors have begun to make the environment a more central feature of their efforts to tackle poverty (USAID et al. 2002; Duraiappah 2004; UK DFID et al. 2002; UK DFID 1999; UNDP and EC 1999; World Bank 2001b).

Natural Resources Play a Vital Role in the Livelihoods of the Poor

Poor rural families make use of a variety of sources of income and subsistence activities to make their livings. Many of these are directly based on nature—like small-scale farming and livestock-rearing, fishing, hunting, and collecting of firewood, herbs, or other natural products. These may be sold for cash or used directly for food, heat, building materials, or innumerable other household needs. This "environmental income" is added to other income sources such as wage labor and remittances sent from family members who have emigrated. The decline of natural systems through soil depletion, deforestation, overexploitation, and pollution represents a direct threat to nature-based income and is a contributor to increasing poverty. *(See Chapter 2 for a thorough discussion of how ecosystems contribute to the livelihoods of the poor.)*

Common Pool Natural Resources Are a Key Source of Subsistence

The poor make extensive use of goods collected from lands or waters over which no one individual has exclusive rights—resources known generally as common pool resources (CPRs) or simply the "commons" (Jodha 1986:1169; Ostrom 1990:30). Common pool resources exist in many different ecosystems and under a variety of public or community ownership regimes. Typical examples include village pastures, state or community forests, waste lands, coastal waters, rivers, lakes, village ponds, and the like (Jodha 1986:1169).

Materials gleaned from CPRs consist of a wide range of items for personal use and sale including food, fodder, fuel, fiber, small timber, manure, bamboos, medicinal plants, oils, and building materials for houses and furniture. Fish, shellfish, seaweed, and other items harvested from coastal waters, rivers, and other aquatic environments are also of major importance to the poor. Nearly all rural families—both rich and poor—benefit from CPR income, but it is particularly important to landless households, for whom it provides a major fraction of total income. Researchers estimate that common pool resources provide about 12 percent of household income to poor households in India—worth about $5 billion a year, or double the amount of development aid that India receives (Beck and Nesmith 2001:119).

When access to common pool resources is unrestricted, as it is often is, it is difficult to keep them from being overexploited. Degradation of open access resources in the form of overfishing, deforestation, and overgrazing is an increasing burden on the poor—a trend that leads away from wealth.

Natural Resources Are Vital Social Safety Nets During Lean Times

Natural resources play a key role as a subsistence source of last resort in times of economic decline and when other food supplies are constrained. In southeastern Ghana, for example, recession and drought in 1982 and 1983 coincided with the normal lean season—the time before harvest when food supplies are naturally low. During this lean season, the poorest households depended on the "bush" for 20 percent of their food intake, compared to the highest income bracket, for which the bush provided only 2 percent of the household food intake. Women and children in particular relied on wild products such as roots, fibers, leaves, bark, fruit, seeds, nuts, insects, and sap. Men also hunted and trapped small mammals, reptiles, and birds (Dei 1992:67).

Environmental Factors Add to the Health Burden of the Poor

Environmental risks such as unclean water, exposure to indoor air pollution, insect-borne diseases, and pesticides account for almost a quarter of the global burden of disease, and an even

Continues on page 16

BOX 1.2 LIFE ON A DOLLAR A DAY

TO BE OFFICIALLY POOR IN INTERNATIONAL TERMS is to live below the World Bank's poverty line of US$1 per day. In actuality, the incomes of poor people vary by nation and by region, but by definition always add up to less than what is needed to make ends meet. To be poor is to have to choose among a range of necessities, not all of which you can afford. Food, shelter, health care, clothes, fuel, transportation, and tools or equipment needed for work are all basic expenditures vying for the limited family budget. Social obligations such as weddings, funerals, and gifts add to these basic needs. With little means and many needs, what do you spend your income on?

The Necessities

Food is the primary and immediate concern, and by far the major expense, for poor households. Studies show that the poorer the household, the greater the percentage of income spent on food. This is in spite of the fact that the poor often grow some of their own food. In Tanzania, the average rural household survived on just 32 cents a day in 2001, with 21 cents—65 percent—going for food (National Bureau of Statistics of Tanzania 2002:68-70). Food spending among the poor shows similar patterns in other regions: food purchases account for 60 percent of household spending in rural Morocco ($0.37/day) (World Bank 2001:4, Table 5) and 75 percent ($0.50/day) in Georgia (Yemtsov 1999:15, Table 5, 42). By comparison, a family in the United States spends an average of 14 percent of the household budget on food (U.S. Dept. of Labor 2004:4).

With food accounting for so large a share of daily finances, other critical necessities must receive proportionately less—often only pennies a day. Housing and the fuel or electricity to heat and cook with, for example, account for only 12 percent of spending among Argentina's poor (Lee 2000:8, Table 2). Health care, another priority for low-income families, receives only three cents of every dollar spent by Morocco's rural poor, the same amount spent in rural Georgia (World Bank 2001:9, Table 17; Yemtsov 1999:15, Table 5). Clothing and transportation costs account for a similarly small share of the daily dollar.

WHAT CAN YOU BUY FOR A DOLLAR?

Country	$1 buys
Bangladesh (Chittagong)	1 Dozen Eggs
Kenya	8 Cups of Milk
Ghana	2 1/3 Bottles of Palm Oil
Ghana	4 1/3 Bottles of Coke
Philippines	4/5 of a Big Mac
USA	1/3 of a Starbucks Tall Latte
Uganda	1/46 of a Bicycle
Bangladesh	1/3 of a Sari
Ghana	1 1/2 Pairs Rubber Sandals
Bangladesh	7 Bars of Soap
Ghana	87 Tablets of Penicillin
India (Andhra Pradesh)	1/2 Unit of Blood for a Transfusion
USA	1/150 of the Average Daily Cost of Nursing Home Care
Tanzania (Nzanza)	1/3 of a Liter of Pesticide
Ghana	4 1/3 Rolls of Toilet Paper
Ecuador (Quito)	1/500 of a Washing Machine
India (Andhra Pradesh)	2-3 Pieces Bamboo for Building
Uganda (Mbale)	1/1500 of the Cost of Building a New Home
India (Mumbai)	1/3 of a Regular Price Evening Movie Ticket

A family of four interviewed in rural Bangladesh calculated that they spent roughly 80 cents a day on food and fuel, allowing them to buy and cook two meals of rice and beans, as well as an occasional piece of meat. Medical costs came to 3.3 cents a day ($12 per year), mainly on medicines for the husband's coughs and colds. Other family expenses included 4.1 cents per day on clothes ($15 per year), 1.6 cents on school books ($6 per year), and 2.2 cents ($8 per year) visiting and giving presents to relatives. Family health and food costs thus accounted for more than 90 percent of the household's basic expenses (Rutherford 2002:10).

What You Can't Afford

When income does not fully cover even daily necessities, everything else becomes a luxury. Thus there are a great many things that the poor cannot afford to buy. Tools, materials, and upkeep for income-generating assets like transportation or farm equipment are all expenses that are routinely left out of the family budget. To cover gifts, dowries, and funerals—expenses at the heart of many social structures and customs—the poor must often sell what little land or livestock assets they have (Narayan et al. 2000a:149-150). Furniture, stylish clothing, or appliances—all items taken more or less for granted in the developed world—are largely an extravagance. Investments in hard assets or insurance to cushion against future hardships are even more difficult to afford. With no insurance or provision for emergencies, an already marginal income becomes an even more precarious foundation for the future.

Poverty often means not being able to take advantage of opportunities and investments that are open to others with more secure incomes. Education is a good example. Although the benefit of an education can dramatically increase a child's chance of leaving poverty, a poor family's budget does not always permit this. School costs can include tuition, supplies, and the loss of labor that the child could have contributed had he or she stayed home (Narayan et al. 2000b:242-244). Other investments that require savings or start-up capital are also out of reach, such as launching a small business, buying fertilizer or a fishing boat, or advertising to reach a wider market. Lacking such investment ability, the poor are often confined to subsistence activities and low-value wage labor that make it hard to get ahead.

WHAT THE RURAL POOR SPEND IN MOROCCO

Daily Per Capita Expenditures of Rural, Low-Income Individuals in Morocco 1998/99 (US$)

	Amount Spent	% of Total
Food	$0.35	61.4
Housing	$0.13	22.8
Clothing	$0.02	3.2
Health	$0.02	3.2
Transport and Communications	$0.01	2.5
Leisure	$0.01	1.8
Other	$0.03	5.1
TOTAL	**$0.57**	**100**

Adapted from World Bank 2001:9, Table 17

greater proportion of the health burden of the poor (Cairncross et al. 2003:2; Lvovsky 2001:1). The poor are far more likely to be exposed to environmental health risks than the rich by virtue of where they live. They also have much less access to good health care, making their exposure more damaging. In turn, poor health is an important obstacle to greater income and a contributor to diminished well-being in every dimension of life. *(See Box 1.3.)*

Climate Change Adds to the Vulnerability of the Poor

The adverse impacts of climate change will be most striking in developing nations—and particularly among the poor—both because of their high dependence on natural resources and their limited capacity to adapt to a changing climate. Water scarcity is already a major problem for the world's poor, and changes in rainfall and temperature associated with climate change will likely make this worse. Even without climate change, the number of people impacted by water scarcity is projected to increase from 1.7 billion today to 5 billion by 2025 (IPCC 2001:9).

In addition, crop yields are expected to decline in most tropical and sub-tropical regions as rainfall and temperature patterns change with a changing climate (IPCC 2001:84). *(See Figure 1.2.)* A recent report by the Food and Agriculture Organization estimates that developing nations may experience an 11 percent decrease in lands suitable for rainfed agriculture by 2080 due to climate change (FAO 2005:2). There is also some evidence that disease vectors such as malaria-bearing mosquitoes will spread more widely (IPCC 2001:455). At the same time, global warming may bring an increase in severe weather events like cyclones and torrential rains. The inadequate construction and exposed locations of poor people's dwellings often makes them the most likely victims of such natural disasters.

Nature as an Economic Stepping Stone

Nature has always been a route to wealth, at least for a few. Profit from harvesting timber and fish stocks, from converting grasslands to farm fields, and from exploiting oil, gas, and mineral reserves has created personal fortunes, inspired stock markets, and powered the growth trajectories of nations for centuries. But this scale of natural resource wealth has been amassed mostly through unsustainable means, and the benefits have largely accrued to the powerful. It is the powerful who generally control resource access through land ownership or concessions for logging, fishing, or mining on state lands; who command the capital to make investments; and who can negotiate the government regulatory regimes that direct the use of natural resources. The poor, by contrast, have reaped precious little of the total wealth extracted from nature. But that can change.

Natural Resources Are a Key Determinant of Rural Wealth

Even though they do not currently capture most of the wealth created by natural systems, the livelihoods of the poor are built around these systems. Indeed, natural resources are the fundamental building block of most rural livelihoods in developing nations, and not just during lean times. Chapter 2 offers many examples of the environmental income that both the poor and rich derive from nature.

The ability to efficiently tap the productivity of ecosystems is often one of the most significant determinates of household income. For example, studies show that the key variable explaining income levels for rural households in Uganda is access to land and livestock. In Ugandan villages near Lake Victoria, the key variable explaining wealth is access to fishing boats and gear. Income-wise, these are found to be even more important than other wealth-associated factors such as access to education (Ellis and Bahiigwa 2003:1003).

Beyond Subsistence: Natural Endowments as Capital for the Poor

Ecosystem goods and services—the natural products and processes that ecosystems generate—are often the only significant assets the poor have access to. These natural endowments, if managed efficiently, can provide a capital base—a foundation for greater economic viability, and a stepping stone beyond mere subsistence. Yet the potential of these assets is often overlooked.

Typical commercial evaluation of natural resources tends to undervalue the total array of ecosystem goods and services, which includes not just the crops, lumber, fish, and forage that are the usual focus of exploitation, but also a wide variety of other collectibles, agroforestry products, small-scale aquaculture products, as well as services such as maintenance of soil fertility, flood control, and recreation (Lampietti and Dixon 1995:1-3; Pagiola et al. 2004:15-19). One of the consequences of the difficulty of assigning a monetary value to ecosystem benefits is that it has led to the systematic undervaluation of the assets of the poor and the underestimation of the potential benefits of improved environmental management.

But the potential for strategic management of ecosystems to raise the incomes of the poor is real. In fact, good ecosystem management can become one of the engines of rural economic growth more generally. Experience shows that the poor use several strategies to make their ecosystem assets a stepping stone out of poverty.

Restoring Productivity

Where ecosystems are degraded, it limits their potential as a source of environmental income. Many communities have found that restoring the productivity of local forests, pastures, or fisheries has the opposite effect, raising local incomes substantially. Often this entails a community effort to more carefully control the use of common property areas and even private lands. For example, the village of Sukhomajri in Haryana, India, has gained widespread recognition for its success in raising village incomes through community efforts to restore and maintain the productivity of local forests and farmland. Careful land management and rainwater harvesting produced large gains in agricultural production, tree density, and available water, increasing annual household incomes by 50 percent in five years (Agarwal and Narain 1999:16).

Many other watershed management projects in India have also reported benefits to village residents, including poor families who do not own land. In the Adgaon watershed in Maharashtra, annual days of employment (wage labor) per worker increased from 75 days at the project's inception to over 200 days after restoration was complete. In Mendhwan Village, laborers found eight months of agricultural work per year after four years of watershed management, compared with only three months before the community began its restoration and management project (Kerr et al. 2002:56).

Marketing Niche Products and Services

One common way to translate ecosystem assets into economic gain is to create or take advantage of niche markets for nontimber forest products, such as bamboo, mushrooms, herbs, and other collectibles. In Nam Pheng village in northwestern Laos, villagers began a cooperative effort in 1996 to expand the market for bitter bamboo and cardamom. They created a coordinated management plan for sustainable harvest of these traditional products, improved the harvest technology, and established a marketing group to both increase sales and obtain higher prices for their wares. By 2001 a day's harvest of bitter bamboo brought ten times the wages of slash-and-burn cultivation, which had been the villagers' main livelihood activity (Morris 2002:10-24). *(See Table 1.2.)*

TABLE 1.2 BITTER BAMBOO AND CARDAMOM VS. OTHER INCOME SOURCES

NAM PHENG VILLAGE, LAO PDR

Income Activity	Income Per Day of Labor (in Lao Kip)
Collection and Sale of Bitter Bamboo	13,500-19,600
Collection and Sale of Cardamom	11,200
Heavy Labor: Road Construction	20,000
Heavy Labor: Agriculture	20,000
Collection and Sale of Fuelwood	17,000
Light Labor: Agriculture	10,000
Slash and Burn Cultivation	1,500

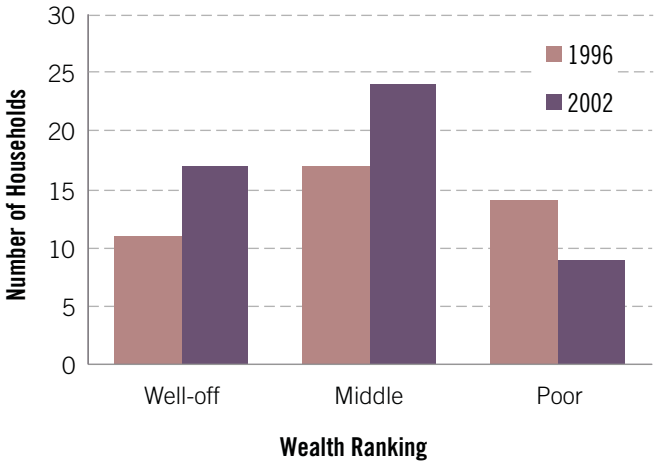
Note: 1000 Lao Kip = US$0.13

Source: Morris 2002:14

By 2002, harvesting bitter bamboo and cardamom provided the main source of income for most villagers and the community had made considerable progress toward higher incomes and more secure livelihoods. *(See Figure 1.3.)* The village poverty rate had fallen by more than half, food security had increased, and the mortality rate for children under five had fallen to zero. In addition, enough community funds from the joint marketing group had been raised to build a school, prompting school enrollment to double, with more than half of the students being girls. While the income potential from bamboo and cardamom is not unlimited, it has clearly provided a stepping stone to larger capital investments, such as livestock, and allowed villagers to diversify their income sources. It has also brought villagers an appreciation of the forest as an economic asset, providing an incentive for long-term care of the forest ecosystem (Morris 2002:10-24).

In addition to marketing forest products like bamboo, poor households can find substantial income marketing ecosystem services, such as recreation. In Namibia, communities have successfully tapped the ecotourism trade built around viewing and hunting the area's springbok, wildebeest, elephants, giraffes, and other animal populations. To accomplish this, the communities have formed legally constituted "conservancies" to regulate the hunting, sightseeing, camping, and other activities that affect local wildlife. The conservancies have generated direct benefits ranging from jobs and training to cash and meat payouts to community members. In 2004, total community

FIGURE 1.3 A TREND TOWARD WEALTH, Nam Pheng Village, Lao PDR



Well-off: Permanent house, equipment, and accessories (e.g., truck, TV/VCR); enough money and rice for one year; some livestock; and enough labor.

Middle: Semi-permanent house (i.e., thatched grass roof, stripped bamboo walls), insufficient money or rice for half the year, few livestock, and enough labor.

Poor: Temporary house (bamboo or small trees for beams and pillars), insufficient rice for entire year, no livestock, and insufficient labor.

Source: Morris 2002:17

benefits reached N$14.1 million (US$2.5 million) in value. Studies have documented that, over the course of 10 years, the conservancies have enhanced the livelihood security of local people while spurring major recoveries in wildlife populations (WWF and Rossing Foundation 2004:v-vi; Vaughan et al. 2003:18-19).

Capturing a Greater Share of the Natural Resource Value

Maximizing environmental income involves not only improved resource management or creation of new markets for nontraditional or underexploited products. It also requires greater attention to marketing traditional products such as fish, so that more of the revenue generated is captured by the fishers themselves in the form of higher prices for their harvests. In Kayar, a community along the coast of Senegal, local fishers worked together to regulate their fish catch, with the idea of stabilizing the catch and insuring a good price at market (Lenselink 2002:43). By limiting the quantity of fish each boat owner could deliver to market each day, they successfully raised fish prices to the point that fishers had surplus income to save. At the same time, fish stocks were better managed by limiting the number of fishers allowed in a given area, the number of fishing trips allowed per day, and the kinds of permissible fishing gear (Lenselink 2002:43; Siegel and Diouf 2004:4, 6). The Kayar fishers made economics and ecosystem management work hand in hand. (*See the case studies in Chapter 5 for other examples of how communities have used better ecosystem management to improve their economic prosperity and reduce poverty.)*

The examples described above involved a different understanding of nature's wealth from the conventional view of large-scale extraction—a different view of what natural wealth is, how it can best be tapped, and who is to benefit from it.

Ecosystem Management as a Basis for Agriculture Growth, Rural Diversification, and General Economic Growth

Making ecosystems work as an economic asset for the poor should be seen not as an isolated goal but part of a larger strategy for rural development. Utilizing the natural assets of the poor is not a "silver bullet" for poverty reduction that can single-handedly bring wealth to poor families. It is rather part of a general transition of rural economies from subsistence to wealth accumulation, working first to support a more profitable small-scale agriculture and natural resource economy—the current mainstays of rural livelihoods—and eventually to build a complementary rural industrial and service economy (World Bank 2003:xix-xxvi).

Agriculture is a particularly important piece of the rural poverty equation. There is a well-established connection between improvements in small-scale agriculture and poverty reduction. One study in Africa found that a 10 percent increase in crop yields led to a 9 percent decrease in the number of people living on $1 per day (Irz et al. 2001 in World Bank 2003:xix). Indeed, rapid agricultural growth is considered a primary avenue for poverty alleviation (Smith and Urey 2002:71). From the 1960s to the1980s, the Green Revolution's use of modern seeds and fertilizers, irrigation, better credit, roads, and technical assistance helped bring this kind of rapid agricultural growth to many rural areas, with a corresponding reduction in poverty. For example, from 1965 to 1991—the period of greatest Green Revolution gains—rural poverty rates in India declined from 54 percent of the population to 37 percent (Smith and Urey 2002:17).

But spreading the Green Revolution's success to the poor families and the marginal lands it has by-passed will require something more than the technocratic approach of those earlier

decades. It will also require good ecosystem management by the poor that helps build and retain soil fertility and allows small farmers to harvest and efficiently use water resources. Failure to take this approach has resulted in fertility loss, salinization, and overdrafting of groundwater on many of the Green Revolution farms—environmental problems that have begun to erode productivity gains in many areas (Smith and Urey 2002:10).

Sustained agricultural growth, augmented by other forms of environmental income, from forest products to forage to aquaculture, can help many poor rural families to create an asset base that allows them to begin the transition away from sole dependence on farming and nature-based activities. Research shows that as growth proceeds, agriculture eventually begins to play a less crucial role in the overall development process and subsequently declines as a share of economic output (Timmer 1988:276, 279). Rural residents begin to depend more on rural industry and so-called "off-farm" income, which provide an additional and quicker route out of poverty to complement agriculture.

But even as rural economies slowly diversify, nature will still play an important role. Many rural industries—such as local processing of agriculture or fishing products, crafts production, and ecotourism—will themselves be indirectly dependent on natural resources. They will thus benefit from a sound approach to ecosystem management. For example, when the shrimp-processing company Aqualma was established in 2000 in a remote corner of Madagascar, it brought permanent jobs to 1,200 rural workers, most of whom had never held a wage-paying job. But Aqualma's future relies entirely on sound fishing practices that insure a continuing shrimp supply. In other words, a good relationship to ecosystems and environmental income supports many dimensions of rural growth and is beneficial at several points in the economic evolution of the rural poor from subsistence to wealth (World Bank 2003:xxii).

Better Governance Is Vital for Higher Incomes

Maximizing environmental income for the poor requires changes in the governance of natural resources. The need for such changes is pressing because the poor are at a great disadvantage when it comes to controlling natural resources or the decisions surrounding them. They often lack legal ownership or tenure over land and resources, which restricts their access and makes their homes and livelihoods insecure. They also suffer from a lack of voice in decision-making processes, cutting them out of the decision-making loop. Natural-resource corruption falls harder on the poor as well, who may be the victims of bribe-demanding bureaucrats or illegal logging and fishing facilitated by corrupt officials who look the other way. The poor are also subject to a variety of policies—such as taxes and various regulations—that are effectively anti-poor.

These governance burdens make it hard for poor families to plan effectively, to make investments that might allow them to profit from their assets or skills, or to work together effectively to manage common areas or create markets for their products. In other words, governance burdens quickly translate to economic obstacles.

Tenure Security is a Primary Obstacle

Ownership and access are the most fundamental keys to the wealth of nature. Unfortunately, many poor people do not own the land or fishing grounds they rely on for environmental income. This lack of secure tenure makes them vulnerable to being dispossessed of their homes and livelihoods, or, if they rent homes or land, subject to sometimes exorbitant rent payments.

The importance of tenure—or the lack of it—to the ability to tap nature's wealth can't be stressed too much. The rights to exploit, sell, or bar others from using a resource—the bundle of rights associated with tenure or ownership—are essential to legal commerce. Ownership also provides an incentive to manage ecosystems sustainably by assuring that an owner will be able to capture the benefits of long-term investments like soil improvements, tree planting, or restricting fishing seasons to keep fish stocks viable.

Tenure issues affecting the poor involve not only private ownership of land, but also the use of common lands. Many areas

Continues on page 23

Box 1.3 HEALTH, ENVIRONMENT, AND POVERTY

GOOD HEALTH IS A BASIC COMPONENT OF HUMAN well-being and a necessity for earning a livelihood. Unfortunately, the poor are much more vulnerable to ill health, and ill health is itself an important factor in reinforcing the poverty cycle. The health vulnerability of the poor has many facets, with environmental exposure being one of these faces.

Health as an Asset

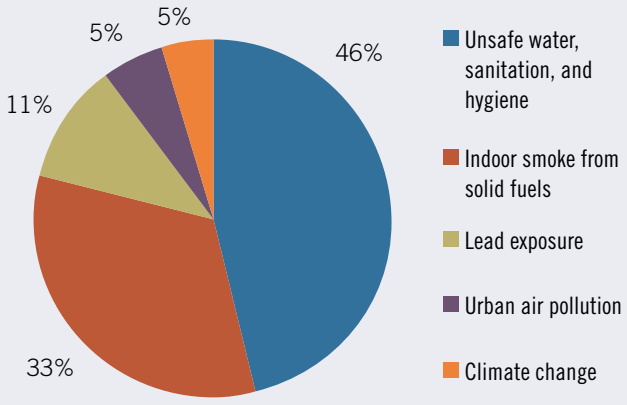
Good health is among the most valuable assets the poor possess. Not only is good health essential to almost any income-generating activity, but most of the other assets of the poor—such as livestock and farmland—yield few returns without the physical capacity to maintain or use them (Barrett and McPeak 2003:8; Lawson 2004:20). Individuals who are sick or disabled are less likely to be hired for wage work, may have difficulty working effectively, and will often be paid less for their services (Narayan et al. 2000:96).

Ill health is not just the lack of an asset, but a negative asset. Having a household member fall ill can destroy a poor family's standard of living. Household and village-level studies show that the illness of a key income-earner—a so-called "health shock"—is one of the leading causes of a household's decline into abiding poverty (Krishna 2004:11; Lawson 2004:3). The immediate loss of income is only the start: health bills can mount quickly and create an urgent need for cash, and since the poor possess few liquid assets that can be used for such emergencies, they may have to sell land or items central to sustaining their livelihoods. Families facing a health shock very often fall into substantial debt, from which they can only emerge with difficulty. One common coping strategy is to pull children out of school and send them to work, depriving them of training they will need in the future to keep themselves out of poverty (Narayan et al. 2000:98).

THE HIGH PRICE OF ILL HEALTH

Serious back problems required a hospital stay for Susan, a poor Kenyan farmer. Even before purchasing medicines, Susan's hospital bill cost her US$27 (2,100 Kenyan shillings). She sold her only 2 goats, her bean crop from the previous year, kitchen utensils, and her few pieces of furniture to raise the money. Even if her back recovers, Susan has been reduced to destitution, and will be hard-pressed to earn a livelihood. Her friends remain as her only source of help in the future (Hamilton 2003:21).

DALYs ATTRIBUTED TO ENVIRONMENTAL HEALTH RISKS



The Disability-Adjusted Life Year (DALY) is a statistical measure of the human costs of sickness in terms of the number of healthy years lost to illness and disability (Ezzati et al. 2004: 2142-3). Time spent in poor health will translate into a loss of income, making the DALY a helpful measure of the impact of health hazards upon the livelihoods of the poor.

Source: Ezzati et al. 2004:2144-45

Elevated Risk of the Poor

The poor are more likely to suffer serious illness during their lifetime. They tend to live in higher-risk areas, with greater exposures to pollution, disease agents, and natural hazards such as floods. They also tend to work more dangerous jobs and have less access to services than the wealthy. Once ill, they face greater challenges in receiving adequate care. A shortage of trained health personnel and gaps in clinics and hospitals may mean that the poor must travel substantial distances and wait in long lines to receive treatment, particularly in rural areas (Narayan et al. 2000:72, 95; World Bank 2004:135).

Corruption in the public health care sector is also widely reported among the poor in the developing world. Patients may be forced to pay for services and medicines that should be free, and are turned away or given inferior care if they cannot afford to pay (Narayan et al. 2000:102;World Bank 2001:83). In Pakistan, a survey found that 96 percent of patients reported some type of corruption associated with visiting the local hospital, such as having to pay extra for beds, X-rays, tests, or medicines (Transparency International 2002:22). As a result, the public health care system is often the last resort of the poor, and many avoid using it at all (Narayan et al. 2000:100; Narayan and Petesch 2002:33-34).

Hunger

Malnutrition is the leading health risk among the poor, accounting for 1 in 15 deaths globally (WHO 2002:54). Of the 1.1 billion people living below the "dollar-a-day" threshold, 780 million suffer from chronic hunger (FAO et al. 2002:8). Because they are often marginalized in society, women and female children in particular may eat last and eat less than the principal breadwinner in the family. Undernourishment of women and children alone accounts for almost 10 percent of the global burden of disease (WHO 2002:54; Economist 2004:68).

Hunger is not only an outcome of poverty but a prime cause for remaining in poverty. Chronically hungry people are less productive at whatever labor they are able to obtain, and thus find it harder to accumulate the financial capital they need to take them out of poverty (FAO et al. 2002:10). The effects of poverty reach across generations as well. Children suffering from malnutrition may suffer physical stunting and impeded cognitive development, and are more susceptible to other forms of disease, both during youth and later in life. An estimated 40-60 percent of children in developing countries suffer from iron deficiencies severe enough to impede cognitive development (Economist 2004:68; WHO 2001:7-8). These disabilities are likely to limit their capacity to generate income in the future, extending the cycle of poverty for yet another generation (FAO 2002:10; WHO 2002:53).

Environmental Health

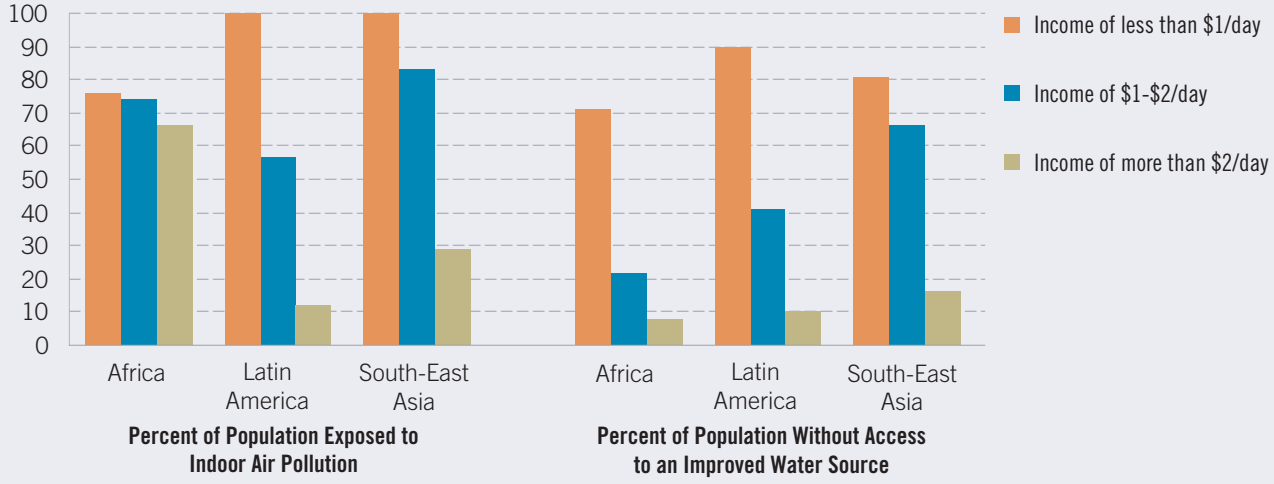
Environmental hazards comprise a significant portion of the health risks facing the poor. By one estimate, environmental causes account for 21 percent of the overall burden of disease worldwide (the combination of days spent sick and deaths due to sickness) (WHO 2002 in Cairncross et al. 2003:2). Acute respiratory infections and diarrhea rank among the highest contributors to the disease burden in the developing world, and these are mostly diseases of the poor (WHO 2002:83).

A disproportionate share of environmental health risk is borne by the very young. Although children under five constitute just 10 percent of the world's population, they suffer 40 percent of the environment-related burden of disease. Diarrhea, caused by unclean water and inadequate sanitation, is responsible for the deaths of an estimated 1.8 million people worldwide each year, 1.6 million of which are children under five (Gordon et al. 2004:14).

Respiratory ailments are caused in large part from exposure to high levels of indoor smoke from cooking with dung, wood, or other biomass fuels. More than half the world's population—3.5 billion people—currently depend on such fuels as their main energy source (Desai 2004:vii). Analysis by the International Energy Agency shows that this dependence will likely increase in the years ahead, with an additional 200 million people—most of them poor—relying on these fuels by 2030 (IEA 2002:30).

THE POOR ARE MORE VULNERABLE TO HEALTH RISKS

Environmental risk factors in countries with high adult and childhood mortality



Source: Blakely 2004:1990, 1992, 2003

Box 1.3 HEALTH, ENVIRONMENT, AND POVERTY

Indoor air pollution is linked to over 1.6 million deaths a year, 500,000 of them in India alone. More than half of those who die of respiratory infections related to indoor air pollution are children under the age of five (Warwick and Doig 2003:2). In urban areas, ambient air pollution from auto exhaust, industrial smoke stacks, dust, and other particulates is also a significant health risk. Ambient air pollution causes some 800,000 deaths a year, most of them in the developing world (WHO 2002:69).

Looking to the future, climate change comprises a considerable environmental health risk, since it can intensify existing environmental health threats. Vector-borne diseases such as malaria, dengue fever, schistosomiasis, and Chagas disease could expand their ranges as temperature and rainfall patterns change. Mosquitoes are among the first organisms to expand their range when climate conditions become favorable, so cases of malaria and dengue fever may increase their already heavy toll among the poor (WRI et al.1998:70). Diarrheal organisms are also sensitive to changes in temperature and humidity, with the health risk they pose increasing as average temperatures rise. A study in Peru found that hospital admissions for diarrhea increased as much as 12 percent for every 1 degree C increase in temperature (McMichael et al. 2003:215). On a broader scale, the World Health Organization estimates that in 2000, climate change was responsible for 2.4 percent of all cases of diarrhea and 2 percent of all cases of malaria worldwide (WHO 2002:72).

The Scourge of AIDS

AIDS poses one of the most potent health threats to poor households. High rates of infection are common in many of the poorest nations in Africa and Asia, and the disease has begun to ravage rural household economies in many areas. When AIDS strikes a family member—particularly a key wage-earner—it administers the kind of health shock that often drives the family into profound poverty. In the Tanzanian village of Kagabiro, households with an AIDS patient spent between 29 and 43 percent of household labor on AIDS-related duties—time that previously was available for earning money (Tibaijuka 1997 in Stover and Bollinger 1999:5). A study in Côte d'IVoire found that when a family member with AIDS died or moved away for treatment, average consumption in the family fell by as much as 44 percent the following year due to loss of income (Bechu 1998 in Stover and Bollinger 1999:4). Research on AIDS-afflicted families in rural Ethiopia found that the average cost of medical treatment, funeral, and mourning expenses amounted to several times the average household income (Demeke 1993 in Stover and Bollinger 1999:4).

AIDS also has profound effects on food security. In eastern Africa, AIDS-related labor shortages have led to lower crop yields, smaller amounts of land being cultivated, and a move from cash crops to subsistence crops, as the rural agricultural economy retrenches.

under state ownership provide the resource base for poor communities, but these communities often have no legal basis for their use of common pool resources. In many instances, these resources—whether they are forests, grazing areas, or fishing grounds—have been governed locally for centuries under traditional forms of "communal tenure," in which resources are owned in common by a group of individuals, such as a village or tribe.

Unfortunately, such customary arrangements are often not legally recognized, and conflicts between communal tenure and modern state-recognized ownership frequently threaten rural livelihoods. State recognition of such traditional ownership arrangements or new power-sharing agreements between local communities and the state that grant specific rights to use and profit from the state commons are often important ingredients in successful efforts to tap the wealth of natural systems (Meinzen-Dick and Di Gregorio 2004:1-2).

Lack of Voice, Participation, and Representation

When important decisions about local resources are made, the poor are rarely heard or their interests represented. Often these decisions, such as the awarding of a timber concession on state forest land that may be occupied by poor households, are made in the state capitol or in venues far removed from rural life. Even if they could make it to these decision-making venues, the poor—and other rural residents as well—would still be unlikely to find a seat at the table. The right for local resource users to participate in resource decisions is still a relatively new concept in most areas and often not embodied in law. Language barriers, ignorance of their legal rights, and a lack of full information about how resource decisions are likely to affect them are also potent obstacles to the participation of the poor. Lack of money, of political connections, and of lawyers or other advocates that can articulate their needs are all sources of political isolation and marginalization (WRI et al. 2003:44-64).

The Wealthy Dominate the Economic Machinery

Wealthier landowners and traders tend to dominate the resources and economic tools necessary to turn natural resources to wealth. In addition to owning more and better land, livestock, farm machinery, boats, or other assets directly relevant to profiting from ecosystems, the rich also tend to have greater access to resources like irrigation water, seed, fertilizers, pest control, and labor (Narayan and Petesch 2002:58-59, 188; Narayan et al. 2000:49-50; Kerr et al. 2002:61). The wealthy also have easier access to credit, which is a key constraint for the poor wishing to improve their ecosystem assets by planting trees, undertaking soil or water conservation projects, or developing new products or markets.

These advantages are often magnified by the dense and interlinked social networks in rural areas, which tend to reinforce the near-monopoly position enjoyed by some wealthier families, leaving poorer families with fewer options and sometimes all-or-nothing choices (Bardhan 1991:240). For instance, surveys from West Bengal, India, found that laborers tied to their landlords through credit were less likely to take part in group bargaining and agitation for raising rural wages. These indentured workers felt it was a choice between a low wage or no job at all—a cycle of dependence that can be self-perpetuating (Bardhan 1991:240).

Capture of State-Owned Natural Resources by the Elite—Facilitated by Corruption

In many cases, state-owned resources like forests and fisheries are opened to exploitation by granting individuals or companies concessional leases or harvest licenses. The wealthy are much more likely to be able to take advantage of these. In Bangladesh, the government leases rights to fish in state-owned water bodies for a period of one to three years through a public auctioning system that generates considerable revenue for the state. Unfortunately, poor fishermen can rarely afford to bid, so the licenses are purchased by rich investors known as "waterlords." These entrepreneurs hire fishermen as daily laborers at low wages, keeping most of the profits for themselves. This has led, in effect, to the institutionalized exploitation of the fishermen by a small rural elite (Béné 2003:964). In other instances, lease holders will exclude the poor altogether from their concession, even though they may have traditionally lived on and collected from these lands.

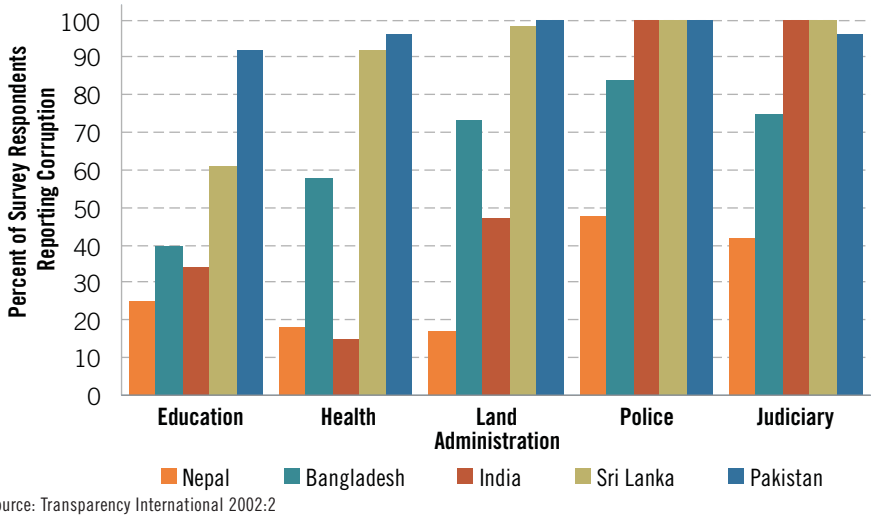
This problem of the capture of state resources by the elite is worsened by corruption, political patronage, and sweetheart deals for insiders. Such corruption and favoritism often focuses on natural resource concessions in remote areas far from official concern and public scrutiny—precisely those areas inhabited by the poor. In 2001, Bob Hasan, Indonesia's former Minister of Industry and Trade, was sentenced to prison for forest-related graft worth $75 million. For years, the timber magnate and close associate of former President Suharto dominated Indonesia's lucrative plywood trade, at one point controlling nearly 60 percent of world tropical plywood exports (Borsuk 2003:1; Barr 1998:2, 30).

Apart from its role in enabling the elite capture of state resources, corruption also stands as a fundamental obstacle to the sustainable management of resources and thus another way in which the natural assets of the poor are diminished. Illegal logging and fishing are prime causes of the depletion of common pool resources that the poor depend on, short-circuiting effective state management of ecosystems and undermining customary management arrangements at the village or tribal level as well (WRI et al. 2003:36-38). *(See Figure 1.4.)* Demands by local officials for bribes or other considerations for access to resources place a special burden on the poor and encourage low-income families to themselves engage in illegal logging, fishing, and other unsustainable resource uses. At a national level, corruption acts as a drag on the economy, behaving essentially as a tax on legitimate businesses. Research shows that corruption suppresses national economic growth—one of the main requirements for effective and widespread poverty reduction (Thomas et al. 2000:144-150).

Anti-Poor Taxes and Regulations Work Against Economic Empowerment

In many countries, natural resource-related activities such as timber extraction, fishing, grazing, small-scale agriculture, and water use are subject to controls and taxes that are regressive with respect to the poor. In China, grain farmers—many of whom are poor—until recently were obliged to sell

FIGURE 1.4 CORRUPTION BY SECTOR IN SOUTH ASIA, 2002



Source: Transparency International 2002:2

the government a fixed quota of their production at below-market prices, essentially lowering their potential income (Ravallion and Chen 2004:21-22). In Uganda, households face a confusing array of resource-related taxes, which often appear arbitrary to rural families. These include taxes on activities as diverse as smoking fish, growing maize, and slaughtering cows or goats (Ellis and Bahiigwa 2003:1008-1009). Around Lake Chad in central Africa, fishery fees are levied by three distinct groups: by traditional authorities, by the central government, and by soldiers (Béné 2003:970). Such overlapping fees discourage low-income families from engaging in market transactions that would help them generate returns from their access to natural resources.

In addition, well-intentioned environmental regulations are sometimes introduced in a draconian way that hurts the poor. For example, there is evidence that China's 1998 ban on tree felling in the upper watersheds of the Yangtze and Yellow River Basins has had very negative impacts on some poor households. The ban was meant to restore the health of the watersheds and avoid repeating the disastrous floods on the Yangtze that had occurred earlier that year. However, expansion of the logging ban beyond state-owned forests into private and collectively owned land has cost numerous jobs and restricted local communities' access to forest products in these areas (Xu et al. 2002:6, 8). In Mali, a 1986 forest law banned bush fires, made felling of certain species illegal without Forest Department permission, and made wood-saving stoves compulsory. In response, the wood trade was forced underground, and poor people unable to pay fines levied against them had their livestock confiscated (Benjaminsen 2000:97, 99-100).

The Environment as a Route to Democratic Governance

The environment provides a powerful tool to promote democratic reform. Particularly among the poor, it offers a unique opening for localizing and building demand for democratic practices because of its connection with livelihoods. In turn, good environmental governance is essential to developing, strengthening, and consolidating democracy in the world's poorest nations because it is a prerequisite for the poor to realize greater income from the environment.

Counteracting the bias against the poor that is embedded in government policies, institutions, and laws will require significant political change. That in turn demands greater access by the poor to true participation, accurate information, and fair representation. The environment itself provides one effective route for this needed transition to democratic decision-making. In countless communities in Africa, Asia, and Latin America, control over and use of natural resources are matters of everyday survival. These are governance issues with immediate bearing. The prospect of more equitable decisions about land and resources gives the ideals of democracy personal relevance to the poor. And it provides a motive for the kind of public activism that brings political change.

There are many examples of poor people organizing around environmental issues to prompt government action, gain rights, or call attention to gross inequities. The 1980s saw poor fishermen in the Indian state of Kerala organize to demand a seasonal ban on industrial trawlers that directly competed with local fishers and reduced their catch. Using tactics such as public fasts, road blocks, and marches against the government, the fishers became a political force that eventually coaxed fisheries managers to adopt a three-month seasonal ban on trawlers (Kurien 1992:238, 242-243). In Brazil's Amazon region, rubber tappers joined forces with the Indigenous People's Union to form the Alliance of Forest Peoples in the mid-1980s, demanding greater recognition of their resource rights. By 1995, their efforts had gained widespread support and the government designated some 900,000 ha of rainforest as Extractive Reserves (Brown and Rosendo 2000: 216).

Although initially the Green Belt Movement's tree planting activities did not address issues of democracy and peace, it soon became clear that responsible governance of the environment was impossible without democratic space. Therefore, the tree became a symbol for the democratic struggle in Kenya. Citizens were mobilized to challenge widespread abuses of power, corruption, and environmental mismanagement….

—Wangari Muta Maathai, Kenyan Environmental Activist and 2004 Nobel Peace Prize Winner, from her Nobel Laureate Lecture

Civil society in general has used the environment to great effect to push the process of democratization in regimes where civil liberties had been restricted. During the turn towards democracy in Chile and East Asia in the 1980s, and Eastern Europe in the 1990s, protests led by environment-focused civil society groups played an important role (McNeill 2000:347-348, WRI et al. 2003:67). For example, WAHLI, a prominent Indonesian environmental group, was one of the few NGOs tolerated by the Suharto government in the 1980s (Steele 2005).

The power of the environment as a stage for social action arose for two reasons. First, environmental problems were serious and were widely known, and second, environmental protests were seen—at least initially—as less overtly "political"

and hence were more tolerated by government authorities. This ability for the environmental movement to maneuver where other civil society groups have not been given as much latitude is now manifesting in China, where activity by environmental NGOs is increasing (Economy 2005:1).

Linking Environment and Governance in the Global Poverty Fight

More than ever, national governments, international institutions, and donors are focused on poverty reduction. But their efforts have often given limited attention to the role of healthy ecosystems in providing sustainable livelihoods, and equally limited attention to the importance of environmental governance in empowering the poor. The models of economic growth that nations continue to rely on for poverty reduction—job creation through increased industrialization, intensified large-scale agriculture, industrial fishing fleets, and so on—do not fully appreciate the realities of rural livelihoods.

For example, these strategies miss the fundamental fact that if ecosystems decline through poor governance, the assets of the poor decline with them. Findings from the recently concluded Millennium Ecosystem Assessment—a five-year effort to survey the condition of global ecosystems—confirm that the burden of environmental decline already falls heaviest on the poor (MA 2005:2). This often results in an immediate drop in living standards—a descent into greater poverty. This in turn precipitates migration from rural areas to urban slums or a resort to unsustainable environmental practices—overfishing, deforestation, or depletion of soil nutrients—for bare survival's sake. For this reason alone—simply to prevent an *increase* in poverty—greater attention to ecosystem management and governance practices that serve the poor is vital. The promise that environment can be one of the engines of rural growth is all the more reason to keep environment as a focal point in poverty reduction efforts.

Refocusing the Millennium Development Goals

One way to increase the profile of environment and governance in poverty reduction is to make them more dynamic players in the global effort to achieve the Millennium Development Goals (MDGs). The MDGs represent a new commitment by the world community to concentrate on poverty alleviation. Nations have endorsed a limited set of universally accepted goals and time-bound targets, and have promised to measure progress toward these goals and hold the community of nations accountable. Goal 7 of the MDGs recognizes the connection between environmental sustainability and poverty reduction, with a specific commitment to "[i]ntegrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources" (UN General Assembly 2001).

Unfortunately, this sustainable development target is the least specific and the least understood by nations of all the MDG targets, making it easy to pass over in favor of targets that are simpler to understand and measure, such as the provision of safe drinking water, or the reduction of infant mortality. In addition, no specific measures of governance (with the exception of measuring the tenure security of urban slum dwellers) are included in the sustainable development target, so the essential tie between a healthier environment and the governance of natural resources is missing.

Furthermore, the idea that the sustainable development goal is basic to the achievement of all the other goals and central to lasting progress against poverty is acknowledged in the MDG structure, but it is not elaborated in a way that guides nations to act or gives them adequate measures of how well they are integrating sustainable development principles in their work to meet the other MDGs (UNDP 2005:3-5). Addressing these important lacks requires clearer guidance on the links between ecosystems, governance, and each MDG, as well as an expanded slate of indicators that better encompasses the governance dimension of these goals.

Refocusing Poverty Reduction Strategies

Much the same kind of criticism can be made of the process that developing countries are using to design their national efforts to reduce poverty. Guided by the World Bank, poor nations are drawing up formal plans—called *poverty reduction strategy papers*, or PRSPs—that describe how they envision creating the conditions for growth and social development that will raise incomes and lower national poverty rates (Bojö and Reddy 2003:3).

PRSPs themselves represent a significant step toward pro-poor development. They arose out of the realization that the structural economic reforms recommended in earlier decades by the International Monetary Fund and the World Bank—polices such as market liberalization and an emphasis on export-oriented trade—have not yet produced enough growth in many poor nations to result in sufficient progress against poverty (Reed 2004:7-9). Therefore the Bank and the IMF have encouraged poor nations to draw up their own blueprints for poverty reduction through a process of national consultation. Being self-generated, it is hoped these strategies will better engage poor nations' poverty efforts and provide a guide for development aid from the World Bank and wealthy nations (IMF 2004:3).

Just as with the Millennium Development Goals, however, the initial attempts at poverty reduction strategies have taken little note of the centrality of ecosystems in the lives of the poor and the need to enhance the ability of the poor to govern them as sustainable sources of income. For example, a survey of initial PRSPs in 11 West African nations showed that they paid little attention to the small-scale fishing sector, even though this sector provides one of the major sources of livelihoods for the poor in the region and is faced with a declining resource base (FAO 2002:iv). More generally, analysis has shown that environmental concerns are often poorly mainstreamed in PRSPs.

This is beginning to change as PRSPs mature from draft to final versions (Bojö et al. 2004:xii). For example, Cambodia's

poverty plan emphasizes the importance of increasing environmental income through community forestry and small-scale fisheries management, as well as better market access for small farmers (Cambodia PRSP 2002:53, 60-61). Still, few PRSPs contain quantified, time-bound targets for improved environmental conditions or better resource management (Bojö et al. 2004:xii).

Since PRSPs provide a national roadmap to poverty reduction, it is particularly important that they do a better job of highlighting the role of natural resources in rural development and prioritizing the need to strengthen local capacity to manage ecosystems. This means they must grapple with the issue of how best to devolve control over natural resources to local communities in a way that empowers the poor rather than simply transferring power to local elites. PRSPs must also adopt a long-term perspective that identifies lasting poverty reduction with sustainability, rather than focusing totally on short-term economic growth. Typically, PRSPs do not reflect long-term strategic thinking about the environment (Bojö and Reddy 2003:1, 9) or the consequences of possible environmental change from climate instability, land use change, pollution, population, or other forces.

From Vulnerability to Wealth

Progress on incorporating ecosystems and governance into the Millennium Development Goals and the PRSP process is only a first step in the effort to make the environment a way out of poverty, rather than another source of vulnerability for the poor. Completing this transition will require much more. It will demand local institutions that are accessible to the poor and empowered to manage local ecosystems; secure tenure that gives the poor a legal stake in good resource management; and viable models to commercialize nature-based products and services, including access to credit, transportation, and marketing savvy. And it will demand scientific guidance and technical help to optimize ecosystem management at low cost, and to ensure that local uses of nature do not threaten ecosystems at larger geographical scales and are consistent with national environmental goals. Facilitating this must be pro-poor political change that increases the accountability of government officials and service providers to the poor, and recognizes the potential role of the poor in national economic growth.

The chapters that follow expand on these themes, providing examples of the vital role that nature can play in poverty alleviation if governance, economic, and management factors are aligned. In doing so, it shows how both social and environmental goals depend on each other for their achievement and must be pursued simultaneously. *World Resources 2005: The Wealth of the Poor* is not only an exploration of the power of nature to provide sustainable livelihoods and support rural growth that increases the incomes and options of the poor. It is equally an exploration of the power of nature as a means toward democratic change and greater social equity.

BOX 1.4 POVERTY AND GOVERNANCE IN A GLOBAL FRAME

MANY OF THE OBSTACLES THE POOR FACE IN turning their natural assets into wealth manifest themselves at the local and national levels. But these governance and economic obstacles often have their roots in policies and practices at the global level. The arenas of international trade, development aid, and international finance and investment influence global poverty trends, in as much as they influence the broad economic and political setting that poor people find themselves in.

Over the past five years, the controversy over the benefits and dangers of globalization has highlighted the power of international policies to affect poverty. This influence can be positive: inflows of capital, goods, and services to developing countries exceeded US$2.5 trillion in 2003 (World Bank 2005). Several East Asian countries like China, Korea, and Taiwan have used export-oriented trade to spur the economic growth that helped many of their citizens escape poverty. China has also attracted large quantities of foreign direct investment, another growth accelerant. Remittances that immigrants to industrialized countries send back home provide a vital source of funds for many developing nations. In addition, industrialized countries provide significant amounts of technical assistance and foreign aid to developing countries—more than US$76 billion in 2003 (World Bank 2005).

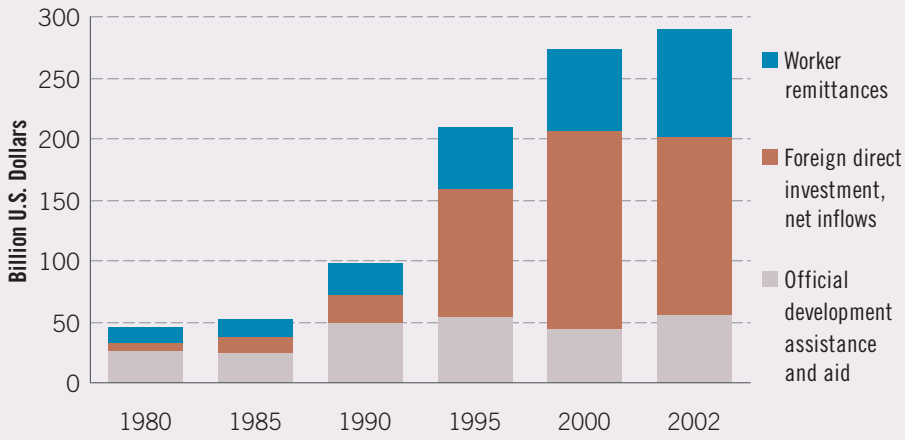
But the fact remains that just as national power is generally controlled by a limited group of powerful individuals and companies, international economics and politics are also dominated by a limited group of wealthier countries. Even when benefits to poor countries do occur, they tend to be restricted to a few countries with the ability to compete in the global marketplace. In 2003 only ten percent of all exports from developing countries originated in the 61 nations classified as "Low Income" by the World Bank (World Bank 2005).

The resulting inequality in global power can exacerbate the causes of rural poverty, dampen growth in developing nation economies, or encourage models of development that may be less effective at reducing poverty. This is why decisions made in industrialized countries are the focus of so much attention in the worldwide debate over poverty reduction.

RICH COUNTRIES DOMINATE GLOBAL EXPORTS

Source: World Bank 2005

FINANCIAL FLOWS TO DEVELOPING COUNTRIES, 1980-2002

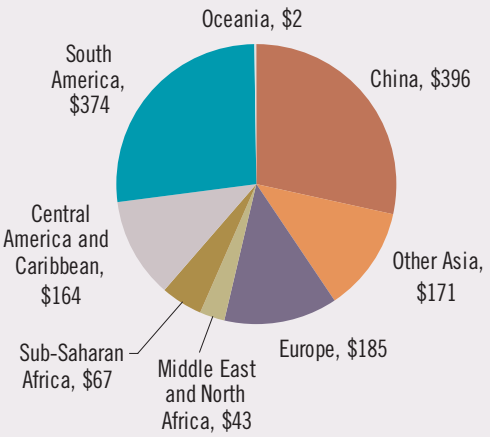


Source: World Bank 2005

Capital inflows can act as a growth accelerant to developing economies. They typically take one of three forms: (1) Official aid includes grant and loans by governments and international institutions to developing countries to promote economic development and welfare; (2) foreign direct investment (FDI) is private investment in a foreign economy to obtain an ownership interest in an enterprise; (3) Worker's remittances include the transfer of earned wages by migrant workers to their home country.

FOREIGN DIRECT INVESTMENT IN LOW- AND MIDDLE-INCOME COUNTRIES, 1993-2002

Total Investment in Billion US Dollars



Source: World Bank 2005

The Effects of Private Investment Are Mixed

Foreign direct investment (FDI)—the acquisition of an ownership interest in a private enterprise—became the dominant route for money flowing from rich to poor countries after the liberalization of global financial markets in the 1970s (Oxfam 2002:11, 15). In 2002 the overseas investments of 64,000 corporations supported 53 million jobs worldwide (UNCTAD 2003:4).

Private investment does not necessarily benefit the poor, however. In the past decade, 80 percent of the private investment in developing countries has gone to just 15 countries—and they are not the world's poorest countries (World Bank 2005). In 2003, for example, the 50 least-developed countries received only 4 percent of private investment to developing countries (UNCTAD 2004:48; World Bank 2005). The investment environment in poor countries is often unattractive, for they lack the economic stability, coherent legal system, and physical infrastructure that investors seek.

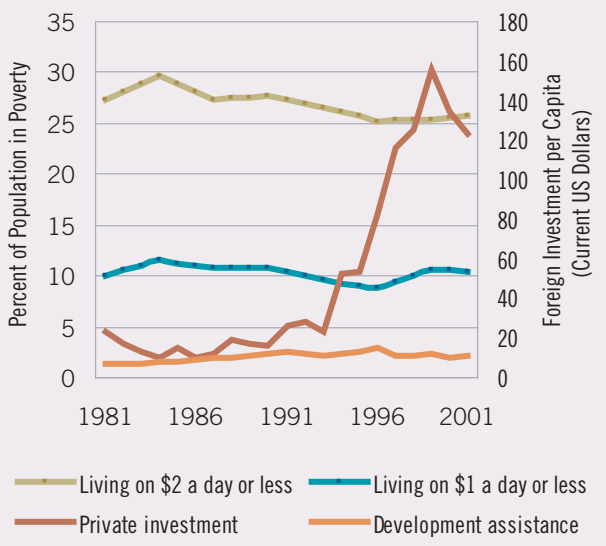
In addition, FDI is typically channeled into infrastructure and larger-scale investments, rather than small or medium-scale enterprises that might benefit the poor. Thus FDI investments may help the poor in the long term, but have not been proven to reduce poverty in the near term. In Latin America, foreign private investment has increased sixfold since 1981 due to expansion in the oil, gas, timber, water, and mining sectors. However, the percentage of the population living below the poverty line has not changed significantly, and the absolute number of poor people in Latin America actually increased from 200 million in 1990 to 225 million in 2003 (World Bank 2004; FAO 2004).

Private investment can help developing nations acquire capital to fund domestic projects, receive new technology and skills, and improve productivity. Without proper regulations, however, it can also increase economic volatility if investors lose interest and pull out. Economic volatility has historically hurt the poor. Since the 1970s, wages have declined in developing countries during economic contractions without expanding to previous levels during periods of growth. An analysis of 32 developing countries experiencing currency crises shows a total wage loss of $545 billion between 1980 and 1998; subsequent recoveries only offset about one-third of this loss (Oxfam 2002:33-36).

International Aid Can Miss Its Target

The international community plays an important role in providing technical and financial support to developing countries. From 1998 to 2003, official development assistance increased by more than one-third, to US$76 billion (World Bank 2005). There has been a concerted effort by donors in the last decade to focus more on poverty reduction in the broadest sense, and most aid agencies are now actively working to support the Millennium Development Goals (MDGs).

TRENDS IN INVESTMENT AND POVERTY RATES, LATIN AMERICA AND THE CARIBBEAN, 1981-2001



Source: World Bank 2004, 2005

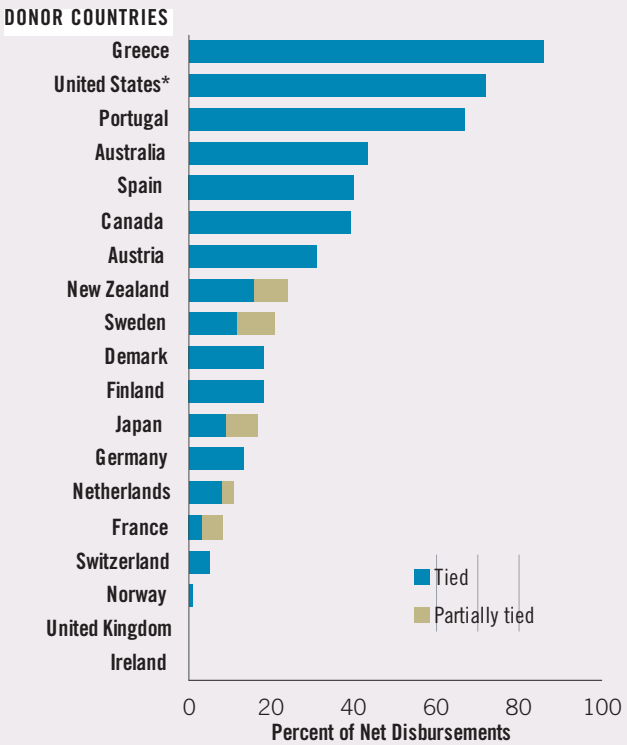
BOX 1.4 POVERTY AND GOVERNANCE IN A GLOBAL FRAME

Accompanying this move towards a greater poverty focus has been a shift by donors away from funding individual projects and toward more programmatic support. While this is a welcome development, many countries still formally "tie" their aid, requiring it to be used to purchase goods or professional services from the donor country. This has been estimated to reduce aid effectiveness by roughly 25 percent compared to untied aid (World Bank 2005).

Technical assistance (TA) is earmarked in many aid packages to provide countries with the knowledge to utilize aid effectively; in 2003 it accounted for more than 25 percent of all aid transfers. While TA can build capacity in developed countries, it can also divert much-needed funds away from their intended recipients. For example, records from the United Kingdom Department for International Development reveal that the 34 largest recipients of its TA contracts are private firms in developed countries (Greenhill and Watt 2005:22).

There has been an ongoing international campaign to reduce the debt that many low-income countries have accumulated over the years. Some debt relief has been forthcoming, but many argue that more is needed (UNDP 2003:14-15, 49). Advocates of development assistance worry, however, that aid agencies measure debt relief in a way that exaggerates its importance relative to other types of aid, since it does not represent actual monetary transfers to a country or contribute directly to poverty reduction (Greenhill and Watt 2005:20).

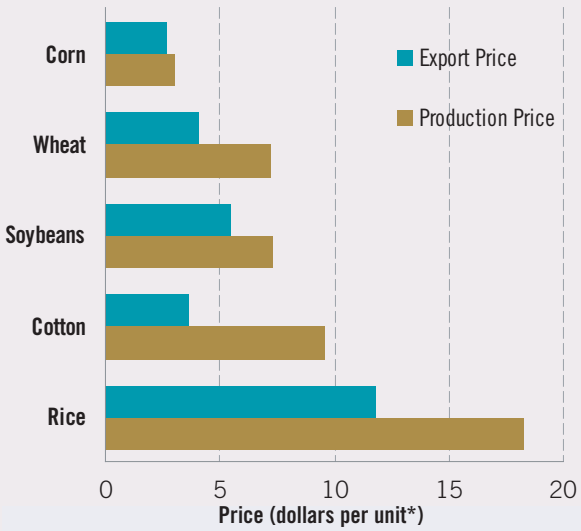
CONDITIONALITY OF DEVELOPMENT AID, 2002



* Data are from 1996.

Source: United Nations Millennium Project 2004

U.S. AGRICULTURAL PRICE SUPPORTS, 2002



*Corn, wheat, soybeans: bushel; cotton: pound; rice: hundredweight

Source: Environmental Working Group 2005; World Bank 2005

Agricultural Trade Policy Favors Industrialized Countries

The world's existing trading system puts most developing countries at a disadvantage. Agricultural products, which make up the main exports of many developing countries, still face heavy tariffs in rich countries. It has been estimated that developing countries would gain well over US$100 billion a year from trade liberalization resulting in reduced tariffs—much more than they receive in current aid flows (Anderson 2004:14-15, 49).

At the same time, rich countries often subsidize their own farmers and the agricultural products they sell abroad. These subsidies enable the products to be sold on world markets at prices below the cost of production. Such "dumping" practices deprive developing countries of vital export markets and suppress world agricultural commodity prices (Murphy et al. 2004:2-5).

Agricultural subsidies are currently high on the agenda of the World Trade Organization (WTO), which provides a forum for

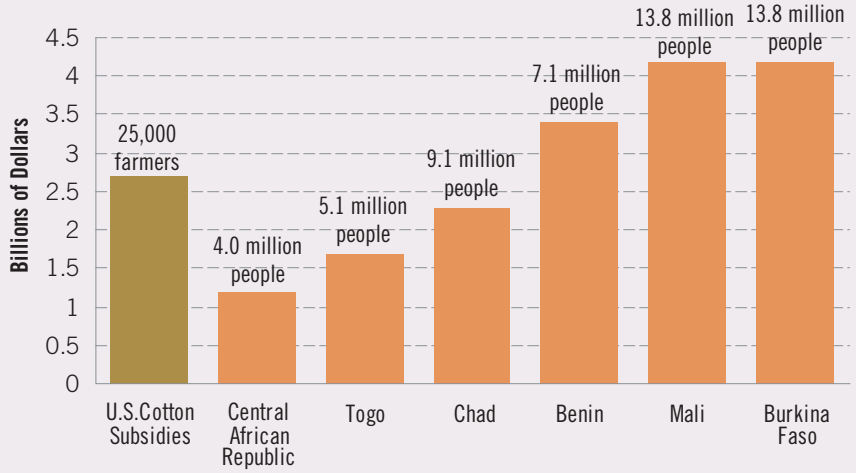
AFRICAN COUNTRIES' DEPENDENCE ON SINGLE-COMMODITY EXPORTS

		PERCENT SHARE OF		
Country	**Commodity**	**Gross National Income**	**Total Merchandise Exports**	**Total Agricultural Exports**
Malawi	Tobacco leaves	23.8	59	74
Sao Tome and Principe	Cocoa beans	16.9	69	97
Burundi	Coffee	7.2	75	83
Kenya	Tea	6.5	26	42
Guinea-Bissau	Cashew nuts	6.3	48	91
Chad	Cotton	5.7	37	71
Ethiopia	Coffee	5.4	62	69
Burkina Faso	Cotton	4.9	39	77

Source: FAO 2002

Many developing nations depend heavily on agricultural exports. These nations are susceptible to fluctuations in prices for the commodities they export, and are hurt by subsidies and dumping in these markets by developed nations.

FAIR TRADE?
U.S. COTTON SUBSIDIES AND THE GROSS DOMESTIC PRODUCT OF SELECTED COTTON-EXPORTING COUNTRIES, 2003



Source: Environmental Working Group 2005

Annual subsidies for 142,000 cotton growers in the United States have averaged $3 billion in recent years. Eighty-five percent of these subsidies go to 25,000 farmers. This is roughly comparable in size to the entire economy of some African countries dependent on cotton exports. Country populations in 2003 are shown above each bar.

negotiating global trade agreements. The WTO offers some advantages for developing countries in that each country has an equal vote, so developing countries comprise the largest group. Still, the world's largest trading nations have historically dominated the WTO's trade negotiations. That may be starting to shift, as shown by the coordinated action taken by developing nations at the WTO's meeting in Cancun in 2003, where they refused to back down from their demands (CAFOD 2003).

Nonetheless, wealthy nations continue to hold enormous trade advantages. Using export credit agencies, they invest millions of dollars each year to build markets for their own exports (Maurer 2003:13). They also pursue bilateral trade agreements with individual or small groups of developing nations. In bilateral negotiations with strong trading powers such as the United States or the European Union, developing countries have a much weaker negotiating position than at the WTO.

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.

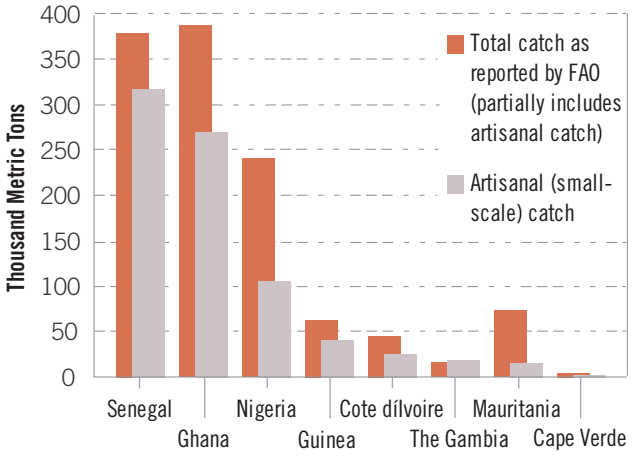
Environmental income can be derived in several distinct ways. Income might accrue to households through direct use of ecosystem services, for instance, by consuming bushmeat and other wild foods, cutting fodder for livestock, using wood products in home construction, or eating produce grown in a home 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.

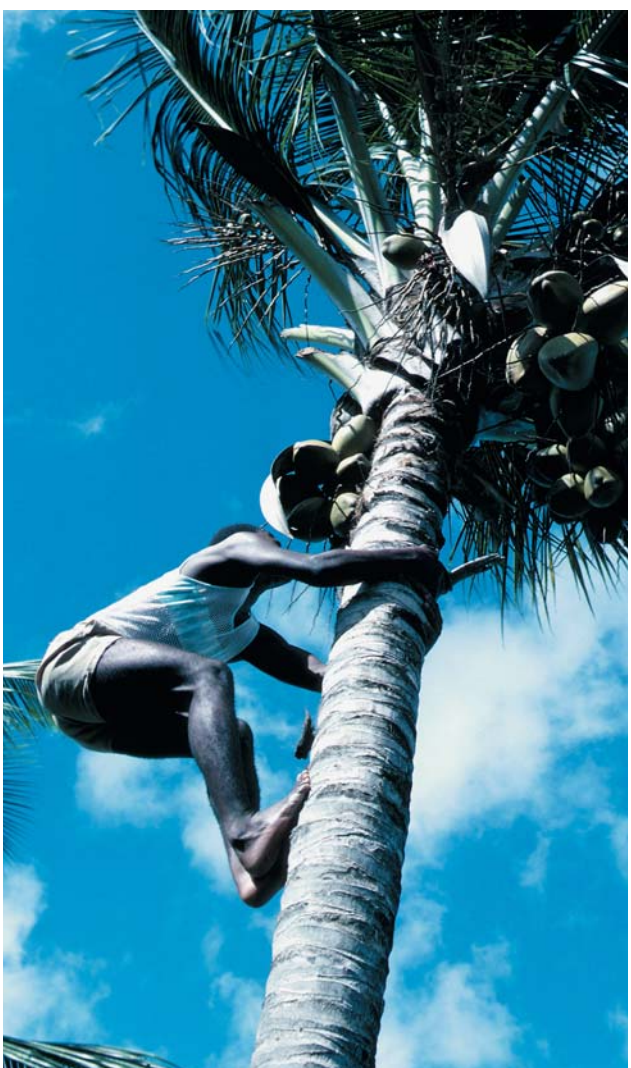
ADOPTING A *LIVELIHOODS APPROACH* TO DEVELOPMENT

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).

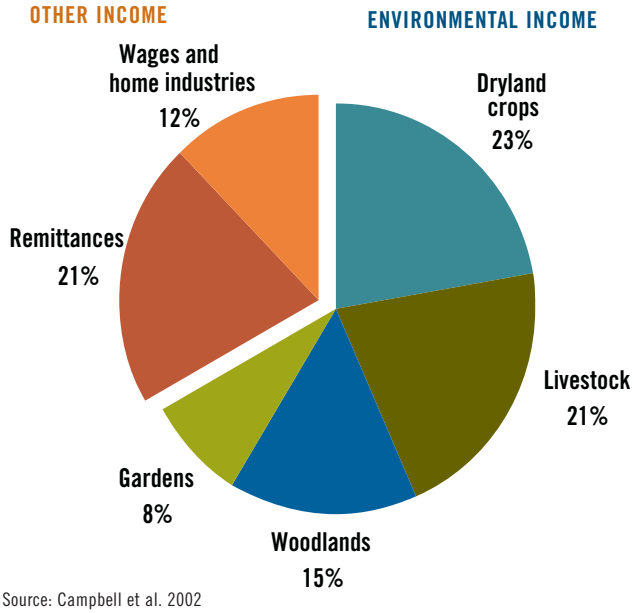
The balance between agricultural income and wild income varies by location, with agriculture supplying more income in some areas, and wild income more in others. For example, a recent survey in the Jhabua district of Madhya Pradesh, India, found that agriculture provided 58 percent of total income of 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).

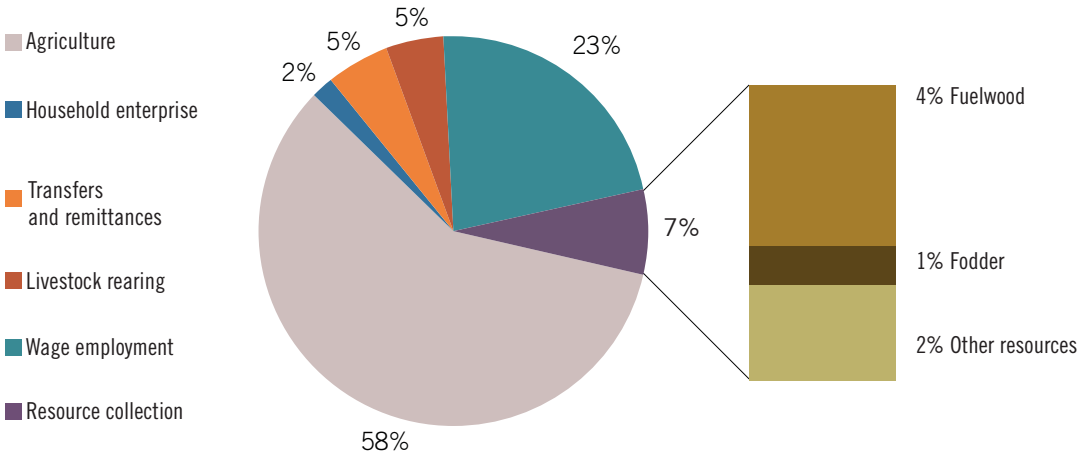
Just how important are they? Research over the past two decades has amassed a fair amount of evidence on this topic, particularly in India. N.S Jodha, in his pioneering study of 80 villages across seven semi-arid states in India, found that the poor make extensive use of common areas, with CPRs contributing 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.

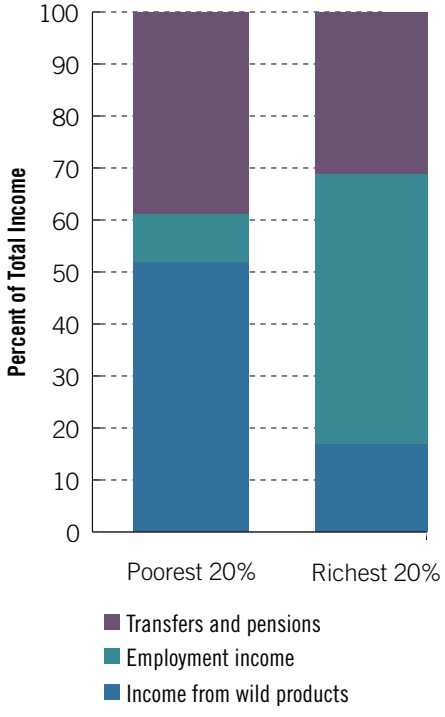
GLOBAL STATUS OF PROVISIONING, REGULATING, AND CULTURAL ECOSYSTEM SERVICES EVALUATED IN THE MILLENNIUM ASSESSMENT

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.

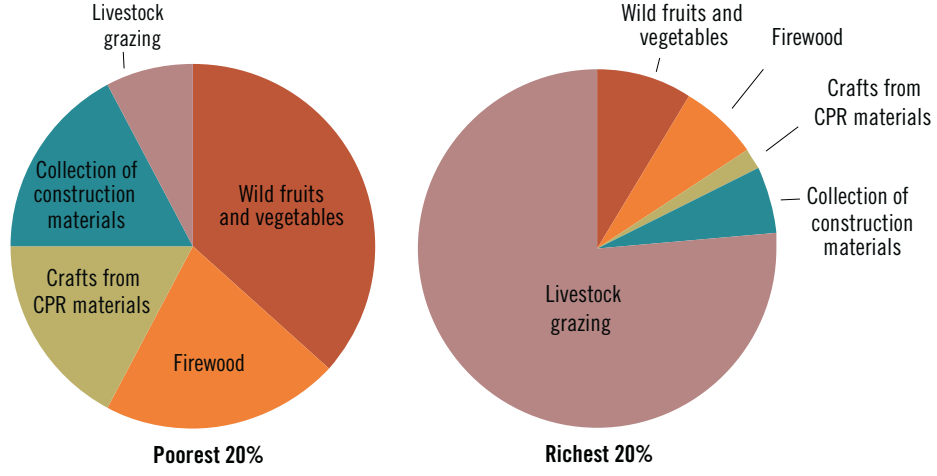
On the other hand, even if the rich capture greater environmental income, they tend not to be as dependent on such income as are the poor. Environmental dependency and poverty seem to go hand in hand. A 1999 study of 12 Himalayan villages found that the poor relied on natural resources for 23 percent 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

Continues on page 47

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.

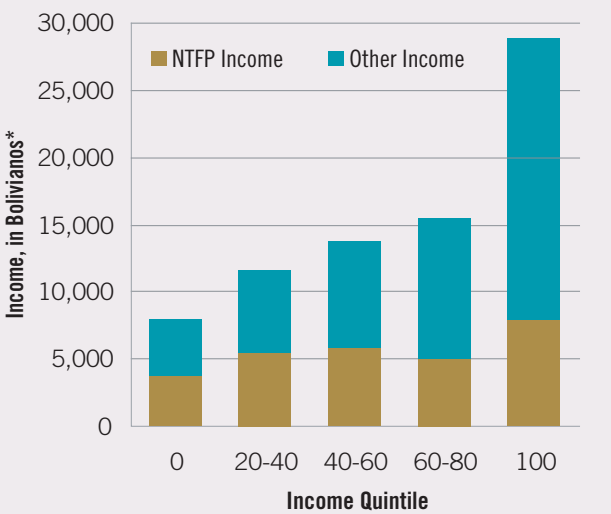
A study conducted between 1996 and 1999 in the outskirts of Riberalta, a rapidly growing city in northern Bolivia, showed that households gain a significant proportion of their income from the collection and processing of Brazil nuts and palm hearts. These peri-urban neighborhoods are peopled largely 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).

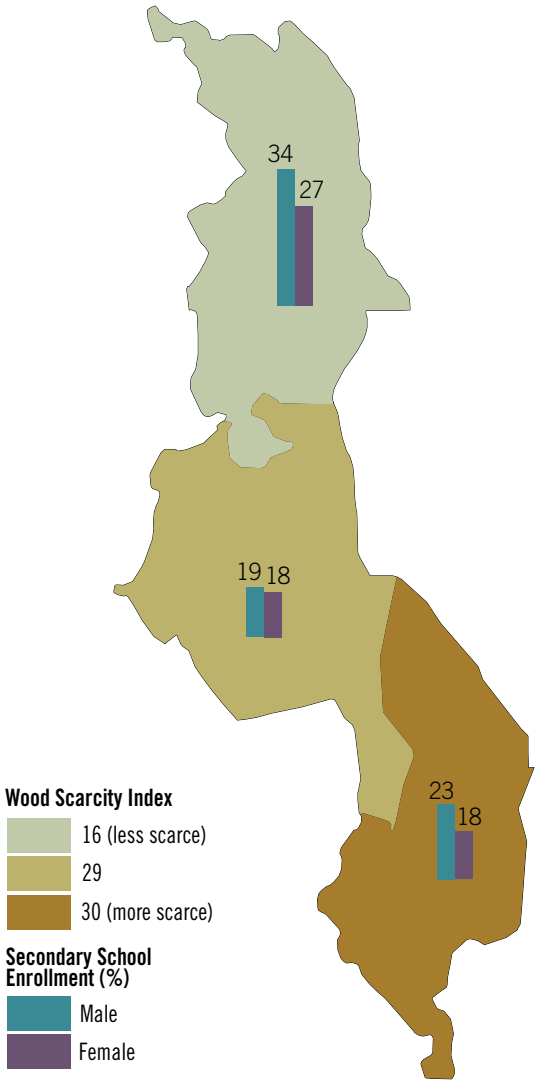
The role of livestock in rural communities extends significantly beyond their economic value. Most notably, livestock play a prominent role in social and cultural relationships. Loans and gifts of livestock contribute to family and community ties and often play a central role in cultural traditions such 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.

The patterns and institutions of governance are the critical factors determining how effectively the poor can harness ecosystems for their livelihoods.

CHAPTER 3

THE ROLE OF GOVERNANCE

AN ABUNDANCE OF NATURAL RESOURCES DOES NOT necessarily translate into wealth for the poor. To make nature a source of prosperity for poor communities requires supportive governance conditions: policies and laws that protect the rights of the poor, coupled with responsive institutions that promote their interests. Without these, the presence of high-value resources like timber, gold, diamonds, or oil can actually be detrimental to poor communities, providing a target for exploitation by outside business interests and politicians. Too often, the result is that most of the revenues are appropriated by others, leaving the community—and local ecosystems—worse off than they were prior to "development."

Even where high-value resources are not present, the patterns and institutions of governance are usually the critical factor determining how effectively the poor can harness ecosystems for their livelihoods. Where laws are biased against the poor and government practices disenfranchise them, the potential for better management of ecosystems to alleviate poverty is greatly diminished.

This chapter examines key governance conditions that influence whether nature becomes a source of wealth and prosperity for many, or merely a select few. It focuses on the three governance factors with the most concrete impacts on the poor and their capacity to derive environmental income: *resource tenure and property rights; decentralization of resource management; and the rights to participation, information, and justice.*

These factors revolve around the rights of the poor to physically access and control natural resources, and their right to be heard in decisions about how to utilize these natural resources.

Resource Tenure and Property Rights: Access and Ownership

A person or community's rights to land and other natural resources defines their natural resource tenure. Legally, tenure is a bundle of both rights and obligations: the rights to own, hold, manage, transfer, or exploit resources and land, but also the obligation not to use these in a way that harms others (Bruce 1998a:1; FAO 2002:10). In other words, tenure defines *property* and what a person or group can do with it—their *property rights*.

However, tenure is not only a legal concept but a complex social institution, often involving traditional practices and customary authorities as much as formal laws. It governs ownership and access to natural resources, which is the gateway to use and benefit from these resources. As such, tenure is at the heart of the poor's ability to derive income and subsistence from ecosystems—to make them part of a sufficient and sustainable livelihood. *(See Box 3.1.)*

In many parts of the world today, resource tenure systems and property rights regimes are undergoing an important evolution. Fundamental shifts are occurring in the way that people and institutions think about the ownership of land, water, forests, fisheries, and other natural assets—about who controls these assets, who benefits from them, and where the power to make decisions about them is vested.

Two countervailing global trends in the evolution of resource tenure are evident. One trend stems from globalization. The growing economic integration of nations and societies has increased the sphere of private property and private responsibility, with government assuming a lesser role with respect to the private sector and civil society. This has important implications for how public lands and natural resources—often common pool resources—are managed, with more power over resources transferred to corporate interests through privatization or the granting of resource concessions (Johnson et al. 2001).

At the same time, there is a trend toward decentralization of natural resource management. Local and community-level institutions have become more assertive in the management of local resources, and this decentralized approach also has important implications for resource tenure. Indigenous groups have, for example, been more vigorous in pressing their ancestral claims to lands they inhabit but to which they lack formal title.

These two trends are shaping—and promise to profoundly transform—the capacity of the poor to earn environmental income from natural resources. For example, as illustrated in a study on the impact of globalization on the implementation of community-based natural resources management (CBNRM) in the Philippines, these global trends have the potential to both undermine and strengthen governance conditions that benefit the poor (La Viña 2002:24). Growing economic integration through increased trade and the emergence of multilateral environmental agreements, such those as on climate change and biodiversity, pose both threats and opportunities for poor communities worldwide.

The significance for the poor of changes in resource tenure systems and property rights systems is not limited to their economic impacts. For many rural communities, resource tenure is a central social institution that governs not only their relationship to the land and natural resources but also the relationships between families, between members of the community and those outside it, and between villages, communities, and peoples. Therefore, changes in tenure and property regimes have implications for the entire social fabric of rural communities. This is true for all tenure and property systems relevant to natural resources, but is particularly evident in the evolution of land tenure.

ENVIRONMENTAL INCOME AND THE POOR: CRITICAL GOVERNANCE QUESTIONS

Resource Tenure: How do property rights enhance or restrict the ability of poor people to derive environmental income? In particular, what is the role of resource tenure in enabling the poor to transform nature into an economic asset? How crucial is security of land tenure to the poor's ability to benefit from natural resources? How important to the poor are community-based forms of tenure?

Decentralization: What effect do institutions such as national forestry or fishery departments, district governments, or village councils have on the ability of the poor to access or sustain environmental income? What is the role of the state in natural resource management, and how does the transition to decentralized and community-level institutions (such as tribal structures, local levels of government, cooperatives, user groups, or watershed committees) affect the poor? When is decentralization the solution to poverty, and when does decentralization work against the poor?

Participation, Information, and Justice: How does political disenfranchisement prevent the poor from utilizing their natural endowments for more than mere subsistence livelihoods? Conversely, what is the role of democratic rights in ensuring that poor people benefit from natural resources? How can poor people use better access to information, public participation through their representatives, and access to the courts when their rights are violated to increase their capacity to earn environmental income? What are the challenges of providing appropriate information, participation opportunities, and real judicial or administrative access to poor communities?

The Insecurity of the "Landed Poor"

Most of the rural poor in developing countries have some access to land on which they can collect forest products, graze animals, grow crops, gather medicinal plants, or in other ways benefit from nature. These "landed poor" typically remain poor not only because their land holdings are small, but because their rights to the land are weak, their tenure insecure (Bruce 2004:1).

Insecure tenure translates to a lack of assurance that one's land or resource rights will be respected over time (Meinzen-Dick et al. 2002:1). In many countries of Southeast Asia, for example, long-term forest dwellers such as indigenous peoples and local farmers often have *de facto* access to forests, but their tenurial control over trees, timber, and the right to manage forest uses is often limited in scope and unrecognized in law (Lynch and Talbott 1995:29). For instance, the traditional system of forest tenure (called *adat*) recognized by many forest dwellers in Indonesia has often been ignored by the government, which asserts legal ownership of all forest areas in spite of customary or historic uses (WRI et al. 2000:36-37).

In addition, the ability of the rural poor to participate in political decisions that affect their livelihoods often is limited by the power of other, more politically connected, parties with an interest in the same resources. Government agencies, corporations, large landowners, poor farmers, indigenous peoples, and different ethnic or cultural groups frequently make overlapping and conflicting claims on the same set of natural resources. Unfortunately, unless the tenure rights of the poor are secure, they usually lose out in these conflicts over competing claims (Alden Wily 2004:5).

While many forms of resource tenure are important, land tenure—rights over the land itself—is often the most fundamental building block of prosperity for the poor (Deininger et al. 2003:5). That is because land rights underpin most other resource rights, with the exception of offshore marine resources. Without secure land tenure, it is difficult to conceive of the poor being able to generate wealth from nature.

Tenure Security and Environmental Investment

Security of tenure exerts tremendous influence on how land and resources are used. Secure tenure can be defined as the certainty that a person's rights to continuous use of land or resources will be recognized and protected against challenges from individuals or the state. This kind of certainty provides an incentive to make long-term investments in maintaining or enhancing the productivity of that property. For instance, a person with the right to use an agricultural field for decades or a lifetime may invest in an irrigation system whereas a farmer leasing a field for only a year will not (Bruce 1998a:2).

When insecurity of tenure acts as a disincentive to long-term investments in soil conservation, irrigation, and the like, land quality can deteriorate and agricultural productivity suffer. For this reason, tenure reform is frequently a component of development projects aimed at enhancing food security and sustainable livelihoods for the rural poor. Tenure reform is distinct from land reform in that it does not redistribute parcels of land per se, but rather makes adjustments in the rights to hold and use land. Examples of land tenure reforms include strengthening informal tenure rights by making them legally enforceable and transforming state-issued permits for specific land uses into leases that provide more protection for users of the land (FAO 2002:20).

Continues on page 59

BOX 3.1 UNDERSTANDING THE SCOPE OF RESOURCE TENURE

UNDERSTOOD BROADLY, "TENURIAL RIGHTS" over natural resources are synonymous with "property rights." Tenure covers all the means by which individuals and communities gain legitimate access to and use of natural resources. To know who has tenure over a natural resource is to identify who owns the resource, who can use or extract it, who can exclude others from having access to it, and who benefits from exploiting it. As such, the details of how tenure is determined and recognized—particularly through national laws and policies—greatly affects the rural poor, whose lives depend on access to ecosystems.

Typical tenure rights and obligations include:

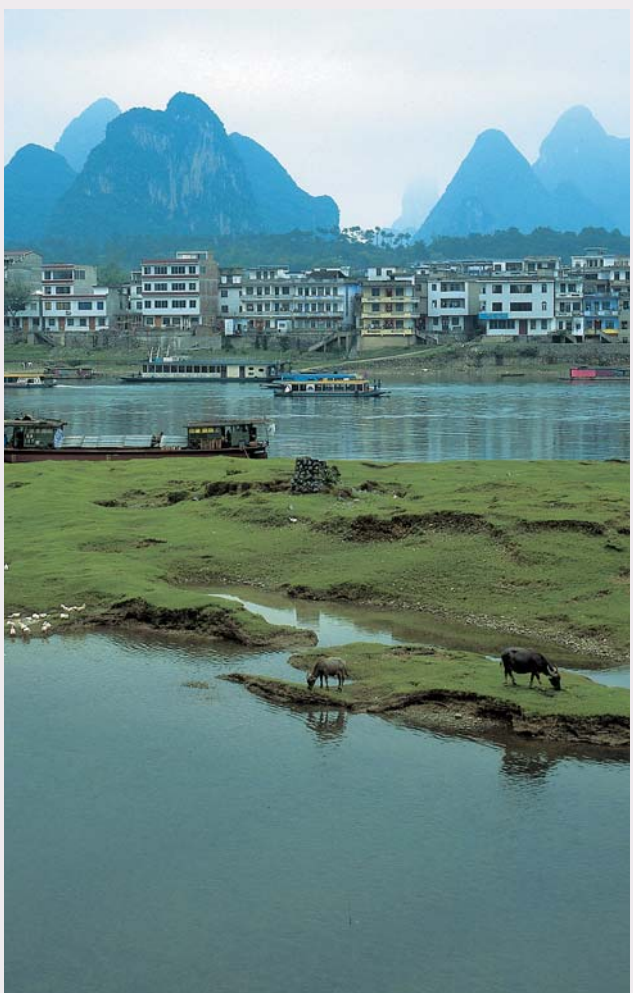
- The right to use the resource (the "usufruct" right) or control how it will be used
- The right to exclude others from unauthorized use
- The right to derive income from the resource
- The right to sell all or some of these rights to others, either permanently, or for a limited time (such as through a lease)
- The right to pass these rights down to one's successors (the right of descendants to inherit land or resource rights)
- Protection from illegal expropriation of the resource
- An obligation not to use the land in a way that is harmful to others
- An obligation to surrender these rights through a lawful action, (e.g., in a case of insolvency, the rights are surrendered to creditors; in the case of default on tax payments, the rights are surrendered to the state) (FAO 2002:10)

Resource tenure includes rights over land, but it encompasses other natural resources as well. Land tenure is the usual focus of public interest, but distinct tenure arrangements apply as well to forest resources (Lynch and Talbot 1995), fisheries (Kinch 2003; Pereira 2000), mangroves (Hue 2002), wetlands (Rahman et al. 1998), watersheds (Kumar et al. 2004; Ayudhaya and Ross 1998), wildlife (Alinon 2002; Hasler 2002), and other natural resources. In a forest, tenure might translate not just to the right to harvest timber but to the ability to harvest fruit from certain trees, to collect fallen branches for fire wood, or bamboo for building materials. In fisheries it might mean the right to fish certain waters, harvest certain species but not others, or fish at certain times of the year.

Resource tenure covers not only formal property rights recognized by the legal system and enforced by the government, such as land titles or forestry licenses. It also refers to traditional practices—often unwritten and informal—through which rural people secure access to natural resources. Official documents issued by the government are not the only ways that tenure is recognized in rural areas. Evidence of long-term occupation or of observance of customary law are other recognized ways of establishing tenure. Experience shows that where states emphasize the use of formal processes and official documents to acknowledge resource tenure rights, it is likely that poor communities, particularly indigenous peoples, will be disenfranchised (Lynch and Talbot 1995:7).

Tenurial rights include but are not equivalent to ownership. The absence of full ownership over a natural resource does not preclude the possibility of other tenure rights over a natural resource (Schlager and Ostrom 1992:256). For example:

- The state may own the forests in its territory but recognize the right of occupants to utilize timber or non-timber resources through some kind of permitting system.
- Protected areas may be part of the public domain, but the right of indigenous peoples and other long-term occupants to inhabit these areas may be legally recognized.
- Coastal waters may be claimed by the state, but local fishers may be granted rights over customary, near-shore fisheries.

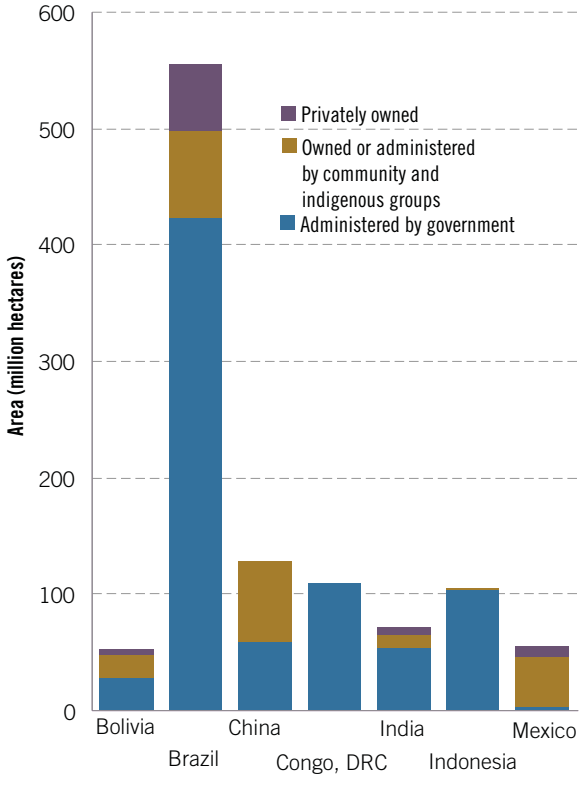


This is true as well for tenure rights over forests, fisheries, and other natural resources where the benefits of good stewardship can only be gained over time. For example, given their limited resources, it is unlikely that the poor would see a value in investing in sustainable forest management practices, including reforestation, if their tenure over forests is restricted and they can't count on reaping the benefits of such practices. Tenure reform, in this context, would require addressing these tenure insecurities by providing longer time-frames for forest management agreements, or by recognizing the communal ownership rights of groups who have long occupied forest lands. Thus, one study of joint forest management agreements in India—agreements between local communities and the state allowing limited local management and use rights on state forest lands—notes an urgent need to first resolve the issue of tenure security to give these community-state agreements a foundation for success (Reddy and Bandhii 2004:29).

Security of tenure is important for poverty reduction because it allows poor people to grow more food, harvest products for consumption or trade, invest more in economically productive activities, or use property to obtain credit. Some studies report that investment doubles on land where tenure is strengthened (Feder 2002, cited in Deininger et al. 2003:8). Recent research also indicates that countries with equitable, efficient land tenure systems, ensuring property rights for both women and men, tend to achieve faster, more sustainable economic development with high levels of food security, health, and welfare (FAO 2002:5; Deininger 2003:17-20).

Case studies from Asia, Africa, and Latin America have also shown that tenure security affects people's long-term investments in modern management practices that can raise productivity, such as agroforestry techniques, livestock feeding practices, or integrated pest management (Meinzen-Dick et al. 2002:1). Failure to invest in agriculture, fisheries, and forest management due to tenure insecurity can greatly impede development goals. In Ethiopia, the nation's tenure regime changed radically in 1975 as the government nationalized all rural land with the intent to distribute land rights more equitably. Unfortunately, continued changes in tenure laws, a growing rural population, and insufficient land to meet demands, have led to markedly insecure land tenure for many. This has undermined investment in agriculture, worked against food security, and contributed to land degradation (Kebede 2002:138-140).

FIGURE 3.1 THE IMPORTANCE OF COMMUNITY-OWNED FORESTS



Communities own or manage a significant percentage of the world's forests, some 22 percent in developing countries. However, the fraction of forest under community management varies widely by country. In Mexico, over 80 percent of commercially harvested forests are controlled by the people who live in and around them.

Source: White and Martin 2002; Antinori et al. 2004

The Importance of Communal Tenure

Property rights can be held by private entities or by the state, and by an individual or a group. Property rights experts generally identify four basic kinds of tenure or ownership (FAO 2002:8):

- *Private,* or owned by an individual, corporation, or institution;
- *Communal,* or owned in common by a defined group of individuals, such as a village, tribe, or commune;
- *State,* or owned by the government;
- *Open access,* or owned by no one.

The term "communal" has been used to cover a plethora of ownership situations, ranging from resources that can be used by virtually anyone (more accurately described as open-access) to resources that are used simultaneously or serially by multiple users, such as land on which all community members have grazing rights or traditional fishing grounds where they can fish. It also applies to tenure arrangements in which ownership is vested in the community, which in turn allocates land or other resources among households for cultivation, resource extraction, and other uses. Communal tenure systems thus may encompass strong household and individual rights to use a particular resource or parcel of land, often passed down by inheritance through a family. In fact, holding exclusive use-rights in a traditional, community-based tenure system can be as secure as private, individually titled property rights in Western countries (Rukuni 1999:4). *(See Figure 3.1.)*

Property rights regimes involving significant communal control over land or resource use have been the prevailing land

tenure arrangements in Africa and Asia for centuries. More recently, however, European colonial powers introduced the western concept of private, individual property. In colonial Africa, both the British and the French created enclaves of individually owned property in urban areas as well as white settler farms, but only cautiously expanded the concept of individually titled property to selected Africans (Bruce 2000:17). Among West African countries, individualized tenure often appeared in tandem with the introduction of cash crops for export (Elbow et al. 1998:5).

Contrary to the belief of some Western observers, communally owned resources (which are a form of common pool resources) are not inevitably subject to overuse and destruction—the so-called "tragedy of the commons" popularized by Garrett Hardin in his scholarly article in 1968 (Hardin 1968). Hardin's thesis—that natural resources held in common will inevitably be overused—more accurately pertains to open-access resources rather than to communally owned and managed resources. With open-access resources, such as ocean fisheries in international waters or state forests where the government presence is weak or absent, all potential users have equal access to the resource and none can be excluded. In contrast, in well-functioning communal tenure situations, the community itself is able to exclude outsiders from using the resource and to enforce norms of behavior—such as fishing or grazing limits—for its own members' resource use (Ostrom et al. 1999:278).

Recent research has shown that community-based tenure systems can be quite compatible with sustainable resource use under the right conditions. For instance, a study of two Guatemalan communities, Las Cebollas and Moran, found that when community members perceive a resource as both necessary and scarce, they invest in efforts to protect it from overuse (Jensen 2000:641). In Jordan, herder cooperatives with management rights on their traditional pastures are achieving higher range productivity than state-managed reserves, without requiring expensive fencing and guarding (Ngaido and McCarthy 2004:1).

The Duality of Emerging Tenure Systems

In practice, property rights in many developing countries reflect a diversity of tenure regimes. Customary regimes based on local traditions, institutions, and power structures such as chiefdoms and family lineages may exist alongside the formal legal tenure system sanctioned by the state. Customary tenure systems have evolved and adapted over time to meet the needs of community members, and they continue to do so in response to modern-day pressures (Elbow et al. 1998:10). This includes the introduction of more individualized property rights arrangements in traditional communal arrangements.

DESIGN PRINCIPLES FOR SUCCESSFUL COMMUNAL MANAGEMENT OF NATURAL RESOURCES

Why are some groups that use common pool resources able to prevent the "tragedy of the commons" while others are not? By examining thousands of case studies, researchers have identified the following conditions as crucial for successful community management of shared resources.

1. There is a clear definition of who has the right to use the resource and who does not, and clearly defined boundaries of the resource.
2. Users feel that their obligations for managing and maintaining the resource are fair in light of the benefits received.
3. Rules governing when and how the resource is used are adapted to local conditions.
4. Most individuals affected by the rules can participate in setting or changing them.
5. Use of the resource and compliance with rules is actively monitored by the users themselves or by parties accountable to the users.
6. People violating the rules are disciplined by the users or by parties accountable to them, with penalties imposed in accordance with the seriousness and context of the offense.
7. Local institutions are available to resolve conflicts quickly and at low cost.
8. Government authorities recognize users' rights to devise their own management institutions and plans.

Adapted from Ostrom 1990:90

A rural community's customary tenure system is often composed of several different kinds of tenure, each of which defines different rights and responsibilities for the use of diverse resources. Clear individual or household rights are generally allocated for more or less exclusive use of arable and residential land, while group rights may prevail for use of pastures, forests, mountain areas, waterways, and sacred areas (Rukuni 1999:2).

But customary tenure systems today do not exist independently. They inevitably live in relationship—often uneasily—with modern state-sanctioned tenure systems. The upshot is that in many parts of the developing world, land tenure systems exhibit a dual nature—that is, property rights that are partly individualized and formalized in legal statutes, and partly community-based and grounded in customary practices (Elbow et al. 1998:16).

For example, in many African countries—including the Republic of the Congo, Cote d'Ivoire, Ghana, Mali, and Togo—land markets based on individualized tenure have developed in response to a perceived commercial potential. For instance, in Cote d'Ivoire, immigrants to forest areas "buy" land from the local population in order to produce cash crops (Elbow et al. 1998:10).

Tenure systems are also evolving because of changing patterns in herding versus sedentary agriculture. In parts of Burkina Faso, Mali, Mauritania, and Niger, tenure systems traditionally have been based on overlapping rights to use land. For example, herders might leave their animals on croplands during the dry season, effectively exchanging the soil nutrients in animal manure for the right to graze their animals on crop stubble, while sedentary farmers might grow crops on pasture land during the rainy season. Increasingly, however, cultivators are expanding into herding, and herders into sedentary agriculture. This has led to a breakdown in traditional tenure arrangements, growing tensions between competing groups, and an apparent shift from overlapping rights to exclusive rights over particular land parcels (Elbow et al. 1998:10).

The state frequently adds to these conflicts through changes in national land policies that weaken customary or community-based tenure practices. In Niger, tenure reforms in the 1960s and 1970s abolished the system of "tithe" payments that tenant farmers paid to local chiefs under customary tenure practice and asserted state ownership over all lands. The intent was to give greater land rights to tenant farmers. However, later reforms in the 1980s reasserted the right of traditional chiefs to control land use by allocating pasture and agricultural land. The confusion brought on by these land policies has created conflicts between farmers, pastoralists, and customary chiefs and landowners, and has weakened tenure security for all parties (Bruce et al. 1995:19-21.)

The dual nature of land tenure arrangements persists whether national policies explicitly recognize customary tenure systems, ignore them, or actively work to dismantle them. Attempts to completely overturn customary tenure systems and replace them with formalized systems of purely individual property rights have rarely been effective, prompting a shift in approach from replacement to adaptation (Bruce 1998b:81). For instance, in the case of forest land claimed by the state, the state may grant individuals from a community the right to collect medicinal plants or fallen branches for firewood, and local groups might have the right to plant trees, but the state might reserve the right to approve any felling of trees and to collect revenue from timber users (Meinzen-Dick et al. 2004:7). Joint forest management agreements between communities and state governments in India often follow this pattern, recognizing in law certain community use-rights but retaining for the state many of the other prerogatives of property ownership, including ultimate title.

The balance between the two components of dual tenure systems is dynamic and ever-shifting. In general, however, customary systems operate as the de facto allocators of land and natural resources in rural areas, with the rules of such allocation increasingly subject to modification by national policies and institutions and in response to changing economic conditions (Elbow et al. 1998:16-17).

Grassroots Pressure for Effective, Equitable Tenure Reform

Today there is mounting pressure for government tenure reform, a mark of the centrality and dynamism of the rural tenure issue. In part, rural populations themselves are responsible for this pressure, as land sits idle and grossly unequal land holdings

coexist uneasily with landlessness, poverty, and the hovering specter of hunger in many parts of the developing world.

Additional impetus comes from research showing that unequal access to land and other productive assets is a defining feature of persistent poverty (Riddell 2000). Peruvian economist Hernando de Soto argues that the lack of a well-defined system for recording, transferring, and enforcing the property rights of the poor is a major source of continued poverty, since it does not allow the poor to make use of their assets for collateral and credit, thus barring them from productive investments (de Soto 2000).

These and other findings have contributed to a growing consensus that establishing secure property rights and making rural land markets work for poor farmers and rural producers is one of the keys to effective poverty reduction. In fact, de Soto goes so far as to predict that the countries that achieve substantial economic progress over the next two decades will be those that have developed strong property rights institutions (Riddell 2000).

Against this backdrop, tenure reform has emerged as an essential component of a broader sociopolitical transition to greater democracy and decentralization in developing countries. Governments are starting to recognize that customary, community-based tenure systems are legal in their own right. They are beginning to put these systems on an equal legal footing with Western, individualized property rights (Alden Wily et al. 2000). Tenure reform movements are active in all regions of the developing world, including Sub-Saharan Africa, Asia, Latin America, and Central and Eastern Europe, with dozens of countries initiating major tenure-reform efforts in the past decade. For example, Thailand has recently completed a major initiative to provide the country's rural population with access to modern land registration, deeds, and credit institutions (Riddell 2000). Mexico has undertaken reforms to strengthen land and credit markets and improve the access to land among poorer households (Carter 2003:52).

Whether tenure reforms positively or adversely affect the poor depends on who designs and ultimately implements them. The extent to which the interests of the poor are represented and promoted by national and local institutions—both critical players in enforcing tenure rights—is key to ensuring that tenure reforms do in fact assist the poor.

Decentralization: Can It Help the Poor?

Across diverse economic and policy sectors, from health care and education to parks and wildlife management, decentralization is one of the most frequently pursued institutional reforms in developing countries today.

Decentralization is a process by which a central government transfers some of its powers or functions to a lower level of government or to a local leader or institution. In the natural-resource sector, an example of decentralization might be transferring from central to local government the responsibility for managing a tract of forest land, including the right to collect some of the income from sales of timber harvests in that forest. Or the central government might give a farmers group responsibility for managing an irrigation system, or grant a village

TABLE 3.1 DECENTRALIZATION: WILL IT HELP THE POOR?

Pros	Cons
Promotes democracy because it provides better opportunities for local residents to participate in decision-making.	Undermines democracy by empowering local elites, beyond the reach or concern of central government.
Increases efficiency in delivery of public services; delegation of responsibility avoids bottlenecks and bureaucracy.	Worsens delivery of service in the absence of effective controls and oversight.
Provides a chance for poor households to participate in local institutions and have their concerns recognized.	Local institutions mirror the anti-poor biases present at the state level.
Leads to higher quality of public services because of local accountability and sensitivity to local needs.	Quality of services deteriorates due to lack of local capacity and insufficient resources.
Enhances social and economic development, which rely on local knowledge.	Gains arising from participation by local people offset by increased corruption and inequalities among regions.
Increases transparency, accountability, and the response-capacity of government institutions.	Promises too much and overloads capacity of local governments.
Allows greater political representation for diverse political, ethnic, religious, and economic groups in decision-making.	Creates new tensions or ignites dormant ethnic and religious rivalries.
Increases political stability and national unity by allowing citizens to better control public programs at the local level.	Weakens states because it can increase regional inequalities, lead to separatism, or undermine national financial governance.

Source: Adapted from ICHRP 2005

council the right to manage wildlife and run a commercial tourism operation in a national park (WRI et al. 2003:97).

Decentralization is being driven by powerful economic, political, and technological forces. International development agencies such as the World Bank have placed decentralization in a prominent position on their agendas, and nongovernmental organizations (NGOs) and governments alike have promoted the concept, although often for different reasons. Advocates of decentralization cite the potential for greater efficiency, equity, and accountability when decision-making is brought "closer to the people" (Ribot 2004:7; WRI et al. 2003:92-97). In theory, devolving power from central government means empowering local institutions that can better discern how to manage resources and deliver services to meet the needs of local people. Modern communication options like the Internet, television, and mobile phones help make local people and organizations more aware of their rights, more able to communicate and organize, and therefore more capable of asserting their rights.

But are central governments really so eager to give up some of the powers they have traditionally wielded? In the 1980s and early 1990s, decentralization emerged as a priority in an era of economic and budget crises. Shifting responsibility for health care, education, parks, and other planning and service functions to local governments offered opportunities to reduce central government budget deficits. Central governments are all too willing to pass on to local and community institutions the responsibility for managing resources and delivering services without providing them with necessary financial or technical support. They tend to be much more reluctant, however, to give up their powers to collect and allocate user fees, fines, or other revenues (WRI et al. 2003:98).

Areas with rich natural resource endowments tend to be geographically isolated and far from centers of political power where the most momentous development decisions are made. Furthermore, central governments are often run by and for elites, and people from poor rural communities or ethnic minority groups seldom occupy senior positions in the decision-making levels of bureaucracies (Sibanda 2000:3). (*See Table 3.1.*)

Not All Decentralization Is Created Equal

Some decentralization advocates—governments, donors, and NGOs—view the poor as particular beneficiaries of decentralization. They envision reforms that make policies more useful to the poor, and processes that encourage the involvement of the most socially disenfranchised people in natural resource decision-making—those people who have the greatest stake in the outcome of management decisions (Asante and Ayee 2004:3-6, 21-22). These advocates point out that effectively implementing poverty reduction strategies often requires specific local knowledge that is best found in local institutions, and that strengthening local delivery capacity for services requires genuine devolution of authority to these institutions (Asante and Ayee 2004:5).

Some countries have responded positively to these arguments. Bolivia, for example, made decentralization across several sectors part of a package of anti-poverty reforms in the 1990s (Pacheco 2004:85, 90). Most West African countries have also declared local development a prime goal of their decentralization efforts (Ribot 2002:8).

Despite its theoretical potential, the record of decentralization has been decidedly mixed. This is true both in general and with respect to poverty reduction. In some instances, efforts to decentralize management of forests, land, water, and fisheries have shown positive outcomes: rural citizens conserving their natural resources; local councils that are increasing revenues from resource use; the poor more involved in local governance institutions and reaping more monetary benefits from local resources; and local governments providing better basic services. One of the longest-standing cases of decentralized environmental management with evident benefits to livelihoods is in Kumaon, India. Since the 1930s, elected forest councils, called van panchayats, have had the right to manage forest use, raising revenue from the sale of fodder and dead trees and enforcing regulations on forest use (Ribot 2004:22).

Similarly, some wildlife co-management schemes in Africa have yielded improved local infrastructure such as roads and schools, while community forest management in Mexico that has come about through decentralization has enabled communities to build water networks, schools, and clinics

(Shyamsundar et al. 2004:9). In Ghana, devolution of power to district assemblies has improved provision of basic services and infrastructure in rural areas through construction of more feeder roads, clinics, public toilets, classrooms, and the like (Asante and Ayee 2004:8).

Yet in most decentralization efforts to date, the intended benefits for local democracy and for the poor remain largely unrealized, due to flawed implementation of the reforms. The choice of which institutions to empower with new management or decision-making responsibilities, and the ways in which those institutions are held accountable to the people, have profound implications for the effectiveness of decentralization—and whether the benefits reach the poor (Ribot 2004:25).

How Decentralization Can Harm the Poor

Governance reforms that are truly empowering for the poor, responsive to their needs, and effective in reducing poverty are rare (Crook and Sverrisson 2001:iii). In a 2001 analysis of decentralization cases from about a dozen locations in Asia, Africa, and Latin America, only Brazil, Colombia, and the Indian states of West Bengal and Karnataka showed good results in terms of increasing policy responsiveness to the poor, or reducing poverty and inequality (Crook and Sverrisson 2001:14-15).

Most reforms in the name of decentralization come up short in two areas that are critical to bringing about benefits to local populations and the poor: they don't create *accountable, representative local institutions*, nor do they *transfer meaningful powers* to them (Ribot 2004:15). Such incomplete or partial decentralization undermines the potential benefits of governance reforms, particularly for the poor.

Decentralization without Accountability

Often, powers over natural resources are handed over to a person or body not elected by the people, and thus not wholly accountable to them, such as a traditional chief, or to a civil-society organization such as a women's association, or to a "user group" such as a forestry cooperative, or a pastoralists' group. Such groups may help broaden grassroots participation in local decisions, but they speak for only a segment of the citizenry. For example, Cameroon's community forest law devolves power to local forest-management committees. While the law requires these groups to consult "representatives" of all segments of the community, it is unclear by whom these representatives are chosen, and the results of the consultation are not binding in forest management plans (Ribot 2004:35). Similarly, in Uganda, the wildlife authority created a committee of beekeepers, but its mandate was so narrow that only interested parties participated—and these beekeepers then excluded other forest users from the committee's deliberations (Namara and Nsabagsani 2003 in Ribot 2004:37).

Retention of Central Government Control

Another common implementation flaw is to empower a district office of the government or a local representative of the central government. Such an office or official is accountable only to central government authorities, not to the people in the town or municipality. Central governments frequently choose to transfer power to a local branch of the bureaucracy, rather than a locally elected body, as a means of maintaining central control over natural resources (Larson and Ribot 2004:6). In China, the central government devolved management of community forests in name, but in practice has shifted greater power to the provincial level, and has implemented national-level policies that override and often contradict local policies (He 2005).

Lack of Power to Generate Revenue

Even where local democratic institutions or bodies are charged with natural resource management, they are commonly entrusted with duties that are circumscribed in scope, and rarely with the power to generate revenue by setting fees or levying fines. The central government often retains the most lucrative powers—such as the right to assess wildlife hunting fees or allocate revenue from a logging or mining concessions—while granting rural communities or governments the less valuable rights to subsistence-scale harvesting, such as the collection of firewood or bamboo.

Elite Dominance of Elections, Participation, and Decisions

All too often, the fundamental differences in power between rich and poor warp the decentralization process, allowing members of elite, wealthier, more empowered groups to shape decentralization to their own ends and derive most of its benefits (Ribot 2004:41). Decentralization then becomes largely a transfer of power from national to local elites. In Indonesia, for example, many of the benefits of rural timber extraction during the Suharto era accrued to powerful business interests in Jakarta, the capital, and illegal logging was widespread. In the decentralization that followed the fall of the Suharto regime in 1998, a realignment of influence occurred, with district governments taking more control over managing timber extraction. Now the influence of local elites and business interests predominates. Rather than cracking down on illegal logging, this has tended to perpetuate the cycle, often with similar inequities and environmental damage (McCarthy 2002:879, 881-82; Djogo and Syaf 2003:9-13, 20-22).

Elites can also slant the electoral process, giving them the upper hand in local governance, and, accordingly, in the decisions made about natural resources by those institutions. Fair and competitive elections are a key means to make policies more responsive to the poor, and create a local government that is accountable to local people (Crook and Sverrisson 2001:50). But elites often have a disproportionate influence on which candidates will run for election—candidates that may then be beholden to their interests. Indeed, party politics are often dominated by local elites.

Parties, in turn, often run slates of party candidates, putting independent candidates at a disadvantage. When officials are elected from party slates rather than independently, research suggests that these officials have less accountability, in particular to the poorest citizens (Ribot 2004:27). In contrast, when independent candidates are given a fair shake, elections are more competitive, and the interests of the poor may be better served. Unfortunately, independent candidates are often barred from local elections. In a 2001 assessment of decentralization in 14 countries, only five (India, Mali, Mexico, Uganda, and Zimbabwe) permitted independent candidates in local elections (Ribot 2004:27).

Senegal shows the shortcomings, especially for poor populations, of electoral systems that do not admit independent candidates. In 1998 a new decentralized forestry law granted rural communities and their councils various rights over forests, including the right to authorize or deny commercial production of charcoal by the forest service and wealthy urban merchants—a forest use rural communities had long opposed. Yet years after the forestry law was enacted, the forest service continued charcoal production. Surprisingly, the forest service's charcoal extraction had the approval of rural council presidents, despite the fact that almost everyone in the communities in the region opposed it. Elected from a party slate, these council presidents were beholden to the party, rather than the local popular will (Ribot 2004:27-29).

Inadequate Participation by the Poor in Decentralized Bodies

Even when decisions and policy-making are devolved to a body made up of independently elected local people, there are inherent biases against equal participation by the poor. Because of their greater confidence, literacy, or other advantages, the better-off members of a community tend to assume positions of leadership in committees and councils. A study in West Bengal, India, showed that *panchayat* (village council) members from lower castes or tribes rarely spoke in meetings and, if they did, they tended to be ignored (Westergaard 1986 in Crook and Sverrisson 2001:16).

Moreover, the poorest members of the community are less able to shoulder the costs of participating in decentralized natural resource management, including membership fees, time spent in meetings or monitoring forests for poachers, and providing labor for maintenance of infrastructure such as irrigation systems (Shyamsundar et al. 2004:10). In addition, the earliest participants in projects often have more voice and opportunity to shape outcomes; the poor, joining in later stages, if at all, are less able to garner benefits (Ribot 2004:39).

Shortcomings of "User Committees"

Decentralized natural resource management often fosters the creation of user committees or user groups, which have proliferated in developing countries since the 1990s (Shyamsundar et al. 2004:5). Intended to give ordinary people a voice in local

Continues on page 68

BOX 3.2 HOW COMMUNITY-BASED RESOURCE MANAGEMENT CAN BENEFIT THE POOR

COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT (CBNRM) is one of the most important manifestations of true decentralization as it relates to control of rural resources. CBNRM programs, if successful, can be models of local empowerment, imbuing communities with greater authority over the use of natural resources. Under the right circumstances, they can also bring important benefits to poor people and poor communities.

Improved Livelihoods

In many countries, community-based management of forests and other natural resources has improved livelihoods for the poor. The benefits of CBNRM can range from job creation to substantial management rights and long-term revenue-generation. For instance, in Nepal, community management of forests has created new jobs, including nursery staff and forest watchers, as well as wage labor for tree planting and weeding (Malla 2000:41). Community forestry concessions along the borders of the Mayan Biosphere reserve in Guatemala have generated more than 100,000 days of labor per year (Cortave 2004:26).

Where high-value resources such as timber are involved, CBNRM can generate significant revenues. A large forestry project in the Indian state of Madhya Pradesh earns an estimated $125 million per year for the communities involved, through sales of sustainably harvested timber and non-timber forest products (Shilling and Osha 2003:13).

Improved Resource Condition

A crucial element of community-based management is its potential to improve the condition of the resources being managed. The Krui people of southwestern Sumatra have practiced a complex form of agroforestry for generations, planting a succession of crops that culminate in a full forest canopy. Their agroforests support about ten times more biodiversity than conventional palm plantations in the area, and have economic uses ranging from resin tapping to timber sales (ASB 2001:1-2).

In northeastern India, the Khasi School of Medicine and others are working to re-establish traditional laws and practices of forest management to safeguard sacred groves of medicinal plants, which had been depleted under centralized management of the resource since the 1950s (Varshney 2003:46). In 1996 the Guatemalan government began awarding forest management concessions to settler communities living on the borders of the two million-hectare Mayan biosphere reserve in the lowland Petén region. Satellite imagery indicates that the 388,000 hectares under community management show better forest cover than adjacent areas (Molnar et al. 2004:19) .

Development of Village Infrastructure

In some communities, a portion of the revenues from community-based enterprises has been directed to investments in key infrastructure needs, such as the construction of schools and libraries, development of drinking water and irrigation systems, and extension of electricity service (Malla 2000:42). Community management of land and water use in Gandhigram, Gujarat, has increased both the area and yield of lands under cultivation, despite three successive years of drought. The increase in income has gone toward village improvements, including fencing to keep out wild animals, construction and maintenance of irrigation structures, tractor and equipment purchases, and to pay down village debt (Down to Earth 2002). In another example, the mountain village of Lazoor, Iran, was one of a number of villages granted substantial control over their land and water resources by the Iranian government in 1999. With technical support from outside experts, the community built an extensive irrigation and erosion-control infrastructure, increasing productivity and opening new lands to cultivation (WRI et al. 2003:183-184).

Representation in Decision-Making Roles

CBNRM is most successful at benefiting the poorest members of the community when it empowers them to play a full decision-making role in resource management. One example of a community-based enterprise featuring equitable participation comes from the village of Deulgaon in Maharashtra State in India, where the community's forest-management committee includes representation by one male and one female member from each household, and all decisions regarding forest use are made by the general membership at its monthly meeting, rather than by an executive committee (Ghate 2003:9). CBNRM in Tanzania has sometimes spurred significant social change within the community itself, such that villagers gradually become less deferential to existing leaders and eventually may replace underperforming managers who serve their own self-interest rather than the interests of the community as a whole (Alden Wily et al. 2000:44).

In Lazoor, Iran—mentioned above—the land management program gave women a direct voice in priority-setting, with a positive impact on their confidence and role in broader village decision-making (WRI et al. 2003:184-185). In the Mapelane Reserve on the northeast coast of South Africa, a partnership between the local Sokhulu people and the government Parks Board resulted in the regeneration of mussel beds that had been a source of bitter conflict. The co-management scheme that emerged altered the community's role from illegal harvesters to resource managers. The Joint Mussel Management Committee, consisting of elected community members, park representatives,

and university researchers, established management rules only after an extended process of experimentation and consultation with Sokhulu harvesters (WRI et al. 2003:176-179).

Reason for Caution

CBNRM can suffer from the same flaws that threaten all forms of decentralized management. Devolving decision-making power to the local level does not guarantee the poor a role in the process. An examination of Bolivia's effort to decentralize forest management found that the process did create new opportunities for marginalized groups to gain control of local resources and capture more of the economic benefits. However, only the better-organized groups have thus far been able to capitalize on the process; elsewhere, decentralization has simply strengthened the local elites (Kaimowitz et al. 1999:13-14).

Forest-user communities are often socially and politically diverse, with a range of different income levels represented (Malleson 2001:18). Unless these distinctions are taken into account, CBNRM will often end up favoring the more powerful. When the government of Laos introduced its land and forest allocation Policy in the early 1990s, it meant to foster local control over some of the country's agriculture and forest lands. However, the policy resulted in wealthier farmers reinforcing their rights to the best land, while small farmers and landless households found their access to both agricultural land and forest resources greatly reduced (Fujita and Phanvilay 2004:12).

Gaps in access to information about resource rights can also cause community forestry programs to work against the people they should support. In a blatant manipulation of the system in Cameroon, local elites in one region used community forestry laws to gain management rights over forests in another region, taking advantage of communities that were not yet aware of how to use the forestry law to protect their rights (Smith 2005:14). Studies from Nepal, one of the first countries to make a serious attempt to devolve forest management, show that lack of access to information and elite capture of forest-user groups have cut many of the poor out of benefits from community forestry (Neupane 2003:55-56, 58).

Finally, high transaction costs and complicated application and management requirements can deter communities from participating in CBNRM, or make it financially unsustainable for them to do so. In Cameroon, the application procedure to gain legal recognition of a community forest is lengthy and centralized. The costs for communities are significant—even more so because management rights are granted for only a ten-year period. Due in large part to these difficulties, only seven official community forests were established from 1995 to 2001 (Alden Wily 2002:18).

resource management, user committees do draw citizens into the policy process and give them significant influence over some programs. However, these committees aren't usually democratically elected, and they don't always benefit the poorest members of society. They also tend to have a short lifespan, which disadvantages poorer members of the community who need more time to develop the skills, confidence, and organizational capacities to participate on an equal footing. The only situations in which poor people are consistently able to wield influence in user committees is when the groups consist largely or entirely of poor people—for example, gatherers of non-timber forest products for subsistence use (Manor 2004:188 in Ribot and Larson 2004).

Project Bias Toward Wealthier Villages and Participants

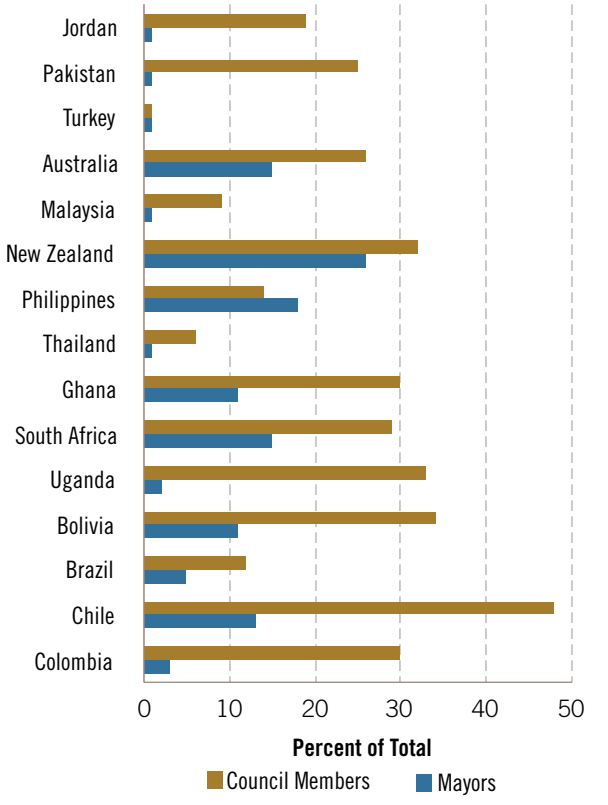
Government agencies, donors, and nonprofit groups engaged in decentralization of natural resources management often have incentives to avoid poorer constituents and invest in wealthier groups or villages with better skills or higher-quality lands needed to make projects succeed. For example, managers of a state-funded watershed development program in the Indian state of Madhya Pradesh tended to work with more prosperous farmers in the valleys, where projects were more likely to generate dramatic results, rather than engaging with poorer hill farmers (Baviskar 2004:30-31 in Ribot and Larson 2004). Similarly, selection for anti-poverty employment programs in the Indian state of Karnataka was based on information provided by village leaders—who tended to be wealthier than other participants—resulting in the inclusion of many better-off families (Sivanna 1990:200 in Crook and Sverrisson 2001:20).

Gender Inequalities in Decision-Making

Women are typically among the poorest and most disadvantaged groups in developing countries. It is no surprise that they tend to be under-represented in positions of authority in local governments, village committees, and other decentralized decision-making bodies to which powers over natural resources are increasingly being devolved. Husbands often do not like their wives to attend group activities, and traditional working patterns and government structures tend to favor men's dominance in public decision-making. For example, in state-approved village forest management groups in India and Nepal, women are likely to be relegated to a peripheral role (Shyamsundar et al. 2004:92-93).

In Bangladesh, an analysis of local elected governance bodies, known as Union Parishads, found that women tend to head committees related to community welfare with little

FIGURE 3.2 LOCAL GOVERNMENT OFFICES OCCUPIED BY WOMEN



Source: United Cities and Local Governments 2005

influence over disbursement of resources, while men typically ran and served on committees clearly related to resource allocation, like finance, agriculture, fisheries, livestock, and infrastructure (Mukhopadhyay 2003:59). Women also have a much smaller chance of becoming elected officials in local government. A study of over 15,000 municipalities in 42 countries found that only 8 percent of all local mayors are women (UCLG 2003). *(See Figure 3.2.)*

When women are absent from decision- making, issues that affect them are more likely to be overlooked. The inequity of this situation is all the more glaring in light of the fact that women are often charged with responsibility for collecting and using natural resources such as water, fuelwood, and other resources for the family's benefit.

New Demands on the Poor

Decentralization that transfers responsibility for managing services and projects to local institutions and communities without providing the financial resources needed to do so can end up creating extra burdens for the poor. For example, in Mongolia, local governments were given new responsibilities for winter preparedness and the cold-weather provisioning of livestock herds, but no new financial resources to meet this responsibility. The result was massive livestock mortality during the brutal winters of 1999-2002, and loss of one-fifth of the nation's herd (Mearns 2004:137). In other cases, newly empowered local governments may enact new revenue-raising measures that hurt the poor. In Malawi, local governments with new decentralized responsibilities have established village-level enterprise taxes that could stifle fledgling efforts of the rural poor to build their assets and diversity their incomes by starting small businesses (Ellis et al. 2003:1507-1508).

Loss of Access to Natural Resources

Privatization—the transfer of public resources such as forests to private individuals and corporations—is often done in the name of decentralization. This transfer of management authority excludes the public from participation in decisions about the resource and often means the direct physical exclusion of people from the land or water as well, with the poor generally suffering most from such loss of access (Ribot 2004:52).

Devolving power over local resources to communities or groups within those communities can also bring problems of exclusion. For example, a community granted the power to manage a tract of public forest might decide to contract with a logging company in one area of the forest to raise revenue. In the process, it may limit local people's collection of non-timber forest products in that section of the forest. This can impose immediate costs on poor households who depend on fuelwood and other subsistence products gleaned from the forest (Shyamsundar et al. 2004:10, 95).

Making Decentralization Work for the Poor

Decentralization can be structured in ways that make it more effective and beneficial for the poor.

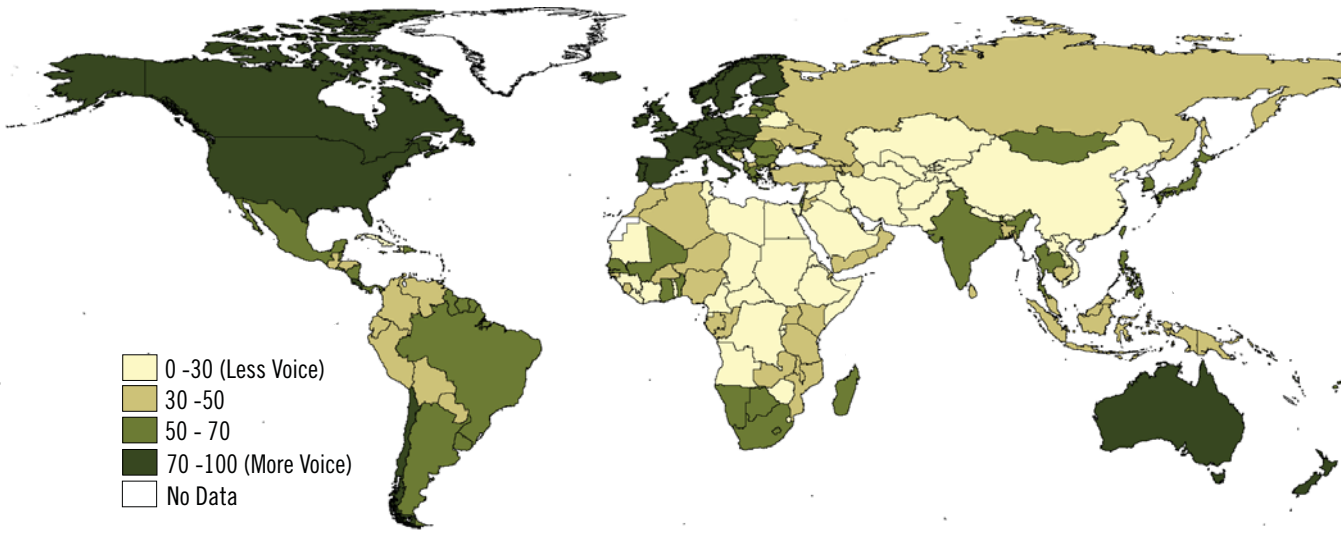
Ensuring Democratic Accountability

The best way to ensure that decision-makers are accountable to local people and decision-making reflects the interests of local people is to vest powers in elected authorities who are chosen through competitive local elections (Crook and Sverrisson 2001:50). While it is often difficult to rein in the political forces that stifle open elections, the benefits can be substantial. For example, competitive local elections in West Bengal, India helped make policy more responsive to the poor, and in Colombia, competitively elected mayors—challengers to the dominant party politics—brought about better education, roads, and water supply (Crook and Sverrisson 2001:15-16, 42).

Special Measures Promoting the Interests of the Poor

A central government can increase the chances of pro-poor decentralization by making an explicit commitment to promote the interests of the poor at the local level and to ensure that marginal groups get a voice in public decisions (Ribot 2004:41). Elected local governments tend to have a poor record of serving the interests of women, the poor, and other marginal-

FIGURE 3.3: VOICE AND ACCOUNTABILITY, 2004



The voice and accountability scores assigned here are based on indicators of political and civil liberties extended to a country's citizens, as well as the independence of the media, which plays an important role in monitoring governance performance. These scores reflect the extent to which citizens are able to participate in the political and decision-making processes, give voice to their concerns, and hold their government representatives accountable.

Source: Kaufmann et al. 2005

ized populations unless required to do so by the central government (Crook and Sverrisson 2001 in Ribot and Larson 2004: 6). Special measures are needed to ensure that decentralization benefits the poorest people and most vulnerable groups—women, indigenous people, the landless, migrants, and minority castes. In 1978, for example, the government of West Bengal specifically sought to increase the power of poor and landless peasants by devolving implementation of government programs to the village councils, and mobilizing poor peasants to participate. As a result, 44 percent of those on village councils in Birbhum District are now small farm owners, sharecroppers, or agricultural laborers, and the benefits of government development programs are increasingly going to the poorer members of the community (Crook and Sverrisson 2001:15-16). Kerala State's approach in 1996 was to give 35-40 percent of the state budget to local governance bodies for development planning, with detailed guidelines to make planning processes both participatory and equitable (Mukhopadhyay 2003:56).

Compensating the Poor for Short-Term Costs

Local institutions can find ways to compensate the poor for any rights they lose when a new management scheme restricts their access to a forest or other resource. For example, the community of San Antonio, Mexico, asked residents to forego cutting pine trees for use as roofing shingles so that they could be harvested as lumber. In return, the local logging business supplied free tin roofing materials and lumber to residents (Shyamsundar et al. 2004:96).

Community-Based Natural Resource Management

One specific approach to pro-poor decentralization of environmental resources is community-based natural resource management (CBNRM). Central governments in many parts of the developing world have begun to shift toward CBNRM in recognition of the limitations of centralized management and in response to the legitimate claims of indigenous groups and local communities to a share in the benefits of local resources. Worldwide, some 380 million hectares of forest land are now owned by or reserved for local communities—over half having been legally transferred to local control within the last 15 years (White and Martin 2002:11). This transformation in forest ownership and management began in Latin America in the late 1970s, moved through Africa in the late 1990s, and spread more recently to Asia. *(See Box 3.2.)*

The Rights to Information, Participation, and Justice: The Importance of a Voice

The democratic rights of the poor and their capacity to participate in environmental decisions affecting their livelihoods are central to their ability to escape poverty. Yet despite their greater reliance on natural resources to earn their livelihoods, the poor have less say than their richer counterparts in how environmental decisions are made.

In much of the developing world the policies, practices, and institutions of political life serve to exclude a majority of citizens

from full participation in public decision-making—especially the poor and socially marginalized. This is true even in many nations that are nominally democratic. Democratic governance is more than merely casting a ballot in periodic elections. It means having opportunities beyond the ballot box to make one's voice heard, including participation in public hearings, review of official documents, and involvement in official processes, such as the preparation of environmental impact assessments. Full democratic engagement also means having opportunities not just to consult on projects already slated for implementation but also to play a role in shaping the design of public policies, in agenda-setting and establishing priorities for public policy, and in monitoring ongoing projects to ensure that they produce the benefits originally anticipated. *(See Figure 3.3.)*

These principles of democratic empowerment in the arena of environmental decisions were articulated over a decade ago at the 1992 Earth Summit in Rio de Janeiro. Principle 10 of the Rio Declaration, adopted by 178 nations at the close of the Earth Summit, put forth a ground-breaking proposition: that every person should have access to information about the environment, opportunities to participate in decision-making processes affecting the environment, and access to redress and remedy—that is, access to justice—to protect their rights to information and participation and to challenge decisions that do not take their interests into account. These three rights—the rights to information, participation, and redress—are often referred to as the *Access Principles. (See Box 3.3.)*

PRINCIPLE 10 OF THE RIO DECLARATION

"Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided."

Adopted by 178 nations at the United Nations Conference on Environment and Development, Rio de Janeiro, June 1992

In 2002, during the World Summit on Sustainable Development, governments reaffirmed their commitment to Principle 10 and the Access Principles. At the same time, a coalition of governments, civil society organizations, and international institutions formed the Partnership for Principle 10 to help implement these principles at the national and local levels. Unfortunately, the record of most nations in conferring these basic rights is still far from perfect. A 2001 assessment of nine nations—both rich and poor—found a variety of systemic weaknesses. For example, many nations have improved their laws granting public access to government data and analysis, but implementation of these laws is weak. Information on water or air quality that average citizens can understand and use is often hard to find, and documents about the environmental effects of development projects are frequently not made available in a timely manner (Petkova et al. 2002:1-8).

MEASURING ACCESS TO INFORMATION, PARTICIPATION, AND JUSTICE

How well are governments upholding the commitments they made at the 1992 Rio Earth Summit to strengthen public participation in environmental decision-making? Are they making sufficient effort to include the poor? Answering these questions requires assessing a nation's governance performance so that it can be tracked over time and compared with good practices in other nations. Since 2000, *The Access Initiative (TAI),* a global coalition of civil-society groups, has worked to insure this basic level of government accountability. Using a shared methodology, TAI coalition members conduct national-level assessments of laws and practices regarding public access to information, participation, and justice. For complete assessment results, visit http://www.accessinitiative.org.

Even if information is made available, the public's ability to participate in resource-related decisions such as timber harvesting or the siting of mines is still limited. Although the process of preparing and publicly airing environmental impact assessments has greatly increased in the last two decades, the public's involvement still tends to be in the later stages, after many major decisions have already been made. And even when public comment is invited, many people do not have the capacity or time to take advantage of the opportunity. Performance on the Access Principles is weakest when it comes to access of ordinary citizens to redress. The ability of local people to appeal decisions they don't agree with is often constrained by obstacles of cost, lack of clarity about procedures for appeal, and also the lack of "standing" as a legally recognized party with a legitimate interest in the case (WRI et al. 2003:48-61).

These access deficits are not restricted to the poor, but the poor tend to suffer them more acutely. Indeed, most of the world's poor are excluded from interacting fully within the political processes of their country—and environmental decisions are decidedly political in many cases. They are held back by lack of education and literacy, by deficits of information and awareness, and by a lack of understanding of their rights and how to exercise them. Even where the poor are aware of their rights, other barriers may prevent them from becoming involved. People who are barely managing to eke out a subsistence livelihood often cannot afford the luxury of devoting time and resources to participation or even information-gathering. And they may be even less able to pursue a legal challenge to decisions with which they disagree, given the expense and time burden. *(See Figure 3.4.)*

Continues on page 73

BOX 3.3 EMPOWERING COMMUNITIES THROUGH FREE, PRIOR, AND INFORMED CONSENT

COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT offers local people the chance to participate directly in decisions about local ecosystems and to benefit economically from their efforts. But in the real world, poor communities often do not initiate the large-scale resource development projects—such as mines, oil and gas development, or major forest concessions—that account for most natural resource wealth. More often, they are bystanders or second-class participants in these negotiations, inheriting the ecosystem costs of these projects with little gain.

The practice of "free, prior, and informed consent"—or FPIC—is designed as an antidote to this state of affairs. FPIC consists of giving local people a formal role—and some form of veto power—in the consultations and ultimate decisions about local development projects. It is intended to secure the rights of indigenous peoples and local communities: their rights to self-determination, to control access to their land and natural resources, and to share in the benefits when these are utilized by others. Many experts believe that without such informed consent on large projects, a community's land and resource rights are compromised.

In fact, without the kind of substantive participation that FPIC mandates, the tenure security of rural communities is always at the mercy of decisions made by others. It is well documented that such insecurity perpetuates poverty. In contrast, with the bargaining power that FPIC provisions bring them, communities can demand direct compensation for damages or a continuing share of the profits of resource extraction. They can even require the backers of development to invest part of the profits from these ventures to meet community needs. In this respect, FPIC is a tool for greater equity and a natural pathway to a co-management role for local communities in large development projects (Permanent Forum on Indigenous Issues 2005).

FPIC is relevant when governments make regulatory decisions—for example, allowing logging in forests traditionally occupied by indigenous peoples, or displacing riverside communities in order to construct a large hydropower dam. It can also be incorporated into infrastructure planning—from the building of roads that traverse through ancestral domains, to tourism development decisions such as providing access to sites considered sacred by tribal peoples. It is equally important in making decisions about bioprospecting for genetic resources as it is for making choices about locating major energy projects, from power plants to pipelines. To date, however, FPIC has been most relevant and critical in cases involving mining projects in countries as diverse as Australia, Canada, Peru, and the Philippines (Bass et. al. 2003:vii; Tebtebba 2002:7).

The potential poverty impact of FPIC in decisions on extractive industries such as oil, gas, and mining is particularly relevant and contentious. In order for communities to reap greater benefits from such development, their rights to sustainable livelihoods must be protected. Rules enforcing these rights will not only promote "cleaner" extraction, but also empower local communities to take the risks and share the benefits of future development. Without FPIC, these projects may further the economic marginalization of peoples and communities that are already poor and vulnerable.

These projects often require involuntary resettlement and all the negative economic consequences such dislocation brings. An FPIC requirement would enable affected people to negotiate more favorable relocation terms, including legally binding provisions on compensation, support for new housing, and the necessary infrastructure not only for shelter, but for livelihoods and education as well. Requiring FPIC could even allow these people and communities to negotiate fair, equitable, and enforceable terms of revenue- and other benefit- sharing. The inclusion of FPIC as a legal condition for financing, investment, or regulatory decisions could become a critical means to make poverty alleviation programs more sustainable (Goodland 2004; Kamijyo 2004).

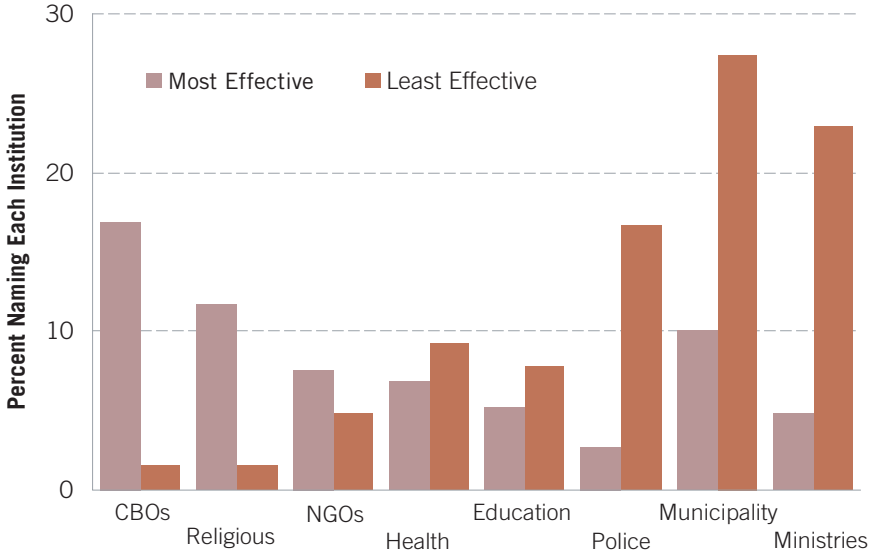
To date, countries like the Philippines (Congress of the Philippines 1997) and Australia (Commonwealth of Australia 1976: Sections 66-78) have enacted laws requiring that FPIC be obtained by the government for projects within the ancestral domains of indigenous peoples. Internationally, the World Commission on Dams (WCD 2000:xxxiv-xxxv,98-112) and the Extractive Industries Review (World Bank Group 2003 Executive Summary: 2-3, Volume 2:29-33, 47-50; MacKay 2004) of the World Bank have recommended the adoption of FPIC in making decisions about dams and oil, gas, and mining projects. In addition, FPIC as a principle has been acknowledged in the Convention on Biological Diversity, with regard to access to and benefit-sharing of genetic resources (Perrault 2004: 22; Casas 2004:2728).

Putting the principles of free, prior, informed consent into practice remains a challenge. Important questions remain:

- How can we define "free" in practice? How far ahead does "prior" mean? What are the formal terms of "informed consent"?
- What is the role of customary law in FPIC? And what is the role of official processes, such as public hearings or referenda?
- In a diverse community, how is consent given and who gives the consent? Is a majority enough or is full consensus required? Is a written, legally binding agreement necessary?
- How is FPIC verified? Does the government verify it or is oversight by an independent party necessary?
- In implementing FPIC, how do we ensure a balance between the state, the general public interest, and affected community interests, particularly in the distribution of benefits?

FIGURE 3.4 THE POOR'S PERCEPTION OF RURAL INSTITUTIONS

Poll: Name the Most Effective and Least Effective Institutions in your Community



In discussion groups held worldwide, poor people were asked to name the five institutions they considered most and least effective. The bars to the left show the most frequently named institutions. Religious and community-based organizations (CBOs) were considered the most effective. Local governments and state ministries were considered the least effective.

Source: Narayan 2002

The sections below detail some of the ways in which the poor are particularly affected by deficits in their rights to information, participation, and justice. Also discussed are some of the successful steps that have been taken to address these shortcomings.

Access to Information

Information for Livelihood Choices

The rural poor face a keen need for information directly relevant to their livelihoods—information such as market prices for their crops, alternative cropping or pest control options, the availability of government assistance or training programs, or opportunities for developing new products or markets for environmental goods, from local crafts to ecotourism. Agriculture-related information is often one of the most immediate needs, since small-scale agriculture is so important to household incomes in rural areas. Information on current crop prices, fertilizer and pesticide costs, and the availability of improved seeds and low-cost improvements in farm technology can help guide the purchases of farm inputs and equipment, or help farmers successfully obtain credit.

Without information of this type, poor families find it harder to take advantage of new opportunities for generating income and increasing their assets. Numerous organizations, from multilateral agencies to local NGOs, are trying to improve access to livelihood-related information. One such effort is the farmer field schools developed by the UN Food and Agriculture Organization (FAO) as part of an Integrated Pest Management project in Indonesia. Using a participatory learning approach aimed at incorporating local knowledge and experience, these farmer field schools are yielding lessons that are being applied to information activities on sustainable livelihoods in other sectors, such as community forestry (Chapman et al. 2003:5).

Information for Public Accountability

Access to information on laws, mandated government services, and government expenses is fundamental for poor people to hold governments accountable for their performance. Unless citizens can find out what governments are doing and how they spend their funds, governments have little incentive to improve performance, deliver on their promises, or even provide basic services at adequate levels.

In Bangalore, India, citizen groups conducted surveys of municipal government performance and used the information to create "report cards" on the quality and efficiency of services such as water, transport, electricity, and police, and to press for reforms. In Rajasthan, India, citizen efforts to gain access to information on government spending and employment rolls led to exposure of local corruption, initiation of corrective action, and prompted consideration of a national right-to-information law. In Argentina, citizens can access a website—audited by a coalition of 15 NGOs—to find easily understandable information on public expenditures across a variety of government programs (Narayan 2002:32).

In Francophone Africa, cooperatively produced radio programming provides listeners of 48 rural radio stations in 10 countries with access to information on laws, legal systems, and justice. Developed during a workshop on law in Senegal, an initial radio program featured lawyers from six West African countries and provided information on land rights, women's

rights in marriage, and other legal matters. Following enthusiastic listener response, the producers developed a series of subsequent broadcasts on related legal issues, such as divorce, inheritance, access to justice, and conflict resolution (Chapman et al. 2003:22).

Language Barriers to Information Access

In many developing countries, language is the most important vehicle for excluding the poor and socially marginalized groups from access to information (Sibanda 2000:9-10). For the mature democracies of Europe, Asia, North America, and Oceania, the language of government is an indigenous language or a language in which the vast majority of ordinary citizens are fluent. However, across the developing world, a significant proportion of the population typically does not use or understand the language of government, which often is a European language—French, English, or Spanish—imposed during the colonial era. It is expensive to produce multiple versions of official documents in indigenous as well as colonial languages, and the process of designating which indigenous languages are to be used in official documents can aggravate existing ethnic rivalries. But the alternative is continued high costs in social exclusion and political instability. *(See Figure 3.5.)*

Choice of Information Technologies

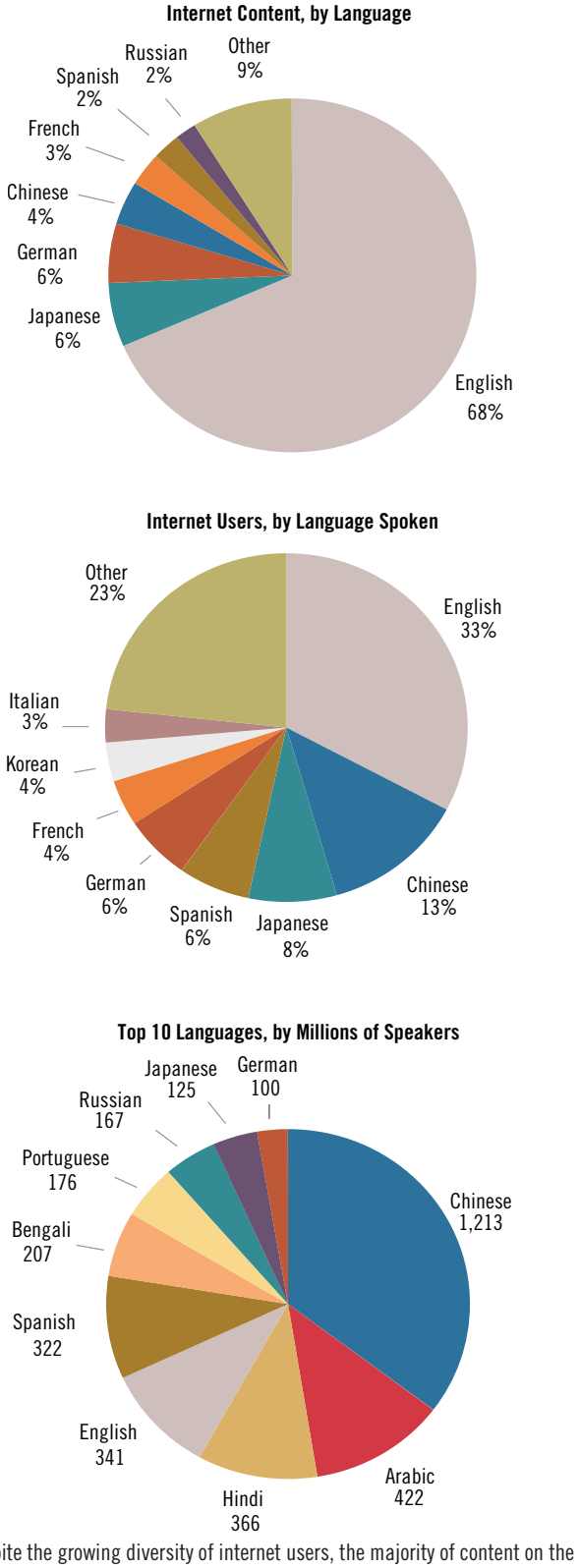
Whether the rural poor have adequate access to information for environmental decision-making is not only a function of the quality and quantity of information supplied. It also depends on whether the delivery technologies are appropriate for the target audience. Different groups may have different information needs and preferences for information delivery, and efforts to increase the poor's information access are most effective when they involve these groups in decisions about the information technologies to be used. For instance, in most developing countries radio and television remain much more widely accessible than the Internet. Technologies such as the wind-up radio make information dissemination possible in communities without electricity or access to batteries (Chapman et al. 2003:19-20).

Nonetheless, experience with pilot efforts indicates that it is possible to reach large numbers of people in developing countries with electronic sources of information. In the Philippines, a pilot project in the *barangays* (townships) on the island of Mindanao is using modern communications technologies to improve local access to information on topics such as agriculture, rural enterprise development, education, and health. The project features multipurpose community telecenters with telephone and Internet access (Chapman et al. 2003:17-18). The challenge remains to apply these pilot approaches more widely in Africa, Asia, and Latin America as well.

Equitable Access to Information

Despite new technological capacity for broad-based information dissemination, evidence suggests that if access to information is not universal, growing supplies of information may simply serve

FIGURE 3.5 ENGLISH DOMINATES THE INTERNET



Despite the growing diversity of internet users, the majority of content on the Internet remains in English.

Source: Global Reach 2005; Internet World Stats 2005; Encarta 2005

to exacerbate existing social, economic, and political inequalities. Historically, information on agriculture-based livelihoods in developing countries was viewed as a global public good that should be made available at no charge to all interested parties. More recently, donor agencies have emphasized private-sector provision of agricultural extension information, which can involve cost recovery and user fees that the poorest farmers cannot afford to pay (Chapman et al. 2003:vii). Involving the poor in decisions about who should pay for information services and how the sustainability of information services can be ensured is vital to ensuring the poor have access to such information.

Demand-Driven, Location-Specific Information

Rural producers in developing countries value locally generated, locally specific information much more than general information. Because farmers and fishers are unlikely to adopt new practices without substantial discussion of local examples, improved access to information is most effective when the information is focused on local conditions and local processing and marketing systems. Modern communications technologies such as the Internet and teleconferencing can enable rural farmers and fishers to discuss specific local problems with technical specialists based outside their area.

In India, the M.S. Swaminathan Research Foundation is using innovative information technologies in community-managed "e-villages" to respond to the information needs of local groups. For example, weather forecasts and information on wave height are being routed to fishers in the village of Veerampattinam. Such initiatives can also stimulate two-way information flow between villages and researchers, so that farmers and fishers can contribute their specialized knowledge to enrich national and international information systems (Chapman et al. 2003:19).

Inclusion of Women and Socially Marginalized Groups

In Swaminathan's e-villages, information centers are run mainly by semi-literate women and by students, with the aim of empowering them through their roles as information managers. By specifically targeting women and marginalized groups in knowledge management, initiatives to enhance the poor's access to information can also promote social equity (Chapman et al. 2003:19).

Access to Participation

Decision-Making About Livelihood Choices

Direct involvement in institutional processes that affect their livelihoods, such as determining the course of agricultural research, is crucial for poor farmers. Often, there is no route for their input, but that does not have to be so. The West African Rice Development Agency uses participatory methods to involve farmers in selecting which new rice varieties should be developed, thus giving poor farmers an opportunity to share information on their preferences and needs with rice breeders (Chapman et al. 2003:20).

Participation in Broader Policy Processes

In many poor countries, poor people have participated in broader development initiatives dealing with poverty and poverty reduction. Citizen participation has been part of the process of crafting national poverty-reduction strategies in several countries, such as Bolivia, Kenya, and Uganda. The poor have also participated in creating citywide strategies for poverty reduction in approximately 80 cities around the world, including Cali, Colombia; Johannesburg, South Africa; Kampala, Uganda; and Haiphong, Vietnam (Narayan 2002:46, 70).

Citizen involvement is a central element in so-called "participatory poverty assessments"—an important tool to inform national policies and budgets. In several countries, participatory approaches to poverty assessments provided insights that had not been obvious from official survey data. In Uganda, for example, citizen participation led to increased investment in water supply and more flexible budget allocations allowing districts to respond to local needs. In Vietnam, people's participation led to the targeting of urban as well as rural poverty, steps to address the ethnic and gender dimensions of poverty, and the piloting of "citizen report cards" on the delivery of basic services (Narayan 2002:38).

Participation in Planning and Budgeting

Pioneered by the city of Porto Alegre, Brazil, participatory budgeting processes enable the poor to have more say in how government resources are distributed. In participatory budgeting, citizen meetings generate information about people's priorities for government budget allocations, which are then aggregated into neighborhood-level priorities. In Brazil, more than $260 million was allocated between 1996 and 1998 to projects selected by participants in citizen meetings, the vast majority of which addressed needs in poorer, underserved districts. As of 2003, some 180 municipalities in Brazil were engaged in some form of participatory budgeting processes (Serageldin et al. 2003:8-9).

Inclusion of Women and Marginalized Groups

In many countries, remedying deep, long-standing social inequality necessarily entails enacting laws requiring the inclusion of previously excluded groups. One example of such an initiative comes from Bolivia, where the Law on Popular Participation provides for the participation of indigenous people's organizations in municipal decision-making. Under this law, which is meant to improve local governance and aid poverty-reduction efforts, "community vigilance committees" are empowered to investigate municipal decisions. These citizen committees even have the power to halt the distribution of central government funds to local governments if they determine that planning and expenditures are not in line with community demands (Narayan 2002:42-43). In India, it took a

constitutional amendment mandating that women must make up at least a third of the councilors in *panchayats* (village-level councils) to create real opportunities for women's voices to be heard in municipal leadership.

Access to Justice

Research shows that the poor are less likely to access the legal system to secure or enforce their rights to use natural resources. A study of seven countries in Africa and Asia found that poor communities are often reluctant to pursue legal claims based on their environmental grievances. In general, economically disadvantaged groups lacked familiarity with legal institutions as well as the necessary financial resources to use legal remedies effectively (Boyle and Anderson 1996, cited in ESRC/GECP 2001:18). Intimidation by local elites and government officials can also make the poor and others of low social status hesitant to assert their right to live in an environment adequate for their health and well-being. For the poor who lack formal, legally recognized tenure to their land and natural resources, the threat of retribution is especially chilling.

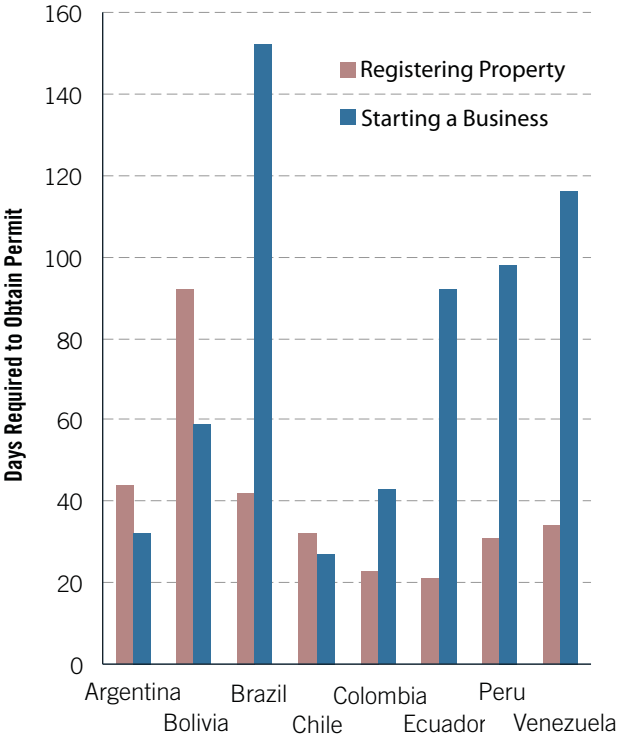
Securing and Enforcing Property Rights

Clearly defined property rights, and confidence that these rights can be efficiently defended against interlopers, are fundamental to governance systems built on the rule of law. As mentioned earlier, appropriate property rights regimes are also central to encouraging the poor to invest in their land or in resource management in ways that bring economic development and poverty reduction. However, in many developing economies, corruption, excessive regulation, and complicated property registration procedures significantly burden citizens, especially the poor.

In Guayaquil, Ecuador, for example, it has been three decades since the passage of land reform laws, and most households are aware of their property rights and the importance of securing title to land. But the majority of these poor households are incapable of navigating the legal labyrinth—including long delays and high costs—surrounding the land titling process. In theory, the process costs about $350, or as much as three months of a typical worker's salary. In practice, the actual cost is closer to $750—a prohibitive sum for most poor families (Moser 2004:42-44). A similar situation exists in Peru, where land registration processes to secure property rights requires land holders to engage with 14 different agencies involved in conferring a single title (Narayan 2002:54).

In several countries, poor people's associations and cooperatives are working with local authorities and financial institutions to address the need for secure land tenure rights and housing. In Mumbai, India, a slum-dwellers' organization has been able to acquire land, housing, and basic infrastructure services for its members. In the Philippines, a scavengers' association whose members live on a 15-hectare municipal dump in Quezon City has helped mobilize member savings to acquire legal rights to land through land purchase. And in Guatemala, 50,000 squatters have formed cooperatives, acquired land through legal means, and are now repaying long-term loans (Narayan 2002:66). Meanwhile, Ghana's land-registration law specifically provides for registration of customary land rights, and pilot projects are now underway to build capacity among traditional-land administrators to improve record-keeping and land registries (Bruce 2005).

FIGURE 3.6 BARRIERS TO DOING BUSINESS



Source: World Bank 2005

Procedural Injustice

The poor typically are most affected by procedural injustices in the legal and court systems. For instance, the poor are least able to afford the costs imposed by long delays in court proceedings. Also, the poor are more likely to be disadvantaged by language barriers in the legal system, such as court documents or hearings in languages not widely spoken by the rural poor (Girishankar et al. 2002:289).

Mechanisms for Alternative Dispute Resolution

For poor people living in remote rural areas, the existence of decentralized local processes for resolving disputes may make the difference in their ability to secure or enforce their rights. However, if such decentralized alternatives are poorly executed, they can end up disadvantaging the poor by reinforcing the dominance of local elites and incorporating local norms that discriminate against women, children, and other socially marginalized groups (Girishankar et al. 2002:289).

Fair Permitting and Licensing

A key element of access to economic justice for the poor is the ability to obtain permits and licenses for small business enterprises via processes that are transparent, fair, and efficient. The state of affairs in many developing countries departs considerably from this norm. In Zimbabwe, for instance, red tape and expensive licensing fees constrain the ability of poor communities to launch small businesses based on wildlife tourism or other products and services. Registration of a tourist company in Zimbabwe takes more than a year and costs about US$14,000 to obtain needed certificates and guarantees (Narayan 2002:55).

In Lima, Peru, registering a small garment workshop employing a single owner-operator takes on average 289 days and costs in excess of US$1,200, or more than 30 times the monthly minimum wage. In Indonesia, the official license fees for registering a small business are about US$400, but the actual costs often are typically triple that amount (Narayan 2002:54-55). *(See Figure 3.6.)*

Fortunately, some state and local governments are starting to make it easier for small entrepreneurs to secure their rights to operate. In Bali, one municipality introduced "one-stop shops" for business licenses and permits. This has not only helped businesses obtain licenses more efficiently but has also augmented government tax revenues by 75 percent. In India the government of the state of Gujarat removed the requirement that gum collectors—virtually all of them poor women—must sell gum at artificially low prices to a handful of government-selected buyers (Narayan 2002:56).

As the numerous examples cited above show, progress in empowering the poor in their rights to information, participation, and justice can be made. Such progress is central to giving the poor the political and business tools to take advantage of their nature-based assets and to participate in rural commerce that leads to sustainable economic progress—the route out of poverty.

Empowering the poor with resource rights
can enable them to manage ecosystems better
and significantly increase their environmental income.

CHAPTER 4

FOUR STEPS TO GREATER ENVIRONMENTAL INCOME

THE WEALTH OF NATURE, IN THE FORM OF ENVIRONMENTAL income, is already a key component of rural livelihoods for both the rich and poor. But there is great potential for this component to grow, given the right conditions, and contribute to higher household incomes that lessen poverty. The first condition is an acceptance that better management of ecosystems can increase their productivity—immediately and over the long term. And, since the wealth of nature flows directly from the productivity of ecosystems, better management brings the potential for greater environmental income.

The second condition is that the access to and control of nature shifts so that the rural poor can both see the advantages of good ecosystem management and claim the benefits from it, overcoming the obstacles of disenfranchisement that have kept them economically and politically marginalized.

In this chapter we explore both these conditions—prudent management of ecosystems and governance that empowers the poor to profit from it. We consider the questions: What do we mean by better ecosystem management? What is its potential for poverty reduction? And what governance changes are required to route environmental income to the poor?

In addition, we examine the factors besides governance and eco-friendly practices that support the evolution of environmental income for poverty reduction. These revolve around the need to find successful models to commercialize ecosystem goods and services, coping with such constraints as marketing, transportation, and the need to capture greater value from nature-based enterprises than the poor often do. In addition, we consider the potential for "payment for environmental services" (payments for preserving the functions of ecosystems, such as water supply or carbon storage) to contribute to the portfolio of income-generating enterprises based on nature that the poor can tap.

In examining these factors, we put forth four steps to generate greater environmental income for the rural poor.

1 MORE INCOME THROUGH BETTER ECOSYSTEM MANAGEMENT

Healthy ecosystems work at peak productivity; degraded ecosystems produce less, particularly of the forest products, forage, clean water, crops, and bushmeat on which the poor tend to rely. In fact, degradation of ecosystem functions—in the form of nutrient-depleted soils, overgrazed pastureland, logged-over and fragmented forests, and overfished lakes and coastal waters—has become a serious impediment to the livelihoods of the poor.

As the findings of the recently concluded Millennium Ecosystem Assessment show, ecosystem decline is widespread. The global drop in ecosystem health not only undermines the natural resource base that anchors a substantial fraction of the global economy but erodes the planet's life-support systems more generally (MA 2005a:1-24). The most immediate victims of this decline are the poor, whose household economies, as shown in Chapter 2, depend heavily on ecosystem goods and services. The pressures on ecosystems are particularly intense on many common property lands and fisheries—the most important source of environmental income for the rural poor. Examples are many and distributed on every continent and sea: denuded hills in western India; exhausted forests in Madagascar and Haiti; and depleted catches off Indonesia, Jamaica, or Fiji are just a few of the many instances where overuse and abuse of ecosystems directly impacts the poor.

Better Management Requires an Ecosystem Approach

But ecosystem decline is not inevitable. Ecosystems are resilient and can be sustained through practices that accommodate their

inherent biological limits, recognizing that ecosystems are not simple production factories but living systems built on complex relationships among species and physical factors such as water, temperature, and nutrient availability. Practices that respect and preserve how ecosystems function are the building blocks of what in the past five years has come to be known as an *ecosystem approach* to natural resource management—that is, management that centers itself around the sustainable and equitable use of ecosystems. In this chapter, when we refer to "better ecosystem management," we mean adopting an ecosystem approach. *(See Figure 4.1.)*

In practice, "better ecosystem management" often translates to fairly simple principles, particularly in the context of the ecosystems that the poor use most frequently. For example, it may mean more moderate harvest levels of forest products, forage, or other vegetation, so that the ecosystem can retain its macrostructure, and so that watersheds maintain their ability to absorb rainwater and retain it as soil moisture. It may involve adopting different treatment of livestock, cultivation methods that reduce erosion, or cropping patterns that minimize depletion of soil nutrients. Where ecosystems have already degraded substantially, it may require a period of non-use and restoration, such as a closed fishing season or a logging or grazing ban. Or it may demand direct revegetation through tree-planting. In all cases, the effectiveness of such measures will be greater when they are actively supported by community members who see themselves as benefiting on a fair and equal basis in the short and medium terms. In this sense, an ecosystem approach is as much people-centered as it is ecosystem-focused.

Income Benefits of Better Management

When rural farmers, forest users, and fishers adopt more sustainable practices, considerable income benefits can follow. A recent study of four low-income farming villages in arid western India illustrates the potential for higher agricultural income. All four villages had participated in government-supported projects from 1995 to 2001 to better manage their degraded watersheds—part of a nationwide program known as Watershed Development. They used a variety of water and soil conservation techniques, such as check dams and contour tilling, as well as tree planting to revegetate denuded slopes. The idea was to capture the occasional but intense monsoon rains, preserving them as soil moisture, rather than letting them run off and erode the soil (Reddy et al. 2004:303-306).

The success of these measures from an ecosystem standpoint showed clearly in the recovery of groundwater levels, with the water table in local wells rising an average of 25 percent in spite of several years of scant rainfall. From this increase in soil moisture flowed other benefits. The amount of land under irrigation increased. Grass forage increased as well in most villages, including forage on common property areas, which, prior to the watershed treatments, had been too degraded to produce useable fodder. Crop yields rose significantly, both on

FOUR STEPS TO GREATER ENVIRONMENTAL INCOME FOR THE RURAL POOR

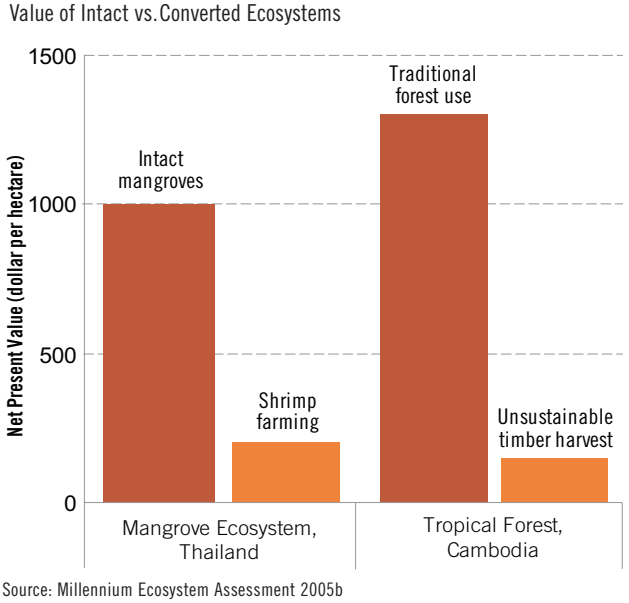
1. **Manage Ecosystems Better for Higher Productivity**
   Improve the stewardship of ecosystems by adopting an ecosystem approach to management—recognizing the complexity of ecosystems and living within their limits. Good stewardship brings higher productivity, which is the foundation of a sustainable income stream.

2. **Get the Governance Right to Insure Access to Environmental Income**
   Confer legally recognized resource rights (such as individual or communal title, or binding co-management agreements). Where possible, decentralize ecosystem management to the local level (community-based natural resource management), while providing for regional or national coordination of local management plans. Empower the poor through access to information, participation, and justice. Create local institutions that represent their interests and accommodate their special needs.

3. **Commercialize Ecosystem Goods and Services to Turn Resource Rights and Good Stewardship Into Income**
   Improve the marketing and transport of nature-based goods produced by the poor. Make credit available for ecosystem-based enterprises. Capture greater value from the commodity chain. Partner with the private sector. Take care to keep successful commercial activities sustainable.

4. **Tap New Sources of Environmental Income Such as "Payments for Environmental Services"**
   Make the newly developing market of payments for environmental services more pro-poor by expanding the array of eligible activities and payment schemes. Look upon ecosystem income as a portfolio of many different income sources. Diversify this portfolio to reduce risk and enhance the bottom line.

FIGURE 4.1 MAINTAINING THE VALUE OF NATURE



Source: Millennium Ecosystem Assessment 2005b

irrigated and nonirrigated land: rice yields up 15-44 percent; peanut yields up 16-81 percent. Village land became more valuable too, because it was in better condition and had more agricultural potential (Reddy et al. 2004:308-312, 318).

With higher productivity, household incomes grew. Income from all sources—agriculture, livestock, and wage employment—increased from 50 to over 100 percent from their levels before the watershed rehabilitation. These increases, in turn, are reflected in higher spending on education and medical care. The benefits from adopting more sustainable watershed practices also extended beyond income. The availability of drinking water went up in all the surveyed villages and the time spent fetching water decreased—as much as 80 percent in one village—a major benefit for women (Reddy et al. 2004:310, 313, 321). *(See Figure 4.2.)*

Likewise, indigenous communities in the Philippines' mountainous Kalinga province have revived traditional irrigation and forest-management techniques that protect local watersheds. Using a combination of reforestation, agroforestry plantings, environment-friendly irrigation, and fish production within active rice paddies, Kalinga families were able to greatly increase agricultural production and raise incomes. They have repaired over 90 traditional irrigation systems to sustainably supply their rice terraces, while on the watershed slopes individual families maintain and protect their own agroforest plantings. Between 1990 and 1996, the combination of watershed protection and good irrigation management raised annual incomes for over 1,000 poor families in seven indigenous communities by an average of 27 percent, all while maintaining over 80 percent of the original high-biodiversity forest cover (Southey 2004:1-2; UN Housing Rights Programme 2005:154).

Similar stories of income gains can be told for communities that have improved their management of local forest ecosystems, fisheries, or grasslands. In the Himalayan village of Waiga, villagers banned grazing and burning on the grasslands above the community in 1995, and planted 1500 alders. Over the next few years grassland recovery raised fodder production sevenfold—enough for all local livestock plus a surplus for sale—while the returning tree cover provided leaf litter for agriculture and stopped gully erosion in the steeply sloped terrain (Munsiari 2003:5, 15-19).

In Fiji, over 100 coastal villages have designated local *tabu* zones in nearshore waters where fishing and shellfish collection is banned to promote recovery of the marine life that forms a central element in local livelihoods and culture. Robust recovery in these local protected zones has spilled over into adjacent fishing areas, increasing the village marine harvest. In three villages where economic evaluations have been conducted, income from marine resources—typically half of all household income—increased 35-43 percent from 1997, when the *tabu* zones were established, to 2003. *(For details, see Chapter 5 case study, "Village by Village: Recovering Fiji's Coastal Fisheries.")*

In each of these instances, villagers have pursued more ecosystem-friendly practices because they visibly supported their resource-based livelihoods, boosting both their direct use of ecosystem goods and their cash incomes. These examples and many others clearly make the case that better ecosystem management pays off at both a household and a village level.

This is good news for rural economies in general. But how effective is this increase in environmental income at reducing village-level poverty? Unfortunately, evidence shows that the benefits of ecosystem improvements are often skewed toward higher income brackets. With more land, trees, cattle, or capital to invest in the increased farming potential of their recovered lands, the rich tend to capture more of the income bonus that healthier ecosystems provide (Reddy et al. 2004:318).

But poor families certainly do benefit also, for example by greater availability of wage employment, and greater ability to

PRINCIPLES OF AN ECOSYSTEM APPROACH

The goal of an ecosystem approach to natural resource management is to foster the sustainable use of ecosystems and the equitable distribution of their benefits. An ecosystem approach is successful if it preserves or increases the capacity of an ecosystem to produce the desired benefits in the future, and increases the capacity of society to fairly apportion benefits and costs.

Manage Within Natural Limits
Recognize the complex functioning of ecosystems and respect their biological thresholds. Conserve ecosystem structure in order to maintain ecosystem productivity.

Manage for the Long Term
Optimize ecosystem productivity—and benefits—over generations, not years. With care, managing for long-term productivity can be compatible with significant short-term gains.

Manage at Both the Micro and Macro Scales
Respect ecosystem processes at the micro level, but see them in the larger frame of landscapes. Decentralize management to the local level when possible. But recognize that ecosystems are interconnected and interactive, and exist on many scales. Local management efforts must be linked and harmonized at the larger scale so they do not work at cross-purposes.

Account for the True Value of Ecosystems
Include the full array of ecosystem goods and services when assigning economic value, not just the commodity value of extracted goods.

Make Trade-Offs Clear
Recognize that ecosystem management will involve trade-offs, since not every good or service can be maximized at the same time. Make trade-offs transparent so that costs can be shared equitably.

Involve All Stakeholders in Decisions
Be inclusive when making major management decisions, involving all stakeholders to foster equity and inspire active participation in the stewardship of ecosystems. Integrate social information with economic and environmental information in the decision-making process. Acknowledge that human modification of ecosystems is not incompatible with good stewardship.

meet their subsistence needs for firewood, fish, and the like. This provides a maintenance level of ecosystem support and greater income resilience for hard times. But it may not provide enough support to take a firm step out of poverty. For that, governance changes that free up access to ecosystems and promote information and market support to the poor are needed.

2 GETTING THE GOVERNANCE RIGHT: EMPOWERING THE POOR TO PROFIT FROM NATURE

As described in Chapter 3, lack of access—physical, political, and financial—is a critical roadblock to the ability of the poor to use ecosystems for poverty reduction. Bringing pro-poor governance to the management of ecosystems begins by removing this roadblock through improvements in tenure security, devolution of authority over nature to more local levels where the poor reside, and empowerment of the poor through information, participation, and the power of redress. The net effect of these actions is to secure the resource rights of the poor and give them the tools to exercise these rights responsibly and equitably.

Securing Property and Resource Rights Through Tenure Reform

Addressing the need for greater tenure security so that the poor can tap ecosystems and invest in their good stewardship is a top priority. It requires reform of the formal tenure regimes that currently make it hard for the poor to exercise property rights over land and resources. Interest in tenure reform has grown significantly in recent years as acceptance of the central role of tenure security in poverty reduction has spread. When well thought-out and appropriately implemented, tenure reform can produce considerable benefits for the poor. The most important is an acknowledgement by the state that traditional tenure arrangements, including communal tenure, are legitimate and legally enforceable.

Recognition of Traditional Rights

Untitled, customary tenure remains the predominant form of tenure in many rural areas of the developing world. The persistence of untitled occupancy—the situation of many poor families who live on land they do not hold formal title to—is a common challenge for tenure-reform efforts. Experience shows that recog-

FIGURE 4.2 EFFECTS OF WATERSHED RESTORATION ON WATER AVAILABILITY AND TIME SPENT FETCHING DRINKING WATER

	Drinking Water Used (liters/household/day)			Time Spent Fetching Drinking Water (hours/household/day)		
Village	Before Restoration	After Restoration	% Change	Before Restoration	After Restoration	% Change
Mallapuram	10.5	11.9	13%	10.5	11.9	13%
S. Rangapuram	10.7	12.8	20%	10.7	12.8	20%
Tipraspalle	11.8	14.3	21%	11.8	14.3	21%
Mamidimada	12.2	14.3	17%	12.2	14.3	17%

Source: Reddy et al. 2004

Continues on page 85

BOX 4.1 NEGOTIATING INDIGENOUS TENURE RIGHTS IN BOLIVIA

IN THE LOWLANDS OF EASTERN BOLIVIA, LAND RIGHTS lie at the heart of a pioneering agreement to preserve both an indigenous people's way of life and a unique tract of dry tropical forest. The deal shows the importance and difficulty of negotiating land tenure amidst differing land uses and user groups.

The setting is the Gran Chaco, an isolated, biodiverse region where the pre-Hispanic Guaraní-Izoceño people have sustainably farmed and hunted the parched, inhospitable land for centuries. In recent decades large-scale cattle ranching and commercial soybean, sunflower, and cotton farming have encroached upon traditional indigenous territory, damaging the land through deforestation and soil degradation. Lacking tenure rights over the public lands they lived on and utilized, the Guaraní-Izoceño were unable to prevent these incursions.

Negotiations in the 1990s between Bolivia's government and the Capitania del Alto y Bajo Izozog (CABI), a grassroots indigenous organization representing the Guaraní-Izoceño, resulted in two landmark agreements. The first preserved 3.4 million hectares of uninhabited Gran Chaco forest and scrub as a national park, designated in 1995. The second will grant the Guaraní-Izoceño title to 1.5 million hectares of land adjacent to the park as a communally owned indigenous territory.

For the Guaraní-Izoceño, the outcome was a pragmatic compromise. On the one hand, they relinquished any ownership claim to the land encompassed by the Kaa-Iya del Gran Chaco National Park (KINP), now the world's largest protected area of dry tropical forest (Winer 2003:181). On the other, the 10,000-strong community, which lives in 23 villages scattered along the Parapet River, will own the sole right to exploit the land and forests of their titled territory—a major step towards safeguarding their livelihoods and future survival (CABI 2004:1-2).

The Guaraní-Izoceño also negotiated a major influence over the park. The KINP is now the only national park in the Americas co-administered by an indigenous organization and a national government. Moreover, the group won the right to pursue sustainable activities, such as ecotourism and fishing, in some park areas, while closing the entire area to new settlers (CABI 2004:1).

CABI's successful land rights campaign was pursued in partnership with the New York-based Wildlife Conservation Society (WCS), which was anxious to protect the Gran Chaco's abundant and often rare wildlife, including jaguars, Chacoan peccaries and guanacos, giant armadillos, pumas, and tapirs (Roach 2004:1). Backed by WCS expertise, CABI submitted a successful proposal for a co-managed national park in 1995. To ensure community buy-in, the park proposal was reviewed in community meetings. To allay livelihood concerns, the border was determined in such a way as to minimize conflict—excluding from the park areas utilized by communities or occupied by third parties (Noss 2005).

In 1997, CABI presented a demand for a Tierra Comunitaria de Orígen (TCO)—designated indigenous territory—under Bolivia's new agrarian reform law. The government approved the request, while retaining ownership rights to underground minerals and awarding water rights to the local municipal government. By April 2005, 300,000 hectares of land had been titled. When the process is complete, 1.5 million hectares of formerly public land will be owned by CABI, as the indigenous people's legal representative, with the remainder of the 1.9 million hectares in private, nonindigenous ownership (Noss 2005).

While the new land rights afforded the Guaraní-Izoceño are clearly conditional, they offer significant potential to boost food and livelihood security. A revitalization of traditional production systems is already underway, with women villagers experimenting with the production of mesquite flour and fish meal for sale in the Isoso communities. Plant-based shampoo and honey are also being commercially developed for sale in Santa Cruz, the regional capital. These activities are managed by CABI's women's organization, CIMCI, whose goals are to empower women, promote traditional culture, improve food availability and nutrition and, ultimately, boost indigenous incomes (Winer 2001:13). CABI has also sought government permission for sustainable commercial trade in collared peccary and tegu lizard skins (Noss 2005).

According to a recent report on the land deals by an the independent consultant, the TCO, by increasing livelihood security, will enable the Guaraní-Izoceño to "retain their identity as an indigenous tribe of lowland Bolivia while building stronger, and more equitable, economic links with the expanding market-driven economy of Santa Cruz" (Winer 2001:12).

The conditional nature of the tribe's land rights, however, is underlined by the presence of the 1,900-mile Bolivia-Brazil pipeline, which bisects both the Kaa-Iya National Park and the TCO. The pipeline was approved before either the park or indigenous territory were created, and the government retains rights to energy resources in the area (Roach 2004:12). As a consequence, Bolivia's government has granted further gas and oil exploration concessions in both the KINP and the indigenous territory, although energy companies would be required to work with CABI to mitigate their social and environmental impacts. A trust fund contributed by the existing pipeline companies, following an agreement with indigenous organizations, including CABI, made up 43 percent of the park's budget between 1998 and 2003 (Noss 2005).

TABLE 4.1 RECENT LEGAL REFORMS STRENGTHENING COMMUNITY FOREST TENURE IN DEVELOPING COUNTRIES

Country	Year Enacted	Key Features of Reform
Bolivia	1996	Ancestral rights of community groups have precedence over forest concessions. Subsequent laws have strengthened community rights.
Brazil	1988	Constitution recognizes ancestral rights over land areas that indigenous groups and former slave communities traditionally occupied. Federal government is responsible for demarcating indigenous reserves on public lands and protecting land rights of indigenous groups.
Colombia	1991	Constitution of 1991 recognizes and outlines a framework for collective territorial rights for indigenous groups and Afro-Colombian traditional communities.
Indonesia	2000	New regulatory process has been recently established by which customary ownership can be recognized.
Mozambique	1997	Titles for customary rights are available.
Philippines	1997	Constitution of 1987 protects ancestral domain rights. Indigenous Peoples Rights Act of 1997 provides legal recognition of ancestral domain rights pursuant to indigenous concepts of ownership.
Tanzania	1999	Customary tenure is given statutory protection whether registered or not. Titles for customary rights are available.
Uganda	2000	2000 draft law currently under revisions. Government is embarking on an ambitious program of devolution to district and local councils.

Source: White and Martin 2002; used with permission, copyright Forest-Trends 2002

nizing and integrating such customary tenure into formal state tenure regimes is a key feature of successful reform. This may require greater flexibility about what is considered legitimate proof of "ownership" so that oral as well as written records of occupation or access to communal lands are accepted. *(See Table 4.1.)*

In Mozambique, Tanzania, and Uganda, new tenure laws simply recognize land held under customary tenure as fully legally tenured "as is." This includes using certification processes based on verbal endorsements (Mozambique), as well as using community-administered land recording and titling processes (Tanzania). In Eritrea, customary tenure has been recognized in the form of lifetime-use agreements, although they cannot be passed down to family members (Alden Wily and Mbaya 2001:15-18).

Other countries are slowly bridging between communal tenure and more individualized land rights. *(See Box 4.1.)* The key is that new individualized rights must be compatible with customary practices, so that they do not create or perpetuate a parallel tenure system that can give rise to conflicting claims later on. Simple and unambiguous procedures for recording land sales and transfers can also help avoid tenure disputes as customary systems interface with modern land markets and land uses (Deininger 2003:52-54).

Traditional rights to resources also extend beyond land rights per se into water rights, the use of fisheries, and pastoral rights. These too can be made more secure through formal recognition and delineation by the state. For example, the government of Fiji formally recognizes "customary fishing rights areas" where villagers have traditionally fished and collected shellfish. These nearshore zones, known locally as *qoliqolis*, have been surveyed and accurately mapped, with the records maintained by the nation's Native Fisheries Commission. Based on these designations, the state Fisheries Department has begun granting local communities the right to draw up their own management plans for *qoliqolis* with the aim of restoring these fisheries as a community asset.

It is important to recognize that increasing security of tenure for the poor does not always require gaining full title or private ownership of land or resources (Deininger 2003:39). In the case of common-property resources like state forests or fisheries, increased tenure security often takes the form of the legally sanctioned use of these resources, including the right to exclude others and manage the resource for optimum benefit. As in the Fiji example above, the key to increased security is that the physical extent of the land or resource, the exact limits of the use, the permissible forms of management, and the limits on the state's ability to modify or terminate the arrangement are specified and agreed to in a legally binding agreement. This kind of unambiguous and enforceable use-right is often a central feature of successful community-based natural resource management projects meant to extend ecosystem access to the poor.

Reduced Transaction Costs and Other Benefits

High transaction costs—the costs of doing business, both in money and time—have traditionally been an important obstacle to the poor in acquiring or disposing of land. Effective legal and land information systems typically form the core of successful tenure reform, thereby lowering property transaction

costs, whether these be sales or leases of resources and use rights. This can help the poor access and manage land and resources as more flexible assets.

Other benefits can come from successful tenure reform as well. One is a decentralization of the bureaucracy that administers tenure and resolves resource and land disputes. When the government machinery for administering tenure rights moves closer to the small rural landowner, it increases the landowner's access to land registration and taxing authorities, as well as legal proceedings involving land disputes. Decentralization of tenure administration has been particularly dramatic in Tanzania and Uganda, with community-based mechanisms for resolving property rights-related disputes appearing in these countries, as well as Mozambique (Alden Wily and Mbaya 2001:14 -18, 46).

Improved security of tenure has also, in many instances, fueled the development of more dynamic land markets in poorer communities. In such cases, poorer households can benefit through greater access to productive land if they have sufficient access to capital. Evidence from Mexico, for example, indicates that policy reforms of the early 1990s that opened up both land and credit markets enhanced access to land among poorer households with adequate access to capital, but not poorer families in general (Carter 2003:52).

Higher Rural Incomes

Greater security of tenure, especially when coupled with access to credit, can help poor farmers in developing countries invest more in their land, thereby improving agricultural productivity and raising farm income. In Thailand, evaluation of a 20-year initiative begun in 1987 to provide the country's rural populations with access to modern land registration and credit institutions revealed that midway through the effort, rural incomes, major investments, and use of formal credit is much higher among farmers with titled land than for those yet to be included in the program (Riddell 2000:10). In China, experimental land policy reforms granting clear ownership rights to village-based cooperatives for communal management of mountainous forest lands enabled villagers in Jiangsu and other provinces to create large, successful orchards (Bruce et al. 1995). In general, successful tenure reform creates both the perception of greater security and the reality of more enforceable rights—both important elements in the willingness and ability of the poor to invest their time and resources in expanding their environmental income. *(See Figure 4.3.)*

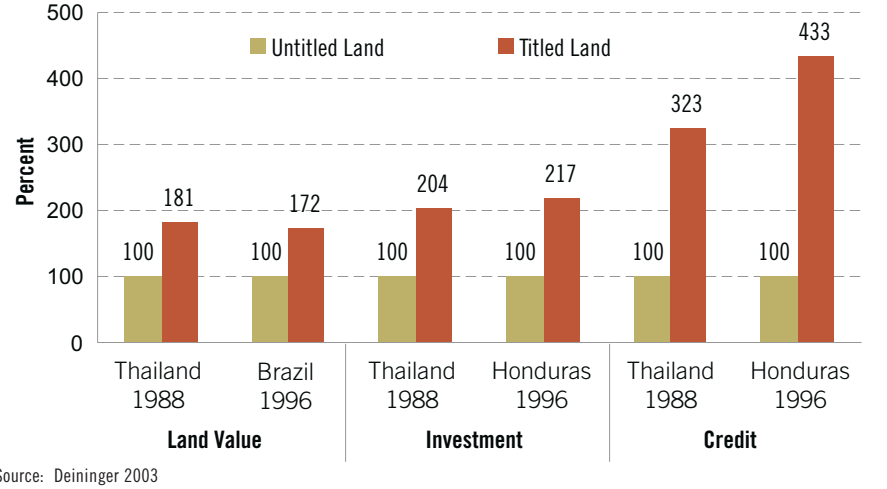
The Dangers of Ineffective Tenure Reform

Reforming something as central to wealth creation as a nation's tenure system is by no means easy. Even though modern tenure-reform efforts rarely attempt major land redistribution, they are still politically perilous, with vested interests often reluctant to change the status quo. Unfortunately, when changes to tenure systems are incomplete or poorly executed, the poor can end up worse off rather than better. Therefore, in designing tenure reforms, policymakers must be careful to avoid the following:

- **Failure to recognize important land uses and users.** Poorly designed attempts to increase security of tenure for some can end up reducing the security of others. For example, land titling and registration projects may overlook rights to important land uses, such as the right to gather non-timber forest products or to obtain water. These uses are most often exercised by women and the poor. If these rights are not legally recognized as part of the land registration process, they may be effectively destroyed (FAO 2002a:20).

- **Land grabs by urban elites.** In some instances, city-based government and business elites have made dramatic attempts at land grabbing through the process of shifting land out of customary tenure systems and into statutory tenure systems. This can take the form of government-granted concessions on indigenously held land over which the state claims ownership. Or it may simply be land purchases by the elite from those who hold land under customary tenure arrangements. Some countries, such as Cameroon, have initiated policies that appear to encourage land speculation, favoring privileged individuals with access to knowledge, influence, and money (Elbow et al. 1998:5).

FIGURE 4.3 EFFECT OF LAND TITLING ON LAND VALUE, INVESTMENT, AND CREDIT



Source: Deininger 2003

- **Exclusion of women.** Women make up the majority of the world's agricultural producers, but they are usually the last to be included in land and tenure reform efforts. Traditionally, women in Africa and other parts of the developing world have only had access to land tenure through their husbands, fathers, or other male relatives. Registration of land in the name of male relatives precludes women from obtaining property rights at a time when women's access to land for cultivation is becoming increasingly important for AIDS widows and other female heads of households (Carter 2003:49).

- **Inadequate procedures for documenting communal rights.** The lack of appropriate procedures for expeditious, cost-effective documentation of untitled communal property rights can compromise the effectiveness of tenure reform. For instance, the government of Bolivia enacted legislation recognizing indigenous land rights in 1996; because of complicated and costly documentation procedures, however, by 1999 only 10 percent of eligible territories had received titles (White and Martin 2002:16).

- **Conditionality and other constraints to land markets.** Many new tenure laws do nothing to remove constraints and limitations that have long hampered land markets in developing countries. For example, none of the recent spate of African tenure legislation removes long-standing requirements to occupy and use agricultural land in order to maintain tenure (Alden Wily and Mbaya 2001:14). Agricultural use may not always be the best use of ecosystems, either economically or ecologically. For example, conversion to wildlife habitat may be a better use of some lands with high tourist potential, or conversion to other commercial purposes. Flexibility in land use may increase the value of the land assets of the poor, while conditions on use reduce the economic potential of the land.

Poor-Friendly Decentralization: Community-Based Natural Resource Management

Improving the tenure security of the poor and their ability to exercise property rights is only one step in the legal, economic, and political empowerment of poor families. A second important step is devolving management authority over ecosystems to local institutions that are more accessible to the poor.

As detailed in Chapter 3, decentralization that actually works for the poor is more the exception than the rule. It requires, at a minimum, that local institutions—whether they be official government institutions like village councils or informal institutions such as user groups, cooperatives, or watershed committees—are formed on democratic principles of representation, meaning that they are accountable to their low-income constituents. But this alone is not usually enough to overcome the structural bias against the poor in local institutions. Special efforts to include the poor are generally required. These can range from reserving gender-based or income-based slots in local institutions to insure participation; arranging for special outreach

and training for members of these institutions; creating rules to insure equitable distribution of local benefits to low-income households; and using participatory rural appraisals and other survey techniques to help local institutions catalogue and quantify community needs and the potential trade-offs for any set of management actions. Of course, this is all predicated on the assumption that the state has granted these local institutions some actual authority over local resources—something that is still far from common.

Pro-Poor Decentralization: An Example

When these minimum requirements come together—true devolution of authority, local accountability, and an effort to acknowledge the special needs of the poor—the outlines of local empowerment can begin to take shape. Uganda provides an instructive example of democratic decentralization that is both ecosystem-friendly and serves the interests of the nation's low-income fishers. Until the late 1990s, management of fishing in Lake Victoria, Lake Albert, and other inland lakes was the province entirely of the central government. A government push for decentralization and the creation of new fishery rules led to the formation in 2003 of Beach Management Units (BMUs)—local institutions charged with regulating fishing along specific stretches of the lake and shore. Each BMU is headed by a committee with 9 to 15 democratically elected members from each of four different stakeholder groups: 30 percent boat owners, 30 percent fishing crew members, 10 percent fish mongers, and 30 percent other stakeholders. In this way wage laborers, merchants, and other low-income families associated with local fishing can participate in the committee along with wealthier boat owners. To address gender disparities, BMUs are encouraged to have women make up 30 percent of the committee "whenever possible" (Waldman et al. 2005:65-68).

The duties of the BMUs cover the daily management of the local fishery: issuing fishing permits and limiting the size of the fishing fleet, registering fishing gear, and working with the government Fisheries Department to enforce regulations against illegal fishing practices. The BMUs also collect fishing data to help guide their management decisions. The local committees are allowed to keep 25 percent of money generated from licenses and landing fees to fund their operations (Waldman et al. 2005:65-68).

Results of the decentralization have been encouraging so far. The BMUs report better control over illegal fishing and improved working relations with central government authorities. The fishing statistics that BMUs have collected have brought greater local awareness to the need to reduce fishing pressure and fish more sustainably. On Lake Albert, BMUs have declared

three non-fishing zones designed to protect known nursery areas and thus maintain the fish stock. The committees report voluntary reductions in the use of illegal fishing gears, indicating a change in attitudes of the fishing community. It is too early to tell if these improvements in management have translated into more income for local fishers, but anecdotal reports of better daily catches are starting to come in. Women are also beginning to change their role. Local culture discourages women from joining fishing crews, but some women have started fishing from the shore; a few women have even become boat owners, hiring men to crew their boats (Waldman et al. 2005:65-68).

The Benefits of CBNRM

Uganda's Beach Management Units are just one example of the broad potential for community-based natural resource management (CBNRM)—one of the most progressive and potentially poor-friendly manifestations of decentralization. This kind of devolution of management authority over state-owned resources has the potential to be both inclusive enough to involve the poor and effective enough to generate increases in environmental income. Well-functioning community management arrangements have shown benefits in all three of the key areas highlighted in this chapter: household income, local empowerment, and ecosystem condition (Shyamsundar et al. 2004:7-13).

Income Benefits

Income benefits come from a variety of sources, including greater access to wage employment as well as to local subsistence goods like bushmeat and forest products (Shyamsundar et al. 2004:9). For example, community forestry arrangements often give rise to forest-related enterprises that can provide substantial local employment; revenue-sharing with the government from timber sales and the like; and greater control over sources of woodfuel and other forest goods in daily use. The same is true of devolving wildlife management to local communities. When the Namibian government in the late 1990s transferred to rural communities the authority to manage wildlife in certain demarked zones called conservancies, it included the right to regulate the substantial tourist trade in these zones and the right to harvest a modicum of bushmeat as well. Conservancy-related activities have created some 3800 jobs that did not exist before the decentralization took place; entrance fees and trophy-hunting fees have generated public funds for schools and other public investments, and even for cash payouts to conservancy members. Local incomes have risen substantially as a result. *(See the Chapter 5 case study, "Nature in Local Hands: The Case for Namibia's Conservancies.")*

Local Empowerment

Some of the most significant benefits of community management are in the area of empowerment. Shifting substantial management control over ecosystems to communities gives them a voice where often they had none. It often restores traditional rights—such as water use rights, forest collection rights, or fishing rights—that may have been lost as modern states centralized their authority. While these political and legal benefits are enormous, the shift in resource control also exerts a substantial psychological effect on communities that may be even more important, particularly for the poor. This manifests as a new sense of pride and control over one's life, as well as greater confidence in dealing with others outside the community and with government authorities. This empowerment dividend is often augmented as local community members gradually develop the accounting, monitoring, planning, and dispute-resolution skills that good resource management demands (Shyamsundar et al. 2004:11). The benefits of such new personal and group skills spill over into domains well beyond resource management.

Ecosystem Benefits

There is also evidence that community-based resource management can create incentives that foster good ecosystem management and contribute to conservation goals as well as economic development. Experiences in Africa, India, and Nepal demonstrate that community forestry management can result in healthier forests and improved tree cover (Shyamsundar et al. 2004:13). A notable example is the HASHI program in the Shinyanga district of Tanzania. With help from the central government, over 800 villages have revived a traditional conservation practice of creating "enclosures" that foster regrowth of the once-abundant forest by controlling grazing and harvesting within the enclosed area.

Management decisions about the enclosures are entirely a local matter controlled by village councils. So far, creating traditional enclosures through the HASHI program has reforested some 350,000 hectares of overgrazed and barren land. Economic benefits distributed to villagers—in the form of fodder, fuel wood, medicinal plants, and greater water availability—have made the HASHI program a popular success. The combination of income and ecosystem benefits made the HASHI program a finalist for the UN's Equator Prize in 2002, recognizing it as prime example of the conjunction of poverty reduction and conservation. *(See the Chapter 5 case study, "Regenerating Woodlands: Tanzania's HASHI Project.")*

Similar ecosystem improvements have also been documented in cases where wildlife management has been devolved to the local level. Wildlife censuses associated with the Selous Conservation Program in Tanzania showed increased animal numbers, and wildlife populations have rebounded impressively in Namibia's conservancy areas as poaching has fallen and conflicts with livestock have been reduced (Shyamsundar et al. 2004:12).

Keeping Community-Based Management Pro-Poor

These successes show the potential for community-based management to empower and enrich local communities and still manage ecosystems well. But CBNRM is no panacea, and

it is by no means always pro-poor. Both the power and benefits associated with community management tend to be directed toward higher income classes unless specific accommodations are made. In pursuing pro-poor CBNRM, communities, governments, and NGOs must keep in mind several points:

Accounting for the Costs of CBNRM

Community management of ecosystems sometimes entails substantial costs that must be accounted for and minimized. One of the major costs of many community-management schemes is the short-term loss of the use of a resource to allow it to recover or to keep its use within sustainable levels (Shyamsundar et al. 2004:10). This "opportunity cost" may manifest as a restriction in the use of common areas for grazing or firewood collection, or a limit on how many game animals or fish can be harvested—restrictions that inevitably fall hardest on the poor. The loss is usually temporary—a typical grazing ban to restore a denuded watershed slope might last for three years. In addition, if the ban is successful, the long-term benefit from the closure will soon exceed the short-term costs. Nonetheless, the short-term costs can impact poor families considerably in the interim and are a frequent source of dissatisfaction (Kerr 2002a:1397).

For example, in a study of villages participating in watershed restoration projects in western India (part of India's Watershed Development program), nearly a fifth of the landless residents reported that the restoration projects harmed their interests because they could not graze their sheep on the commons due to grazing bans (Kerr 2002a:1396). Women too complained of their loss of access to common lands, which they used to collect grasses for brooms, tamarind pods, and tendu leaves—some of the few income sources that they controlled independent of their husbands (Kerr 2002a:1395-97).

This and other studies show that without a mechanism to compensate the poor for their short-term losses, achieving good ecosystem management and maximum benefit to the poor may be antagonistic goals, at least in the initial stages of ecosystem recovery. Offering wage labor to try to offset the income loss is one common way to avoid this trade-off. For example, watershed restoration may require seasonal labor for several years to build check dams, plant trees, install fencing, create ponds, or recontour croplands to retain water. However, this will only provide adequate support if the poor are hired preferentially for such jobs and the labor persists for as long as their access to resources is restricted. In the study of watershed restoration in western India, for example, wage labor, while helpful, was not sufficient to make up for loss of access to grazing on common lands (Kerr 2002a:1388, 1395-1396; Shyamsundar et al. 2004:17-18).

Other approaches to reducing short-term costs or providing compensation may also be useful. Staging the restoration of common areas so that they are not all closed at once, but in rotation, is one strategy to reduce the burden on the poor. Another approach is to provide extra services specifically to poor families, such as training in skills that open other employment options, or establishing credit or savings groups to help them manage household resources better and make investments in land (Kerr 2002a:1391-92).

Assuring Equity in Benefits Sharing

As has been stressed above, richer families in a rural community usually hold a structural advantage in capturing the benefits from good ecosystem management. For example, watershed restoration in arid climates will clearly advantage those with more land, especially if these are low-lying lands where the groundwater captured by the restoration is likely to accumulate most. Likewise, owners of large boats with more efficient gear will be able to harvest more of a healthy fish stock than the poorest fishers paddling small *piroques*. Even when local resource management projects try to make poverty reduction a goal, this natural advantage often intervenes (Kerr 2002a:1388-9, 1398; Kumar 2002:763).

Given the structural advantages of the rich, developing mechanisms to share benefits and costs equitably among all community members must be a priority when communities begin local management of common resources. But finding acceptable recipes for benefit-sharing is notoriously difficult. Successful attempts often require analyzing the benefits carefully so that they can be apportioned not just on the basis of the quantity of water, fish, or forest products produced, but on the economic value of these benefits.

The village of Sukhomajri in the Indian state of Haryana offers one famous example of the successful sharing of benefits. Watershed restoration there in the 1970s produced the same benefits seen in other successful restoration projects: revegetated upper slopes produced more fodder and more surface water in low-lying areas that could be used for irrigation and other income-producing activities.

The innovation came in giving each family an equal share of the water that collected in the village's new catchment ponds, with the option to use it or sell it to others if they wished. Landless families could thus sell their water to farmers with greater need for irrigation, turning their share to cash, as well as benefiting from wage labor that might result from more irrigated crops. Each family also received equal shares of the watershed's valuable *bhabhar* grass, which they could similarly use or sell. This arrangement resulted in considerable increases in household income throughout the community. By 1998, 70 percent of village households were earning Rs 2000 per month (US$47) (Agarwal and Narain 1999:14-17; Kerr 2002a:1390; Kerr 2002b:56).

Unfortunately, there is no easy formula for benefit-sharing arrangements, which are highly specific to both the resources being managed and the social structure of the community. In some instances, the resource is highly divisible and marketable, such as the harvest of high-priced medicinals, and sharing may be straightforward. Or community benefits may come in the form of access fees from tourists, timber revenues, or other income that can be split among community members. In

Namibian conservancies, for example, revenues from tourist access, campgrounds, and the sale of game hunting licenses to foreigners generate income that in some instances has been turned into a cash payout to each conservancy household—an easy way to assure equal treatment (US AID 2004:13).

But in other instances, easy division may be impossible. For example, in many restored watersheds the increase in water will not result in accumulation of surface water in ponds where shares can be calculated. Instead, extra water may manifest as more groundwater, which is legally the property of the land owner from whose well it is pumped to the surface. This makes the community benefit difficult to calculate and hard to tap by poor families without land or wells. Addressing this would require an arrangement where groundwater is considered community property no matter where it is pumped, with users paying a fee to the community to tap it (Kerr 2002a:1391-1392, 1399).

Another approach to community equity is to grant special arrangements just to the lowest income families. For example, one Indian village in Maharashtra state granted to the village's landless residents exclusive fishing rights in a run-off pond that the community had built (Kerr 2002a:1391-1392, 1399). Likewise, low-income families could be allowed special areas to fish, extra harvest or grazing periods, or an extra share of the resource being managed. In all cases, this requires a progressive view of benefits and a careful definition of user rights that is formalized and accepted by the community.

Acknowledging the Limits of Participation

There is a growing consensus that communities can establish functioning institutions capable of managing local resources, and that these institutions—from village councils to user groups—can function through community participation, making real the promise of local devolution. But there is also the realization that community processes are rarely egalitarian. Except in rare instances, communities are not homogeneous, and naturally break into various interest groups, making equity a challenge. Often, these are based along class, ethnic, and gender lines, with women and the poor usually being the least powerful of these groups (Kellert et al. 2000:705; Shyamsundar et al. 2004:16-17, 19; Kerr 2002a:1388-1389; Kumar 2002:765-766).

A scene several years ago from a village meeting about a new watershed restoration project in the Indian state of Karnataka illustrates the problem. At the front of the room sat the wealthiest landholders, who owned fertile, irrigated land in the valley bottom. Behind them sat middle-income farmers with less-desirable but still good land. In the back stood poor families with the least fertile land at the top of the watershed. The landless hung around the periphery; no women were present (Fernandez 2003:6-7).

In situations such as these, assuring true participation for the poor requires considerable institution-building so that mechanisms of inclusion can gradually work against ingrained social patterns. For example, one NGO in Maharashtra state that helps villages undertake watershed restoration programs insists on a consensus-based approach to all decisions about the watershed and spends a good deal of time facilitating such decisions and building the social basis necessary to foster them (Kerr et al. 2002:16, 34). Although it is more unwieldy than a majority vote, this approach offers an organic way to make sure the interests of the landless minority are not simply swept aside.

Another method that has proven effective in some situations is to encourage the poor to form a separate affinity group or self-help group—such as a credit or savings association—where they can discuss common concerns, develop skills such as bookkeeping and management of common funds, and come to common negotiating positions. One or more members of such self-help groups can then act as an official representative on the watershed committee or other local authority charged with managing the natural resource in question, insuring that the poor have an official voice and at least a modicum of representation. In Karnataka, such arrangements have, for example, resulted in better recognition of the need to provide forage to the landless during the watershed regeneration process (Fernandez 2003:5-10).

Often, these self-help and affinity groups have a high proportion of women. This points up the fact that achieving real participation of the poor inevitably means making special efforts to bring women, who head up many of the poorest households, into a greater decision-making role. Overcoming gender bias is particularly important in natural resource management because of the role women play in generating environmental income and their place in managing the household economy. They are usually the front-line users of natural resources on a day-to-day basis.

Unfortunately, there is abundant evidence that even when women are given places on village committees, they often are treated as tokens rather than full members, with their voices being lost among the male majority or their votes simply a proxy for their husbands' opinions. Techniques to increase the influence of women include requiring parity—or close to it—of representation on such committees, as well as deliberate scheduling of meetings to accommodate women's domestic and child-care responsibilities. Including women in technical training about managing the resource in question is also important to insure parity in skill levels and reinforce the idea of women as co-managers rather than dependents (Kerr 2002a:1398).

Nongovernmental organizations are frequently essential partners in helping communities devise decision-making processes that include the poor. Local NGOs often provide both technical help with the task of resource management, but also capacity-building in group dynamics and conflict resolution, as well as administrative capabilities such as bookkeeping, budgeting, keeping records, filing reports, and interacting with government officials. In Karnataka, the NGO MYRADA provides a series of 14 training modules for the use of local self-help groups covering topics such as crafting a common vision, developing internal rules and regulations, resolving conflicts, and maintaining proper books (Fernandez 2003:6). As with MYRADA, the involvement of local NGOs can be the catalyst for innovations in local governance that help the community reach beyond its traditional social hierarchy to recognize the need for greater equity in benefits-sharing (Kerr 2002a:1390-1392). Such groups can also bring isolated rural communities into contact with networks of similar communities to share experiences, as well as with a wider global community of ideas and funding that may offer new resources and partnerships (WRI et al. 2003:71-88).

While communities can look to civil-society groups for new approaches to local governance, they often need to revisit traditional community institutions as well. Customary sources of authority such as chiefs or village elders are frequently key players in helping communities to organize around the goal of local management. In many cases, community action could not proceed without at least the tacit blessing of the traditional leaders.

In some instances, these traditional institutions have acted in parallel with democratic institutions such as village councils, creating a synergy between new and old that has been key to the success of the management effort. In Fiji, it was the encouragement of the local district chief that led to the first experimentation with community management of a local fishery and the establishment of the no-fishing zone that helped rejuvenate it. In Tanzania's HASHI project, protected forest enclosures are officially managed by the local village councils, but the councils are guided by the villages' customary Council of Elders and informed by traditional village assemblies called *Dagashida*.

While traditional institutions generally engender the community's respect and buy-in to local management regimes, they can also be obstacles to equity and equal participation if they simply reinforce entrenched power arrangements or provide a route for powerful families to monopolize the benefits stream (Shyamsundar et al. 2004:7).

A Continuing Role for the State

The goal of devolving control over natural resource management from the national level to the local level is to give local residents a stake in management, thus increasing its effectiveness and equity. But the state still plays an essential role in helping such local management to succeed. For example, it is the state that must put in place the policy and legal framework to allow local management to take place at all. In addition, the state has a special responsibility to look beyond the level of community management to make sure that broader environmental standards are upheld and management efforts are coordinated. The state can also help local management to become a source of substantial income through training and capacity building, as well as deploying its more traditional economic development tools of transport, marketing, and credit assistance. More specifically, the state has an important role in eight areas:

1. **Defining the legal space for local management.** Without official state recognition, local management regimes can never be secure. This usually requires altering the framework of national laws that define the state's role in resource

ownership and management. Many nations have made significant progress in crafting new forestry, wildlife, and fishery laws that specifically sanction local management regimes. In South Africa, for example, the 1998 Marine Living Resources Act included a provision recognizing the legitimacy of managing local fisheries for subsistence use (WRI et al. 2003:180). In Africa alone, more than 30 countries have passed new forest laws since 1990 that mandate varying levels of decentralization and new opportunities for local participation in management (Shyamsundar et al. 2004:20). However, interpreting these laws and establishing the limits of local management authority are ongoing challenges that demand continued state attention and experimentation. This includes not only the details about technical management itself, but also such institutional questions as the structure of local management committees. The state, for instance, may play a progressive role by encouraging gender balance on such committees.

2. **Granting resource tenure.** As stated earlier, tenure is a central requirement for real access and control of resources. As it defines the parameters of local control, perhaps the state's most important contribution is to clearly establish the resource rights of communities in a legally unambiguous manner. This allows communities to make firm management plans and financial commitments without fear of disenfranchisement. It gives them the legal basis to seek redress through the courts if they feel their resource rights have been violated. This access to redress is essential to the exercise of true authority, and lack of this right is a frequent bugaboo of local management efforts.

3. **Requiring community consent.** One way that the state can safeguard local community management rights is to insist on a requirement of free, prior, and informed consent (FPIC) by the community whenever large-scale economic projects like mining, energy extraction, or major timber harvests are proposed nearby. Planning for such projects often excludes effective community participation and conflicts with local priorities. FPIC is both a principle and a process that some governments and international institutions are beginning to incorporate into their policies. As a principle, FPIC is the right of local communities and indigenous peoples to participate meaningfully, through consent procedures, in decisions about how the land they occupy and the natural resources they depend on are to be utilized. As a process, FPIC enables rural communities—who are often politically weak—to present their concerns to those proposing large-scale projects, whether they are from the government or the private sector. Its intent is to promote equal bargaining power among all parties and shield communities from coercion, threat, or manipulation. Without this shield, experience shows that poor communities often lose control of local resources. *(See Box 3.3.)*

CO-MANAGEMENT EXPERIENCES IN SAMOA

In 1995 the Fisheries Division of Samoa developed a co-management policy for the nation's small-scale coastal fisheries. It began to work with fishing communities to develop Village Fisheries Management Plans, providing villages with any technical assistance they needed to develop the plans. Provided the rules proposed in the management plans were consistent with national law, the government would help the communities make them legally binding by issuing them as by-laws. Once approved, the by-laws were disseminated via radio.

Within the first two years of implementing the co-management policy, the Fisheries Division had helped 44 communities adopt Fisheries Management Plans. These plans all contained elements of sound ecosystem management. For example, all of the plans banned the use of dynamite (a destructive fishing practice), 86 percent established local marine protected areas, and 75 percent set mesh size limits on fishing nets to reduce the accidental capture of juvenile fish. The government implemented the program gradually, providing extension services to roughly 10 new villages per year. Extension officers would first meet with the community; if it was interested, the officers would convene a community assembly to negotiate the co-management arrangement, including the various duties and obligations of the state and the community. Satisfaction with the program was generally high. An internal review in 2000 found that 86 percent of the villages were implementing management plans at or above average competency (King and Fa'asili 1999:138-140; World Bank 2004:42)

COMMUNITY-BASED FISHERY MANAGEMENT IN SAMOA

Management Technique	% of Villages Adopting
Banning the use of chemicals and dynamite to kill fish	100
Banning the use of traditional plant-derived fish poisons	100
Establishing small protected areas in which fishing is banned	86
Enforcement of limits on the size of mesh nets	75
Banning the dumping of rubbish in lagoon waters	71
Placing controls or limits on the number of fish fences or traps	<10
Offering prayers for the safe-keeping of the marine environment	<10

Source: King and Fa'asili 1999: FAO 2002b

4. **Creating local-state co-management partnerships.** In many cases, local management is best pursued as a partnership between the community and the state. Co-management regimes, as these partnerships are called, allow the state to contribute its expertise in some areas while devolving substantial control over most day-to-day management. Co-management regimes have become common in fisheries, where communities may not have the capability to take on some essential tasks such as fisheries research and stock assessment, or to manage an entire fishery. But they are

Continues page 96

BOX 4.2 FAIR TRADE CERTIFICATION: RURAL PRODUCERS MEET THE WORLD

A COFFEE DRINKER IN SAN FRANCISCO has little chance of ever meeting the small-scale farmer in Nicaragua who may have raised the original coffee beans. But if the coffee drinker has bought "Fair Trade" beans, he or she has made a conscious effort to support the coffee producer with a fair wage. Goods that are certified as "Fair Trade" are priced a little higher than the market rate, with the premium routed to the small rural producer in the form of a slightly higher profit. The Fair Trade concept aims to bring small farmers a fair price for their products and to support sustainable and socially responsible production methods (FLO 2004:3-8). Fair Trade is thus one of the more benign faces of globalization, with the potential to connect poor rural producers with global markets.

Besides coffee, Fair Trade items include tea, cocoa, sugar, honey, bananas, fresh fruit and vegetables, dried fruit, fruit juices, rice, wine, nuts and oilseeds, cut flowers, ornamental plants, cotton, and a variety of handmade crafts—but coffee remains the core of the Fair Trade system (FLO 2005; Young 2003:6). Fair Trade certification—where producer cooperatives commit to a series of labor and environmental practices and social equity goals—began in 1988, when Mexican and Dutch trading partners launched the Max Havelaar Fair Trade certification, sponsored by the Max Havelaar Foundation in the Netherlands. In 1997, the growing family of Fair Trade organizations formed an umbrella organization, Fairtrade Labeling Organizations International (FLO), which standardized labeling and certification procedures. In 2004 there were some 400 organizations and more than 800,000 producers certified under the FLO umbrella (FLO 2005).

Fair Trade producers can earn more than double the conventional market price for their beans. The 2004 price for Fair Trade Robusta coffee was set by the FLO at a minimum of US$1.01 per pound, with an additional $0.15 premium for organic coffee. This compares to prices on the conventional market that averaged US$0.40 per pound (FLO 2004:11; Bacon 2005:505). This can translate into a significant income boost for farmers. In Chiapas, Mexico, farmers in one coffee cooperative have reported 100-200 percent growth in income in recent years due to Fair Trade sales (Taylor 2002:19-23).

Direct gains in income are critical for small farmers, but some of the less visible benefits of Fair Trade can be even more important for producers in the long term. Members of the La Selva cooperative in Chiapas, Mexico, cite the importance of the "apprenticeship in commercialization" they have gained from working directly with buyers and learning about potential markets (Murray et al. 2003:12). Other important benefits include greater access to credit, broader networks of contacts, and technical training and information exchanges that help farmers produce higher-quality coffee (Taylor et al. 2002:20).

Finally, Fair Trade and shade-grown coffee can significantly reduce the vulnerability of small farmers, impacting livelihood security in ways that are often overlooked. A typical shade coffee farm consists of a mixed plantation that can produce fruit, firewood, timber, and other products in addition to coffee. This allows families to be less dependent upon a single crop, and provides resources that can be used directly or sold for cash. Studies in Guatemala and Peru suggest that these non-coffee products can provide as much as 25 percent of the total value earned on a small farm (Rice 2001 in Valencia 2001:2). Fair Trade cooperatives also offer a set price for a crop—this gives farmers the ability to plan ahead, a rare luxury (Murray et al. 2003:7). A survey of Nicaraguan farmers found that farmers participating in Fair Trade and other alternative markets were four times less likely to feel at risk of losing their land due to low coffee prices (Bacon 2005:506).

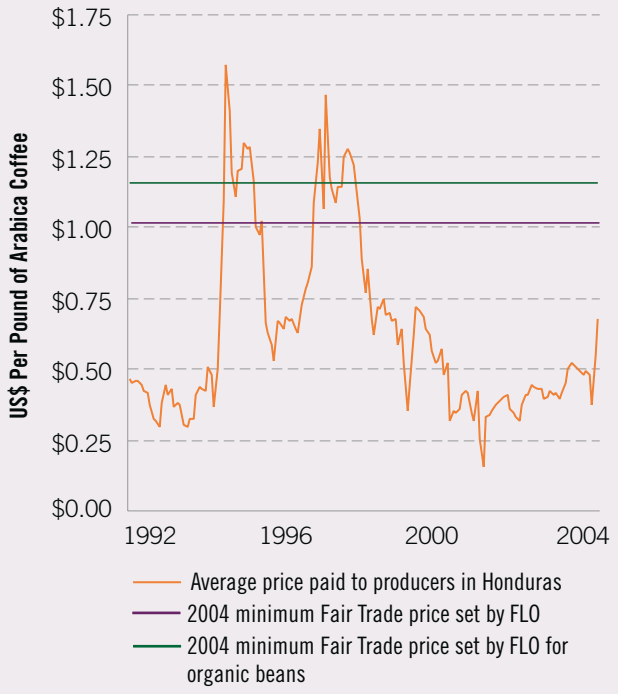
Fair Trade coffee production also has important environmental benefits. While Fair Trade cooperatives do not require their members to raise shade-grown coffee, they encourage it along with organic production methods. Most training and financing are linked to sustainable production methods, and organic coffee can earn an additional price premium (Taylor 2002:3-4).

The Samyukta Vikas Cooperative: A Fair-Trade Success

While coffee is the focus of much Fair Trade commerce, villagers near Darjeeling, India, have concentrated on tea. Residents of three remote hill villages located on a former tea plantation are now successfully exporting organic Darjeeling tea to U.S. consumers. The new tea enterprise has helped the villages of Harsing, Yankhoo, and Dabaipani become economically self-sufficient. Tea income has allowed residents to construct a community drinking water supply, and the villagers are developing plans to add ginger, cardamom, and oranges to their organic exports.

Life for the villages' 483 families, all of Nepali descent, has improved significantly in just eight short years. Since the tea estate they inhabit was abandoned in 1952, the isolated communities had survived on subsistence farming, cultivating maize, millet, and vegetables, and keeping a few cattle, goats, and chickens—almost all for domestic consumption. Most

THE BENEFITS OF FAIR TRADE TO COFFEE FARMERS IN HONDURAS



Source: FLO 2004, ICO 2005

families had small landholdings averaging 1.5 acres. Their soil's high acidity, the result of intensive tea cultivation, led to very low productivity. Local deforestation had also contributed to soil erosion, landslides, and the loss of forest products (RCDC 1996:5-7).

Most families lived a precarious existence, surviving on less than 12,000 rupees per year (US$275). A 1996 survey by a local development NGO, the Darjeeling Ladenla Road Prerna (RCDC), reported that the villagers "have very low self-esteem and display an attitude of despair." When asked their views on development priorities for their communities, 30 percent replied "no idea" (RCDC 1996:4).

All this changed in 1997 when RCDC persuaded the villagers to form the Samyukta Vikas Cooperative and use their own resources to improve their livelihoods. Three community members were chosen as "animators" and trained by RCDC in participatory decision-making and co-op management. These three explained what they had learned to households across the scattered hamlets. The villagers then voted to establish a cooperative of three levels, with farmer families as the bottom tier, elected hamlet committees as the middle tier, and an elected board, with members from every village, as the highest decision-making authority (Down to Earth 2004:44). The board's first actions were to set up a milk cooperative and a small credit union through which villagers could sell milk and borrow small sums at far less interest than charged by middlemen (TPI 1999).

Once the cooperative was functioning, RCDC linked the villagers with Tea Promoters of India (TPI), a Calcutta-based, family-owned company that manages four organic tea gardens, all run according to Fair Trade standards. During a series of negotiations, the cooperative board voted that all members would convert to organic farming, while TPI undertook to buy the villagers' tea supply, distribute grasses used for soil rehabilitation to the farmers, and train them in organic techniques including composting, pruning, and use of natural pesticides. The company also supplied 4,800 tea saplings at a 50 percent discount (TPI 1999:1-2).

Tea-leaf production from the villages has grown steadily since the first collection for TPI in May 1998. Tea collectors are selected from the community by each hamlet committee, and paid a wage by TPI. Other co-op members transport the leaves to TPI's nearest tea garden, where they are processed and blended for export (Down to Earth 2004:44).

Samyukta Vikas Cooperative is the first non-plantation, cooperative tea supplier established in Darjeeling. Since 1999, organic English Breakfast, Earl Grey, and green tea sourced from its family-owned plots has been exported by Tea Promoters of India to the Fair Trade company Equal Exchange, based in Massachusetts. From there it is sold to food co-ops, health stores, churches, restaurants, and cafes around the United States. TPI, Equal Exchange, and Dritwelt Partners, a European certification organization, jointly bore the cost of the international organic certification process for the Samyukta Vikas Cooperative's tea supply. In 2004, Tea Promoters of India provided more than eight tons of tea to Equal Exchange (nearly 140,000 boxes), 10 percent of which came from the Samyukta Vikas Cooperative (Howard 2005).

While it remains a small-scale enterprise, the successful collaboration between community-owned farms in Darjeeling, local Fair Trade exporters, and overseas Fair Trade importers demonstrates one route by which global markets, when combined with fair prices and local governance over use of natural resources, can benefit poor producers in developing nations.

also common in forests, such as India's Joint Forestry Management agreements, where communities are granted limited management and use rights on state forest lands. The challenge for co-management regimes is to assure that the state cedes sufficient rights and authority to local communities but does not abandon them, leaving the communities without proper support.

5. **Accounting for the scale challenge.** Inherent in the management of ecosystems is the problem of scale. Ecosystems can exist simultaneously at different scales, from a forest block in a single watershed to interconnected forest tracts extending a thousand kilometers. Sustaining ecosystems requires keeping in mind the interconnections between these scales, from micro to macro. Forest management in one community's watershed may affect downstream communities and adjacent forests. Local communities cannot be expected to manage well at this macroscale, and thus the state retains an essential role here. This means helping to coordinate management plans in adjacent communities—and across the nation—so that they do not conflict or overemphasize a single kind of use (Shyamsundar et al. 2004:20). The state also has an oversight responsibility to make sure that local management aligns with national environmental laws, and even with international treaties such as the Convention on International Trade in Endangered Species (CITES).

6. **Monitoring and enforcement.** Good ecosystem management relies on keeping harvest activities, tourist use, or other impacts within the ecosystem's tolerances. This in turn demands an attempt to monitor the state of the ecosystem or the intensity of the impacts so that management decisions can reflect conditions on the ground. It also demands enforcement of the community's harvest or use rules and the prevention of illegal logging, fishing, or other encroachment on the resource. Communities can often develop monitoring and enforcement capabilities, and, in fact, this is one area of group participation that can become a source of empowerment, as community members develop scientific skills or volunteer as forest guards or game wardens. But for transboundary monitoring or enforcement

actions where large-scale poaching or illegal activity is involved, the state can usefully intervene with personnel or funds or both.

7. **Capacity-building and networking.** Developing the management acumen required to effectively manage a fishery, game population, ecotourism trade, or forest concession takes time and training. While NGOs can help with much of this capacity-building and training, the state—as a repository of skills and budget in these areas—clearly has a part to play. The state, as overseer and coordinator, also has a natural role in helping communities share lessons and skills. It can also help communities participate in larger international networking efforts and partnerships, such as UNDP's Equator Initiative, which brings together governments, NGOs, businesses, and local communities to identify and support examples of sustainable community resource management that increases rural incomes.

8. **Supporting communities with transportation, credit, and market regulation.** If one of the prime goals of local management is to increase income from the community resource, then the state can help by fulfilling its traditional role of supporting economic development by assisting local communities to develop their transportation and marketing infrastructure. Without an outlet to viable markets and the knowledge and funding to create demand, local communities will not be able to maximize their gain and reward good management practices. At the same time, the state must do its part to insure that competitive markets exist for the products of rural enterprise. That means regulating markets to avoid the price-fixing and monopoly control of resource markets that frequently occurs in poor nations.

When the state supports communities by playing these roles well, it can greatly increase the chances for successful local management. In turn, the state can look forward to significant returns on its investment in the form of better management results, higher tax revenues, reduced resource conflicts, and smaller outlays for monitoring and enforcement (Shyamsundar et al. 2004:13-14).

3 COMMERCIALIZING ECOSYSTEM GOODS AND SERVICES

Success at managing ecosystems can bring the poor higher agricultural yields, more fodder, and higher fish catches. Success at creating local institutions that serve the poor can bring a fairer distribution of this enhanced productivity. But these steps alone do not necessarily bring wealth. They may enrich the household diet and stabilize daily subsistence, but they do not assure the kind of cash income that aids the transition out of poverty. That usually requires successful commerce. Success at commercializing ecosystem goods and services often marks the difference between using nature as a low-income livelihood support and making it a substantial source of cash and a path to the accumulation of economic assets (Marshall et al. 2003:128, 135-136; Neumann and Hirsch 2000:43). There are several important elements to successful commercialization:

Provide Marketing Assistance

Product processing, marketing, transport, and sales are the main aspects of commercialization. While emphasis is often placed on the process of production itself—the farming, fishing, or collection of wild products—the importance of the commercialization process is sometimes under-appreciated. That's unfortunate, because commercialization factors are the most frequent obstacles to higher cash income from ecosystems. A recent study in Mexico and Bolivia found that marketing and sales—not production issues—were the main constraints to successfully turning nontimber forest products like resins, basket-weaving materials, honey, bamboo, and bark into successful commercial products (Marshall et al. 2003:130, 135).

These constraints manifest in a variety of ways. Rural farmers and fishers may lack a way to get their products efficiently to market. Forest collectors may not know how to effectively price their product, may lack information on how to improve their product's quality or consumer acceptability, and may not know how to build demand in specialty markets in urban areas or among tourists. Guides or others serving the ecotourist market may lack contacts, experience, or language skills to market their unique services. It is not surprising that research suggests an urgent need for better business planning, market analysis, and market development if rural ecosystem users are to find commercial success (Marshall et al. 2003:135).

To a certain extent, sheer lack of information on current market conditions and trends contributes to lack of marketing power. New information services can help with this. In Uganda a coalition of NGOs, government agencies, and private companies operates FOODNET, a regional network that collects weekly or daily price information on commodities. Rural farmers access the information through radio broadcasts, the Internet, and cell phones. The service, which reaches seven million people weekly, prevents middlemen from manipulating prices to undercut producers. Farmers estimate that the service has raised their return on products by 5-15 percent (WRI 2005).

But the problem goes deeper as well—to a lack of training in business planning. NGOs and state extension services can be important partners in providing the training and technical support to meet these planning and marketing needs. For example, Mexico's PROCYMAF program, cofinanced by the government and the World Bank, offers training to community enterprises in forest management as well as marketing information for wood and nonwood products. The program has financed over 60 marketing studies and 10-12 pilot projects to test the viability of nontimber forest product enterprises (Scherr et al. 2003:50, 57).

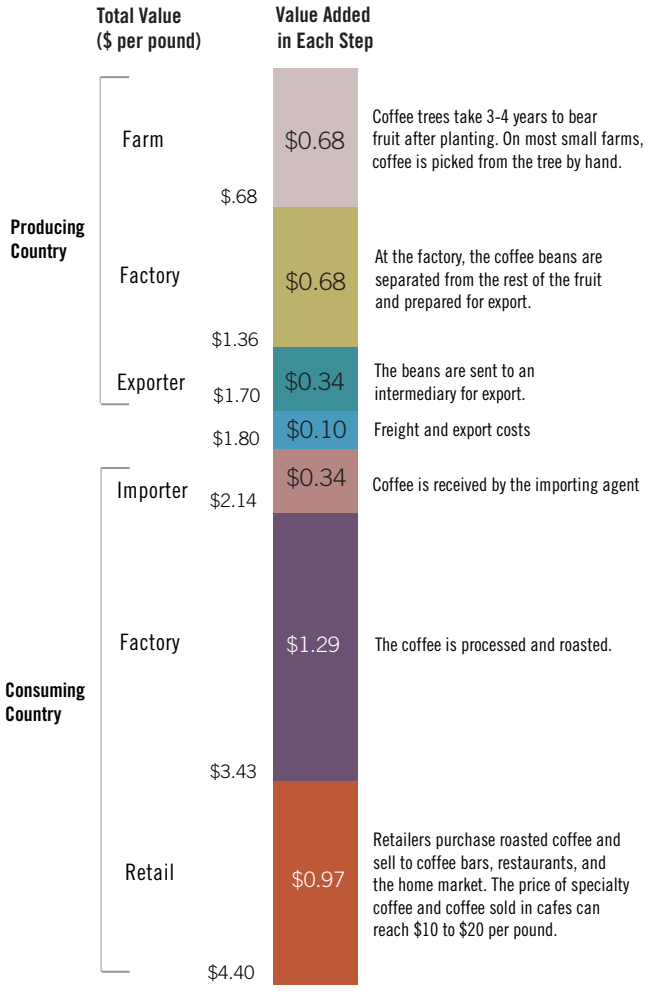
Understand the Limitations of Transportation

Rural areas are notoriously difficult to reach. Roads and rail links are usually scarce, often in disrepair, and frequently impassable. This puts transportation high on the list of critical factors determining the commercial viability of ecosystem goods and services that the rural poor may wish to market. In the remote Iquitos region of Peru, for example, transportation costs are often the deciding factor in what is marketed (Neumann and Hirsch 2000:51-52).

Fresh fruits, vegetables, fish, milk, and other perishable items are particularly subject to the limitations of transport infrastructure. In Nigeria's Niger River delta region, marketing of the African or Bush Pear *(Dacryodes edulis)*—a nutritious and valuable fruit much in demand—is held back by impassable roads during the rainy season, just when the pear is bearing most heavily (Adewusi 2004:144). Likewise, a market analysis of palm fruits harvested in the one of Brazil's Extractive Reserves found that it was only profitable to market those fruits picked within 114 km of a market—about 3.5 days travel time. Beyond that, it was too slow and too costly to be worth the effort (Neumann and Hirsch 2000:52).

Of course, the need to provide efficient rural transportation goes well beyond its importance to building markets for ecosystem goods. It is a basic requirement for rural development more broadly. Studies show that transportation deficits and bottlenecks are an obstacle to economic growth. The connection of roads to poverty reduction is also well-understood. A recent study shows that living close to a highway decreases a household's chance of being poor by 17 percent and increases its access to work by 32 percent (Manasseh and Chopra 2004). Nonetheless, providing adequate rural transportation has been a constant challenge for national and local governments due to the high costs of transport infrastructure, and it is likely that getting products to market will remain a lingering problem for poor producers.

FIGURE 4.4 COFFEE MARKET VALUE CHAIN



Source: Wheeler in Fitter and Kaplinsky 2001

Make Credit Available

One of the most frequently cited constraints to commercializing environmental goods is a lack of financial services such as loans or credit. Credit is simply unavailable in many rural settings, handicapping the ability of the poor to use their environmental assets. By one estimate, 500 million economically active poor families have no access to credit or other financial services. Without access to credit, the poor must rely on their own savings to capitalize their enterprises, but these are frequently inadequate to fully exploit their economic opportunities (Marshall et al. 2003:135; IFAD 2004:9).

Considerable strides have been made in recent years in providing new credit channels for the poor, from informal savings clubs to more formal Grameen-type microfinance banks. These have dispelled the myth that the poor are not creditworthy or are unable to save (Morduch and Haley 2002:2-3). But the dimensions of the credit problem require continued progress in extending microfinance to diverse rural communities. One promising strategy involves taking advantage of the fact that the poor have already formed thousands of self-help groups and saving clubs to address their own finance needs. Linking these groups with traditional banks would allow the banks to extend their services to a ready-made clientele with a history of enterprise and saving. In turn, these small groups of poor households would then become connected to the larger financial market and could draw on its business expertise (IFAD 2004:15).

Other more traditional strategies will be needed as well if credit availability is to rise substantially. These include strength-

ening rural banks, both private and community owned; reforming agricultural development banks so that they become major microfinance providers; and helping current microfinance providers to create networks and take advantage of supporting services such as credit rating and refinancing (IFAD 2004:12-14).

Capture Greater Value

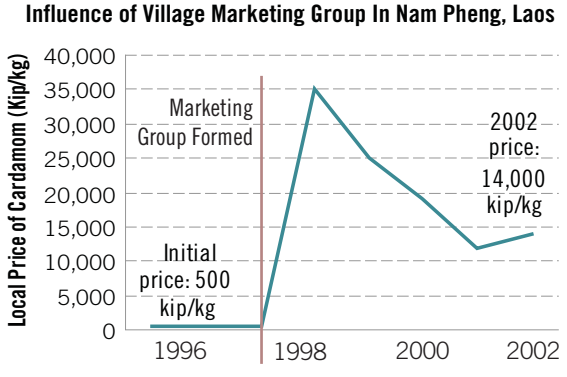
Increasing the economic return that the poor realize from nature-based products is an important element in any strategy to use nature for poverty reduction. Many of the goods that the poor produce or obtain from nature yield low prices relative to the labor involved. Changing this involves action at three different levels.

Improve Production and Processing

The first level of creating value is improving production or processing efficiency so that the same labor yields more or a higher-quality product. An important aspect of this is improving the storage and handling of products to reduce losses and improve quality. A high rate of post-harvest losses is typical for small producers. In Ethiopia, post-harvest grain losses from spoilage, insects, and rodents rob grain producers of 5-26 percent of their harvest (Gabriel and Hundie 2004:4). Losses of milk in Tanzania total some 60 million liters per year, worth over US$14 million (FAO 2005). Reducing losses involves a concerted effort to educate small-scale producers about good production hygiene and the use of low-cost technologies for storage and shipment. For example, FAO is currently helping to implement milk-hygiene programs for small producers in East Africa, and to explore the adoption of an inexpensive milk preservation system called the lacto-peroxidase system to extend shelf-life of small-producer milk (ILRI 2003:6).

Paying more attention to factors like appearance, packaging, or labeling, particularly for export or tourist markets, can also raise the value of products. State extension agents or NGO technical assistance can frequently help. In one example, small farmer cooperatives in Nicaragua have worked with the U.S. Agency for International Development and the Thanksgiving Coffee Company to build "cupping labs" to taste their coffee after processing. Thanks to the labs, the Nicaraguan farmers have begun garnering international awards for coffee quality and are successfully reaching specialty markets in Europe and the United States (Bacon 2002:i-iii; USAID 2004:1).

FIGURE 4.5 MARKETING GROUPS RAISE PROFITS



Source: Morris 2002

Cooperatives Raise Marketing Power

The poor frequently capture only a small percentage of the value of the ecosystem products they sell, while middlemen and retailers higher up the commodity chain often capture a much greater share. Middlemen perform valuable services by transporting products to wider markets and tapping into distribution chains to which the poor have no access. But they are also key actors in keeping producer profits low. For example, small-scale coffee farmers capture, on average, only 4.5 percent of the retail price of coffee sold in U.S. supermarkets (Gresser and Tickell 2002:21). In Senegal, an analysis of the charcoal commodity chain likewise found that the profit of a typical woodcutter at the base of the chain is less than 4 percent of the profit that an urban charcoal wholesaler earns (Ribot 1998:318). *(See Figure 4.4.)*

A common way for rural producers to increase their market power and avoid middlemen is to form cooperatives or marketing groups. These groups can help poor producers receive better market information, increase their prices, and expand their markets. They also provide a natural forum for training, networking, and sometimes for management of the resource being marketed. In Nam Pheng village in northern Laos, villagers formed a marketing group in 1998 to coordinate their harvest of bitter bamboo and cardamom and to try to increase the price received at market. The marketing group collects the villagers' individual harvests, sells them on a large scale to traders, and delivers 85-90 percent of the final sale price to villagers (Morris 2002:4-5).

The effectiveness of the group was immediately apparent when, shortly after forming, they were able to raise the local price of cardamom from 500 Lao Kip per kilogram to 35,000 Kip. Although the price has since dropped to 14,000 Kip, it is still well above what villagers got when they marketed on an individual basis. The 10-15 percent of the sale price that the marketing group keeps goes into a community investment fund that has supported a new school and an improved water supply, as well as providing loans for a number of households. The marketing group has ventured into management by setting regulations for when and how much to harvest, and also providing training in collection techniques. Decisions are made jointly by the marketing group members, which include virtually all households in the village (Morris 2002:4-5). *(See Figure 4.5.)*

In Mexico, the Union de Ejidos de la Selva, a peasant organization, has helped organize small coffee producers in Chiapas state into an effective marketing force. The union collaborates with 1,250 families in 42 communities to ensure the adoption of better soil-management and environmental

practices, including certified organic techniques that limit erosion and water pollution. The union has partnered with a civil society organization called the Vinculo y Dessarrollo to create a chain of five up-scale coffee shops in Mexico City—the Café de la Selva—that serves the organic coffee produced by the Union de la Selva farmers. By controlling the entire vertical chain of coffee production, the Union de Ejidos de la Selva has been able to capture the full urban consumer value of coffee and use it to improve farmer income and self-sufficiency (Samperio 2002).

Use New Commercial Models

A third tactic for increasing commercial payoff is to make use of new models of commercialization, such as organic certification or the Fair Trade movement. These specialized markets, in which consumers purchase an item (often at a premium) in order to further social, environmental, and health goals, have continued to grow year by year. Although they do not account for a large percentage of total sales of any commodity, these markets can offer several advantages. The Fair Trade movement, for example, is targeted to support small rural producers, with the explicit goal of providing a fair wage for growing or crafting export items such as coffee, tea, bananas, or any of a number of handicrafts. It essentially amplifies the idea of a typical cooperative or marketing group to the global level, offering low-income producers a route to high-value international sales they would otherwise have little chance of obtaining. *(See Box 4.2.)*

The markets for certified organic food, sustainably harvested lumber, and sustainably caught seafood also offer potential for low-income rural producers. Certification offers consumers a guarantee—through inspections or other verification methods—that a given product has met certain standards in its growth, harvesting, or processing. The kinds of small-scale production that the poor engage in often lend themselves to organic or sustainable methods. Many small coffee producers, for example, follow organic practices by default.

But certification offers challenges to the poor. The most significant is meeting the cost and technical requirements of certification. For example, fishery certification by the Marine Stewardship Council requires a time-consuming and expensive evaluation of the harvest levels and equipment used by fishers; forest certification similarly requires a verified forest management plan. For the poor to be able to participate, their certification costs will need to be reduced or subsidized by donors, NGO

CAPITALIZING ON THE COMPETITIVE ADVANTAGES OF THE POOR

Although they suffer some obvious disadvantages, small rural producers also hold some competitive advantages that can help them successfully commercialize their ecosystem assets. Exploiting these advantages increases their economic leverage.

- **Control of commercially valuable forest resources, land, or fishing rights.** Poor households and communities with well-established resource tenure are sometimes in a position to parley this into commercial opportunities. This is especially true for those communities within reasonable proximity of expanding centers of domestic or industrial demand, such as inland cities far from commercial ports. Constraints on the private sector's ability to meet wood demand in India, for example, have motivated more than a dozen companies to partner with rural farmers to grow trees on the farmers' lands (Mayers and Vermeulen 2002:45; Scherr et al. 2002:4-5).
- **Lower cost structure for some products.** For communities or farmers with excess labor or land not currently under crops, there may be little opportunity cost for growing trees or establishing low-tech aquaculture ponds. These operations may have lower costs than large-scale plantations or high-tech fish-raising enterprises run by outside business interests. Agroforestry systems, for example, may offer lower costs for tree production because trees are produced jointly with crops and livestock. For products like wood fuel and charcoal, transportation costs even from rural communities may be lower than importing these commodities from international markets (Scherr et al. 2002:4-5).
- **Sole providers of some products.** Because of their access to ecosystems and their traditional knowledge, poor households may be in the best position to supply some niche markets, such as for medicinal plants, exotic fruits, or traditionally made handicrafts or art objects. They may also be in the best position to sell to "socially responsible" markets, which may value the fact that their products come from small community enterprises rather than factory farms or plantations (Scherr et al. 2002:4-5).
- **Ability to compete in domestic markets for some products.** Low-income producers may not always be able to be competitive in international trade, but they can frequently compete effectively in domestic markets. This is particularly true for certain products that do not offer high margins, such as "commodity grade" wood used for fencing, storage structures, crop and tree supports, or packing crates. Larger international producers typically do not compete in these markets with cheaper domestic products, which small-scale farmers can in many cases supply by growing trees in agroforestry schemes or wood lots (Scherr et al. 2002:4-5).
- **Better monitoring and enforcement abilities.** Local people may have greater ability than outside companies to prevent illegal logging or fishing. This may mean they are in a better position to assure the quality of certified wood or fish products (Scherr et al. 2002:4-5).

In general, low-income communities will find it easier to compete in commercial markets where there is less competition with large-scale producers, where there are few substitutes for their goods, where their low labor and start-up costs give them a lower overall cost structure, and where their deficits in transport are minimized.

partners, or the state. Innovations in the certification process to make it more inclusive can also help. One forest certification organization has experimented with videotaping community members as they describe their management and implementation plans, rather than making them submit a written plan (Shanley et al. 2002:296).

Another difficulty for the poor is that forest or organic certifications generally focus on the land where the timber or crop is grown, guaranteeing certain practices—such as absence of pesticide use for a specified number of years—on these lands. For those with secure ownership of land and resources, this may be fine. But many nontimber forest products are collected on common lands or by the landless, so guarantees about a given parcel of land cannot be made. In this case, certification may have to be modified so that it focuses on the training and practices of the harvesters themselves, with certification residing with a harvester association rather than with a land parcel (Shanley et al. 2002:296-298).

Partner with the Private Sector

It is hard to imagine successfully commercializing ecosystem goods and services without substantial participation of the private sector. The capital, facilities, know-how, and markets that businesses command make them strong potential investors and partners for nature-based enterprises of the poor. In Southwestern Ghana, the Swiss Lumber Company has entered into contracts with rural farmers to grow hardwoods on degraded lands, where they will not compete with agriculture. The company provides a lump-sum down payment, a 20-50 percent share (depending on the size of the down payment) of the timber at harvest, and an annual land rent. In return, Swiss Lumber—which does not own timber lands or have access to government timber concessions in the area—gets first option to buy the timber at market prices when the trees are ready for harvest (Mayers and Vermeulen 2002:141).

As the Swiss Lumber example shows, the business relationships that can develop between rural residents and companies can be beneficial to both. For poor households, benefits can include a more consistent income stream and access to credit, training, business planning, and marketing. One of the biggest benefits is that poor households can share the risks of a business venture rather than assume all the risks on their own (Mayers and Vermeulen 2002:viii, 97-101).

The obvious benefits to companies are access to raw resources such as timber, fish, nontimber forest products, or scenic sights and experiences for tourism. The poor also comprise a low-cost labor force for management tasks like tree pruning, growing of specialized crops, or hand-collection of wild fruits. In addition, despite their limited means, poor households can provide a substantial consumer pool for the products and services that companies sell. Targeting sales to the sizable consumer group at the "bottom of the pyramid" is a strategy that many companies are beginning to explore, and building brand recognition and engagement with rural communities is a first step to this end. *(See Box 4.3.)*

Continues on page 104

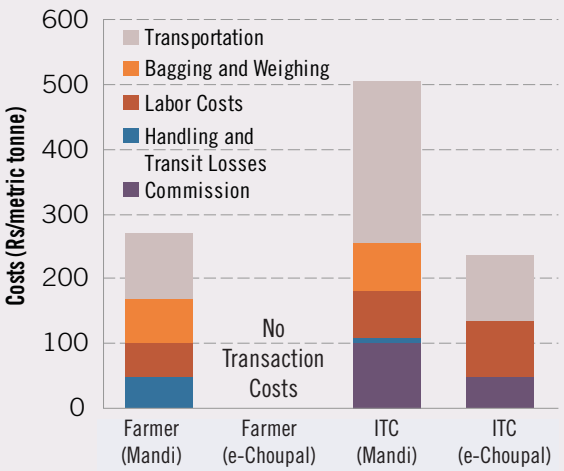
BOX 4.3 SERVING THE POOR PROFITABLY: A PRIVATE-SECTOR APPROACH TO POVERTY

THE 4 BILLION PEOPLE WHO LIVE IN RELATIVE POVERTY are a potentially huge market. In the aggregate, their purchasing power is substantial, even if their individual means are limited. Increasingly, innovative companies are finding ways to serve these customers—meeting their basic needs and empowering them through access to information, access to credit, expanded consumer choice, and other benefits. These are not philanthropic endeavors; they are market-driven and intended to be profitable. Indeed, to be sustainable and scalable, they must be profitable. The hallmark of these private-sector approaches to poverty is close attention to the real needs and social and environmental circumstances of the intended customers. In many cases, new products or services are co-created with the communities for which they are intended.

An example of these poor-focused business models is the e-Choupal system deployed in rural farming areas in several Indian states by ITC, one of India's leading private companies with interests in agribusiness, packaged foods, and a range of other products. The e-Choupal system was designed to address inefficiencies in grain purchasing in the government-mandated marketplaces known as *mandis*. In the *mandi* system, traders who act as purchasing agents for buyers control market information and are well-positioned to exploit both farmers and buyers through practices that sustain system-wide inefficiencies. Farmers have only an approximate idea of price trends and have to accept the price offered them at auctions on the day they bring their grain to market (Annamalai and Rao 2003:1, 8-9).

The approach of ITC has been to place computers with Internet access in farming villages, carefully selecting a respected local farmer as its host. Each e-Choupal (*choupal* means gathering place in Hindi) is located so that it can serve 6-10 villages, or about 600 farmers. An e-Choupal costs between US$3,000 and $6,000 to set up, and about US$100 per year to maintain. Using the system costs farmers nothing, but the host farmer, called a *sanchalak,* incurs some operating costs and is obligated by a public oath to serve the entire community. The *sanchalak* benefits from increased prestige and a commission paid for all e-Choupal transactions (Annamalai and Rao 2003:1, 11).

REDUCED TRANSACTION COSTS UNDER E-CHOUPAL



Source: Annamalai and Rao 2003

Farmers can use the computer to access daily closing prices on local *mandis*, as well as to track global price trends or find information about new farming techniques. They also use the e-Choupal to order seeds, fertilizer, and consumer goods from ITC or its partners, at prices lower than those available from village traders. At harvest time, ITC offers to buy crops directly from any farmer at the previous day's market closing price; if the farmer accepts, he transports his crop to an ITC processing center, where the crop is weighed electronically and assessed for quality. The farmer is then paid for the crop and given a transport fee. In this way, the e-Choupal system bypasses the government-mandated trading *mandis* (Annamalai and Rao 2003:1, 13-14).

Compared to the *mandi* system, farmers benefit from more accurate weighing, faster processing time, prompt payment, and access to a wide range of price and market information. Farmers selling directly to ITC through an e-Choupal typically receive a price about US$6 per ton higher for their crops, as well as lower prices for inputs and other goods, and a sense

of empowerment. At the same time, ITC benefits from net procurement costs that are about 2.5 percent lower (it saves the commission fee and part of the transport costs it would otherwise pay to traders who serve as its buying agents at the *mandi*) and it has more direct control over the quality of what it buys.

The e-Choupal system also provides direct access to the farmer and to information about conditions on the ground, allowing the company to improve its planning and build relationships with farmers that increase its security of supply. The company reports that it recovers its equipment costs from an e-Choupal in the first year of operation and that the venture as a whole is profitable. As of late 2004, e-Choupal services reached more than 3.5 million farmers in over 30,000 villages, and the system is expanding rapidly (e-Choupal 2005).

What began as an effort to re-engineer the procurement process for cropping systems has also created a highly profitable distribution and product-design channel for the company—an e-commerce platform that is also a low-cost fulfillment system focused on the needs of rural India. Advocates for the e-Choupal system say that it has acted as a catalyst for rural transformation, helping to alleviate isolation, create more transparency for farmers, and improve their productivity and incomes. The increased system efficiencies and potential for improving crop quality also contribute to making Indian agriculture more competitive.

Although many farmers are happy with the e-Choupal system, not everyone has benefited from it. Since its success draws business away from the traditional *mandis,* many of the workers at the *mandi* exchanges have been severely affected. Laborers who used to weigh and bag the produce at the *mandis* have suffered from the drop in volume. Vendors at the informal bazaars that grew up around the *mandis* have also lost business as traffic has been diverted to the new ITC processing facilities. In the long run, these workers may be reemployed at the ITC exchanges, but in the short term many traditional *mandi* players have lost income (Annamalai and Rao 2003:25-26).

In spite of these transition costs, the e-Choupal experience and others like it are building confidence that private-sector actions can contribute substantially both to poverty alleviation and to sustainable commercialization of ecosystem services.

Engaging with rural communities can also help companies meet demand for specialized products such as certified lumber or organic foods. In 1990 the U.S. company Smith and Hawken faced growing consumer demand for sustainably harvested tropical hardwoods such as mahogany for furniture and other high-end home furnishings. In response, it helped *campesino* forestry groups in northern Honduras—community organizations of 5-50 members that manage state forests under use agreements with the government—attain certification for their mahogany and other hardwoods. The *campesino* groups are now using the publicity they have received to expand the market for less well-known woods (Mayers and Vermeulen 2002:147).

Arrangements like the ones undertaken by Swiss Lumber and Smith and Hawken to contract with rural farmers to supply trees are perhaps the most common arrangements between poor households and natural resource companies. These "outgrower" schemes are programs where timber companies pay small farmers to plant trees on their own (or sometimes communal) land in order to ensure a reliable supply of timber in the future. The schemes, which can be found in many countries on every continent, vary widely by company and by country. In some, the company provides seedlings, access to credit, technical help in planting and caring for the trees, and even the construction of roads for harvest. In other cases, the arrangements are more sparse, with no finance and little other than seedlings and an offer to buy the trees at market price (Mayers and Vermeulen 2002:140-154).

The poverty-reduction potential of outgrower schemes varies, but can be sizable. In the South African province of KwaZulu Natal, some 10,000 farmers—more than half of them women—participate in the outgrower programs of the Sappi and Mondi paper companies. With materials supplied by the companies, the farmers grow eucalyptus trees on their small plots of a few hectares. Sappi and Mondi agree to purchase the plantation wood after 6-7 years for their pulp mills. Studies have shown that participating in these outgrower programs contributes 12-45 percent of the income needed for a household to remain above the "abject poverty line," so outgrower programs can be important sources of stability in some rural economies (Scherr et al 2003: 51; Mayers and Vermeulen 2002:143).

For companies, outgrower programs can benefit the corporate image as well as securing the timber or pulp supply for the future. In Brazil, pulp-and-paper company Klabin works with timber outgrowers in a variety of joint ventures that have generated annual income for farmers ranging from US$76 to $217 per hectare. Klabin's stated reasons for running its outgrower program include the need to maintain a good company image. The company also tries to gets its outgrowers certified as sustainable timber producers in order to supply the demand from local furniture companies that want certified wood. Klabin has guaranteed 10 years of timber supply to these small furniture companies, which it hopes its outgrowers will provide (Mayers and Vermeulen 2002:143).

Despite the promise of such programs, nature-based investments in poor communities are not necessarily easy for companies or communities, and are by no means always successful. The history of such partnerships shows many missteps, reflecting the difficult circumstances of poor households that push them to seek quick returns at low risk, and demands investments of training and trust-building. For example, several outgrower programs in India were plagued with inconsistent participation by poor families. Free seedlings offered by the companies were often neglected; loan and credit deals were too complicated and cumbersome to be attractive; and participants often abandoned the programs when they learned they could find better prices on the open market than the prices offered by the companies (Mayers and Vermeulen 2002:v, 45-52).

For both companies and communities, partnerships sometimes have high transaction costs, and take negotiation and continued care to succeed. In addition, coping with government regulations can be confusing and time-consuming. Experience shows that it is important for both sides to enter an outgrower agreement with realistic expectations about the income potential and the responsibilities of each side. Outside legal advice, perhaps provided by an NGO, can help poor families clarify contracts, while a system of arbitration set up ahead of time can help resolve disputes. It takes energy and good faith to deal with these complexities, but where there is willingness on both sides, the local income gains and corporate benefits can be substantial (Mayers and Vermeulen 2002:xi-xv).

Keep Sustainability in Mind

Success in commercializing an ecosystem good or service creates its own problems. If a poor household or a rural community finds a winning formula for production, marketing, and delivery of a nature-based product, the temptation will be to push the formula to its limits to increase sales and income. This can easily lead to overexploitation of the type that typically degrades ecosystems. Reconciling the desire to maximize income with the need to sustain ecosystems so that they remain productive assets is one of the inherent challenges of using environmental income for poverty reduction (Neumann and Hirsch 2000:102).

Succeeding Too Well

An example of the dangers of succeeding too well with marketing a natural product can be found in Bolivia, where one indigenous community worked hard to commercialize the sale of string bags made of natural sisal fiber they collected and processed from the wild. They developed a low-cost marketing model to get their bags to customers in Europe, who paid a handsome price. As this enterprise began to succeed, local women involved in bag-making saw their purchasing power increase markedly. This, in turn, encouraged them to rely more on making sisal bags for income, abandoning other lower-profit activities such as subsistence agriculture. As economic reliance on sisal bags spiraled upward, pressure on native sisal plants grew, depleting local sisal sources around the community, and eventually forcing locals to lower their harvest to a more sustainable level (Shanley et al. 2002:279).

Many other examples of the potential for unsustainability can be found. African bushmeat hunting, for example, has reduced the population of primates like chimpanzees, whose low reproductive rates make them especially vulnerable to overharvest. The use of cyanide by poor fishers in Indonesia and the Philippines to catch prized fish for sale to high-end restaurants has decimated many coral reefs (Barber and Pratt 1997:10-21). In Southern Africa, the expanding market for handmade baskets has put pressure on some 30 indigenous plant species used for fiber and another 22 used for dyes. In western Zimbabwe, one weaving club that began with 20 members in 1986 had expanded to 500 by 1988. This is all the more remarkable given that handmade basket-making had only begun as a commercial enterprise in the 1970s as an economic development project in Botswana (Neumann and Hirsch 2000:102-103, 107).

In these examples, activities which, when pursued on a limited basis, might not harm the resource are pushed to unsustainability by sheer expansion of the scope of the activity. But there are other contributors to unsustainable commerce too. In some cases poor harvesting techniques or agricultural practices exacerbate the situation. Some harvesters of African *mbare* palm leaves—one source of basket-making fiber—engage in wholesale cutting of the palms, which kills them. A sustainable alternative is to simply cull individual leaves, which permits the palm to continue growing (Neumann and Hirsch 2000:103-104).

Governance Matters

Governance factors such as tenure—or lack or it—also play a role. Sometimes when a new market appears for a nontraditional product, there may not be a well-defined system of customary practices surrounding ownership and use of the product, and the resource essentially becomes an open-access resource subject to no practical controls on its use. Ecotourism can even fall into this category sometimes. In other instances, there may be well-defined customary or legal property rights over a valuable medicinal, fruit, or other resource, but it may break down as the market for the product—and its value—increases, leading to poaching. This emphasizes the important role of enforcement—through custom or law—in complementing well-defined resource tenure as foundations for viable commerce (Neumann and Hirsch 2000:105-106).

Diversity is Sustainable

Ultimately, the question of sustainability boils down to a question of ecosystem capacities and trade-offs. How much disturbance can an ecosystem tolerate and still remain healthy? What opportunities for environmental income are lost as other opportunities are emphasized? And perhaps most importantly, what is the best strategy to optimize environmental income without compromising ecosystem integrity?

The answer to this last question is not simple, but the idea of diversification of activities and income streams is one approach that many analysts have put forward. A mix of commercial uses of nature, including agriculture, agroforestry, collection of nontimber forest products, and commercial fishing may yield greater ecological resilience, at least at a landscape level. It may also offer greater economic stability for rural economies. From a household perspective, a portfolio of different products and activities will minimize risks for poor families. Neither a monoculture nor a monocommercial approach to environmental income is likely to give the best results (Chater 2003:3-4; May 1992:4; Scherr et al. 2003:22).

4 AUGMENTING NATURE'S INCOME STREAM: PAYMENT FOR ENVIRONMENTAL SERVICES

When the poor engage in good ecosystem stewardship, they create the conditions for higher productivity and greater direct environmental income for themselves. But they also safeguard ecosystem services whose benefits extend beyond their immediate surroundings. By maintaining a healthy forest cover, for example, they are helping to preserve watershed services like flood control, continuous water supply, and erosion control that landowners downstream will benefit from. In the past, these services have been considered "public goods" and available for free, but in recent years it has become clear that many of these

Continues on page 107

BOX 4.4 PAYING THE POOR FOR ENVIRONMENTAL STEWARDSHIP

PROGRAMS THAT PAY LANDHOLDERS TO MAINTAIN ecosystem services like storing carbon, maintaining stable water flow, or preserving scenic landscapes for tourism have burgeoned in the last decade. Most of these "payment for environmental service" (PES) programs don't do a good job of reaching the poor, even though poor households are often active environmental stewards. A small but growing number of projects show that this does not always have to be the case. Two PES programs in particular—in the Cauca Valley of Colombia and in Chiapas, Mexico—demonstrate how PES can yield benefits for poor communities.

Cauca Valley, Colombia

In the late 1980s, private farmers initiated a voluntary system of payment for water use in the Cauca Valley, Colombia. The payment system was designed to improve the livelihoods of the upland poor as part of a strategy for sustainable watershed management. The uplands of the Desbaratado Watershed in the Cauca Valley were inhabited by poor farmers. Seventy-two percent lacked sanitary facilities and 83 percent had no electricity, but most held titles to their land (Echavarría 2002:6).

Overgrazing and deforestation on the slopes of the watershed had led to erratic stream flows and destructive seasonal flooding in the lower basin, the effects of which were being felt by landowners downstream. These landowners consisted mainly of wealthy sugarcane growers who had invested in costly farming technologies, including laser leveling and underground drainage and irrigation systems (Echavarría 2002:7). With the threat of continually escalating costs to protect their investment, the farmers became interested in regulating the stream flow by restoring and improving management of the lands in the upper watershed. They subsequently organized into twelve Water User Associations and instituted voluntary user fees to finance upland watershed management.

The Water User Associations came to the conclusion that the surest route to achieving long-term land-use change in the upper watershed was to improve the livelihoods of the land users. With the aid of the government, planners met with upland communities to identify community priorities for development. The result of these meetings was a series of programs with wide-ranging social benefits, including:

- A "social program," providing education and skills training;
- A "production program," which includes building home gardens to improve diets and increase earnings, as well as reforestation and crop-planting projects;
- An "infrastructure program," which focuses on improving sanitary and drinking water facilities, building roads, and constructing erosion control structures (Echavarría 2002:7).

From 1995 to 2000, an estimated US$1.5 million was invested in the upper watershed—all from the water fees assessed by the Water User Associations (Echavarría 2002:5). So far, the environmental commitment of downstream users has remained strong, and upland projects have continued even in the face of armed guerilla activity in the region. Considering the length of the project, this suggests that benefits on both sides have been worthwhile.

Chiapas, Mexico: Scolel Té

The Scolel Té project in Chiapas, Mexico, represents one of the first efforts to make the international market for carbon storage benefit poor communities. Companies interested in offsetting their greenhouse gas emissions can purchase carbon credits from a local organization, Fondo BioClimático, with two-thirds of the revenue going to farmers (Scherr 2004:43; IUCN 2003:1). The largest buyer thus far has been the Fédération Internationale de l'Automobile, which purchased over 13,000 tons of credits to offset some of the emissions from professional auto racing (IUCN 2003:1).

Farmers who join the Scolel Té scheme must draw up a management plan for their land and agree, to the extent possible, to maintain the trees on their land over the long-term. Fondo BioClimático provides technical support and training to participants in managing their land (Phillips et al. 2002:8). Scolel Té is more than a strict reforestation program. It also allows participants to plant "live fences," shade-grown coffee plantations, and mixed agroforestry plantations. In addition to the PES payment they receive, farmers can make money on regulated sales of timber as well as non-timber products. They also commonly plant food crops under the trees until the canopy closes over (IUCN 2003:1). Because of this variety of income sources, the program is more attractive to farmers.

Since it began in 1996, Scolel Té has gained more than 700 participants in 40 communities. In 2002, sales of carbon credits at US$12 per ton amounted to $180,000, translating into $120,000 distributed among the participants (IUCN 2003:1). The project has also enabled farmers to penetrate markets in sustainable timber, organic coffee, and other agroforestry products. For many, access to these valuable markets has been the more important route to greater income (Rosa et al. 2003:27). The project has generated positive environmental benefits locally as well. Plantings on denuded hillsides are helping to reduce erosion and improve soil quality.

TABLE 4.2 PAYMENTS FOR ENVIROMENTAL SERVICES

Locale	Enviromental Service	Value to Community
Costa Rica	Forest conservation and reforestation for watershed maintenance and carbon storage	More than US$100 million disbursed under 10-15 year contracts with over 450,000 ha enrolled in program. Funded by a fuel tax and contributions from private companies. Rodriguez 2004
Pimampiro, Ecuador	Forest protection of headwaters to ensure clean water supply for the town	$1 per hectare payments constitute 30% of income for those households participating in forest protection. Grieg-Gran and Bishop
Cauca Valley, Columbia	Forest management to improve stream flows and reduce sedimentation of irrigation canals	US$1.5 million invested in poor communities in the upper watershed by downstream farmers. Scherr et al. 2004
Kerala, India	Discovery and maintenance of a continued supply of Jeevani, a commercially marketed medicine	500-1000 families will earn wage income from cultivation and harvesting of the fruit and leaves that are used to manufacture the drug. Ongoing royalty payments to the community from drug sales. Landell-Mills and Porras 2002
Botswana, Kenya, Namibia, South Africa, Tanzania, Zimbabwe	Support of ecotourism in southern and eastern Africa through the maintenance of landscapes, natural resources, and wildlife habitat	Direct employment of 3000 people; over US$100,000 reinvested in local economic development and conservation activities. Landell-Mills and Porras 2002
Scholel Té, Chiapas, Mexico	Forest management leading to carbon sequestration	Two-thirds of the value from the sale of carbon contracts goes to farmers. In 2002, US$120,000 was distributed to 700 participants. IUCN 2003

ecosystem services have a quantifiable economic value. If people downstream are being regularly flooded, the ability of the intact forest to moderate stream flows and lessen the flood risk will be worth something to them, and they may be willing to pay the upstream forest owners to preserve and protect this service—or even to restore it.

In the last decade or so, markets based on this kind of interchange—called *payment for environmental services* (PES)—have begun to develop worldwide. *(See Table 4.2.)* The most common environmental services marketed so far have been associated with forests and fall into four categories: watershed services like those described above, carbon storage, biodiversity conservation, and preservation of landscape beauty. Since the poor are the stewards of many rural ecosystems, it makes sense that they should be able to tap these payments for environmental services (PES) as an additional source of environmental income—another element of their "nature portfolio." In a few cases, they have been successful in doing so. But for the most part, the markets for environmental services, which are still in their infancy, do not yet serve the poor well.

Deals involving PES range in scale from local to international and are undertaken by a range of actors, including private companies, NGOs, communities, and state governments. Private businesses that depend on natural resources are sometimes willing to pay for protection of ecosystems, usually following signs that a resource is threatened or already in decline. In one promising example in Colombia's Cauca Valley, downstream sugarcane growers hurt by flooding paid upland communities—predominantly poor—to change their land management practices to protect the watershed. This evened out the water supply on the valley sugarcane farms and reduced crop damages, while bringing public benefits—clean water supply, sanitation, and other economic development projects—to the upland communities. *(See Box 4.4.)*

Payments for preserving biodiversity and landscape beauty often come from conservation NGOs or local businesses involved in ecotourism. For example, Rainforest Expeditions, a private company in southeastern Peru, signed a 20-year agreement with the local Infierno community, splitting profits and management of the business in return for preservation and access to the forest and wildlife on the community's lands (Landell-Mills and Porras 2002:166).

Governments often act as originators or participants in PES schemes. In 1996 the Costa Rican government became a leader in PES when it established the first national program to dispense payments to farmers willing to maintain or restore forest ecosystems and their services. The program pays landowners to reforest their lands or conserve forest lands they already own, rather than convert them to pasture. By 2004, more than 450,000 hectares were included in the program, and

the government had dispensed over US$100 million to farmers (Rodriguez 2004:13). The government has used a number of strategies to finance payments, including a national fuel tax, international sales of carbon credits, payments from private utilities and industry, and funding from the World Bank and GEF (Rosa et al. 2003:16).

In Brazil, the government took a different approach in the state of Acre, where it had set aside large extractive reserves for indigenous rubber tappers. To preserve the economic viability of the extractive reserves, it directly subsidized the rubber tapping industry, with the subsidy amounting to an indirect PES program to maintain the natural forest cover of the reserves. In Colombia, the government is experimenting with a regulatory approach, requiring hydroelectric utility companies to transfer a percentage of their earnings to support good land management in upstream communities, thus reducing reservoir siltation and preserving water flows (Tognetti 2001:17).

The Challenges of Pro-Poor PES

Despite the theoretical potential for PES programs to benefit the rural poor, many current programs present serious obstacles to the inclusion of poor households. This reflects the fact that PES programs were originally designed primarily to meet conservation goals rather than support the livelihoods of the poor. The Costa Rican program, for example, grew out of the Forestry Department, and its structure favored larger and wealthier landowners (Rosa et al. 2003:16-19). A survey in one Costa Rican watershed found that while all of the large landholders (owning more than 80 ha) were participating in the program, only one third of small landholders (owning less than 10 ha) had signed up (Miranda et al. 2003:21-22)

The obstacles to including the poor in PES programs mirror many of the problems holding them back from other forms of environmental income. The Costa Rican case, which has been one of the most thoroughly studied, has faced several of these:

- **Tenure and formal titles.** Secure property rights are one of the foundations of a PES program. Land ownership is almost always used to identify who should rightfully receive payments. That leaves those without secure tenure—particularly the landless—unable to benefit unless some special provision is made, or unless benefits are distributed to larger community associations that can then attempt an equitable distribution. In Costa Rica's original PES program, for example, only titled land holders could participate, which blocked many poor farmers. As PES programs mature and the market for environmental services builds, this may provide governments yet another incentive to improve tenure security for the rural poor. In the interim, however, a growing PES program could make things worse for the untenured poor if it makes rural lands more attractive to—and more liable to be snapped up by—large landowners.

- **Restrictions on land uses.** PES guidelines may bar grazing or other traditional forest uses that seem to conflict with the environmental services that the program is paying for. Without access to these or other replacement activities, poor families will not be able to afford to participate in PES programs. Costa Rica's program did not allow farmers to graze cattle or practice agroforestry on any lands enrolled in the program, yet the PES payments were not sufficient to serve as a primary income source. This left many small farmers no choice but to opt out. In 2002 the government amended its program to allow agroforestry activities (Rosa et al. 2003:20).

- **High transaction costs.** The costs of applying for a PES program, drawing up a contract, and monitoring performance can become a considerable burden on poor families. Applicants for the Costa Rican PES program have reported spending large amounts of time and money obtaining and

certifying documents, paying for land management studies, and having quarterly visits from a forest manager. The government has committed to reducing these costs substantially and has also moved to allow groups of small farmers to join the PES program collectively, thereby spreading the costs over a larger group (Miranda et al. 2003:29-32; Pagiola 2002:43-44).

- **Lack of credit and start-up funds.** Changing farming and other land-use practices or reforesting pastures to comply with PES requirements often requires a significant investment in new material, training, and lost income during the transition period. Covering these costs is difficult for poor families, who typically lack credit and cash savings. Costa Rica has tried to address this by front-loading payments to farmers, sending half of the total payments (normally dispersed over five or ten years) within the first year of joining the program (Pagiola 2003:11).

In spite of these obstacles, there is considerable hope that PES programs can be modified to make them work for the poor. The policy attention around PES programs in many nations has shifted to identifying reforms needed to increase their potential for poverty reduction. Costa Rica, for example, has striven in the past few years to modify its program so that it serves the poor better. It is no coincidence that many of the governance changes advocated in this chapter as pro-poor, such as establishing secure tenure and promoting community-based institutions that can collectively bargain for and represent the interests of the poor, are the same governance changes necessary to make PES programs better at poverty reduction.

Even in their current imperfect form, PES programs have managed to deliver some important benefits to low-income participants. Many times these are related more to social organization and skills training than the monetary payment. For example, small farmers in Costa Rica's PES program cite the technical training provided in the program as valuable enough to justify participation, even if the payments themselves are not large. The formation of local organizations to help small farmers take advantage of these schemes has also produced lasting gains in social capital, with the rural poor becoming more willing to demand compensation and ownership rights for natural resources (Rosa et al. 2003:23-26).

Participation in PES programs can also open doors to other sources of environmental income. The small farmers involved in the Scolel Té carbon sequestration scheme did not earn large sums from the environmental-service payments themselves. However, the project enabled farmers to penetrate markets in sustainable timber, organic coffee, and other agroforestry products (Rosa et al. 2003:27).

At their best, PES schemes offer a way to serve conservation goals while they add to the income profile of poor families and build social capital in poor communities. In contrast to the establishment of parks, which in many cases relies on excluding rural residents, the PES approach is more inclusive and based on a positive role for rural communities in ecosystem management (Rosa et al. 2003:13). Like other forms of environmental income, PES by itself is not likely to allow poor families to escape poverty, but it can become an important contributor to livelihood security due to the regularity of the payments and the incentive they provide to manage sustainably.

BEYOND ENVIRONMENTAL INCOME

In this chapter, we have explored a bottom-up approach to generating environmental income by the poor. We have emphasized that better ecosystem management and a realignment of local resource governance to empower the poor can lead to significant increases in their household incomes. It is a strategy grounded in the belief that rural poverty reduction can begin with nature—the resource and employment base that already supports rural livelihoods.

At the same time, we realize that poverty reduction depends on many factors beyond our discussion in this chapter. For example, we have emphasized that good ecosystem management combined with effective commercialization of nature-based products helps reduce income risks for low-income families. But poor families face risks other than inadequate or uneven income, such as the risk of catastrophic loss from natural disasters or health shocks. Without mitigating these risks as well—through interventions such as crop insurance and access to better health care—the poor will not find a stable economic foundation in spite of good stewardship of their ecosystem assets.

Likewise, access to technology is another important factor we have only lightly touched on. Many examples show that innovations in technology and management practices have the potential to increase environmental income substantially, but there are considerable barriers to adoption of such innovations. For example, researchers in Brazil have found that a combination of planting legumes to enrich pasture soils and using solar-powered electric fences to better control where cattle graze on a given pasture could allow smallholders to sustainably double milk production and triple the carrying capacity of their land, bringing a marked increase in profits. But lack of credit and training, distance from markets, and lack of political commitment to extension programs means that few Brazilian farmers are likely to benefit from these innovations. Under the present economic incentives, poor farmers are likely to continue with their usual practices (Chater 2003:3).

This brings up the larger point that rural enterprises, although they may be physically remote, are connected to the national economy—and increasingly to the global economy—and therefore subject to macroeconomic and governance policies originating far from the village level. *(See Box 4.5.)* Without pro-poor policy changes at these higher levels, the ability of the poor to deploy their ecosystem resources for greater income will be greatly attenuated. For example, national fisheries ministries typically concentrate their attention and

budgets on industrial fisheries, ignoring the small-scale fisheries that the poor rely on. Without changing this dynamic, the poor will find their attempts at better ecosystem management frustrated by official inattention. Likewise, without high-level action to make credit and other financial services available for small rural enterprises, the poor will find it hard to capitalize on their governance and management successes.

On the other hand, this chapter shows that governments can create a foundation for greater environmental income by providing incentives for nature-based enterprises, empowering the poor by granting legally binding resource rights, and fostering responsive local institutions. In fact, as the case studies in Chapter 5 show, a high-level political commitment to expanding environmental income through local empowerment is crucial to scaling up village-level successes. When this happens, region-wide improvements in management practice and governance can occur that provide the poor a first step in economic advancement.

BOX 4.5 GLOBALIZATION, GOVERNANCE, AND POVERTY

THE CURRENT WAVE OF ECONOMIC GLOBALIZATION has lifted many people out of poverty and enhanced human welfare. But the benefits of globalization have not yet reached far enough: over three billion people still live impoverished lives, and the fields, fisheries, forests, and waterways they depend on are increasingly at risk.

As the Millennium Ecosystem Assessment points out, the transformation of ecosystems over the past five decades dwarfs the cumulative impact over the preceding centuries. This degradation is undercutting rural livelihoods (MA 2005:2). Half of all jobs worldwide depend on agriculture, forestry, and fishing. Yet agricultural subsidies and other import restrictions in developed countries make it difficult for developing country farmers to compete on the world market (WTO 2003:10, 22).

Improving this situation will require better and smarter globalization. Ultimately, a sophisticated market economy is the only mechanism capable of generating lasting prosperity. Market-based approaches, where informed by socially and environmentally responsible public policy, have also been effective in forging solutions to some environmental problems. Emissions trading has been successful in reducing sulfur dioxide and nitrogen oxides, and tradable fishing quotas have reduced over-fishing (Aulisi et al. 2005:11; Kura et al. 2004:92; Ellerman et al. 2000:315; NRC 1999:192). Innovative approaches are being used to assign value, and hence to protect, "ecosystem services"—from crops and fisheries to water filtration and flood prevention. All of these need to happen in ways that rural people can participate in and benefit from—which will only happen if they have a degree of control over the process and the ecosystem "assets."

The public equity markets steer billions of dollars every day to companies and projects around the world. While often inadvertent, this allocation of capital all too often hastens the loss of forests, fisheries, and watersheds, and underwrites the build-up of greenhouse gases in the atmosphere. To counter this trend, many private banks have committed to the "Equator Principles," which incorporate social and environmental criteria in investment decision-making. Major corporations are investing in environmentally cleaner technology because they are convinced it will increase their profits and make them more internationally competitive. In the energy sector, the International Energy Agency estimates that US$16 trillion will be required for global infrastructure investment over the next twenty-five years (IEA 2004:383). Redirecting this massive capital flow to clean energy and transport systems could reduce poverty, increase security, and stabilize greenhouse gas emissions.

To be pro-poor, investors and borrowers need to incorporate environmental sustainability in their activities. The developers of power, oil, gas, and mining projects will need to do a better job of managing risks to human health, as well as damage to rivers, fisheries, and other ecosystems. Borrowers from the Equator banks may have to drop or change their plans to meet environmental standards, as was done in many of ABN AMRO's projects last year. However, while steering private investment in pro-poor directions is critical, it cannot achieve the desired outcome where bad governance is pervasive.

Private investment in hydrocarbons and other extractive industries has sometimes been associated with corruption, environmental degradation, social dislocation, and impoverishment. Changing this will require more transparency, public participation, and accountability. The Extractive Industries Transparency Initiative (EITI), launched by the British government, is already proving successful. Royal Dutch Shell and BP have agreed to disclose detailed payment information on their oil operations in Nigeria and Azerbaijan, respectively. Investors representing over US$7 trillion have endorsed EITI, and civil-society organizations are using EITI as an instrument for government accountability. Endorsement of EITI by G-8 nations and oil-producing countries would make a decisive difference to the lives of the poor who live in the 60 countries that depend on oil, gas, and mining revenues (Soros 2005:43).

Economic globalization has led to a host of technologies that can aid efficient market functioning, promote sound governance of natural resources, and protect the interests of the poor. Low-cost environmental data collection using remote sensing and high-resolution satellite mapping is one example. Tracking and monitoring devices are helping to reduce over-exploitation of fisheries. In Malaysia conservationists use satellite transmitters to keep count of elephants (WWF 2005). Rural Indian farmers with high-speed Internet receive online updates about market prices and weather, making them more competitive (Annamalai and Rao 2003:1). Increasingly low-cost and accessible technologies are beginning to measure trends in deforestation, soil erosion, and climate change. India, China, and Brazil have launched their own satellites, and are sharing data with other developing countries. Hopefully, it will not be long before existing databases—including poverty maps and maps of ecosystem services—can be overlaid routinely on the sites of proposed mining operations, timber harvests, or industrial plants to identify how these developments might affect poor families in the region.

A smarter approach to economic globalization can work when the poor are empowered through access to information, participation, and justice, and when they have legally recognized resource rights that allow them to manage, sell, rent, and invest in ecosystem services. By partnering with the private sector to make credit available for ecosystem-based enterprises, and by improving the marketing and transport of goods produced, the poor can gain income and benefit from the wider marketplace that globalization affords.

Each situation faced by the rural poor is unique,

but the desire for better lives—materially, culturally, and spiritually—

is universal.

CHAPTER 5

TURNING NATURAL ASSETS INTO WEALTH

In *World Resources 2005* we have argued that environmental income is the wealth of the poor, with the potential to provide not just subsistence but a path out of poverty if the right governance conditions prevail. In many communities, this argument is borne out every day, in on-the-ground, village-level experience.

he five case studies in this chapter come from far-flung parts of the world—communities in different physical environments and with different histories and cultural values. In each case, a poor rural community shows us how it has learned to restore and manage its local ecosystems for greater production, and how it has turned these natural assets into higher household income. But the heart of these stories is how communities have tried to meet the challenge of democratic governance. These cases are testaments to the difficulty and rewards of pursuing community-based natural resource management that is inclusive of the poor. Finally, these studies remind us that each situation faced by the rural poor is unique, but that the desire for better lives—materially, culturally, and spiritually—is universal.

The establishment of the Millennium Development Goals and national Poverty Reduction Strategies has raised hopes that governments and multilateral institutions can be mobilized to address world poverty.

SPECIAL SECTION

GLOBAL DEVELOPMENT POLICIES

MAKING THE MDGs AND PRSPs WORK FOR THE POOR AND THE ENVIRONMENT

IN THE PRECEDING CHAPTERS AND CASE STUDIES WE HAVE approached poverty reduction from the village and local level—the level where ecosystems are accessed for income. We have presented numerous examples of how community-scale projects have improved the livelihoods of the poor by enabling them to manage fisheries, forests, and common lands for income and sustainability.

But the rural village economy we have focused on exists within a national and international framework of economic, legal, and political policies. This special section deals with innovations in poverty policies at these larger scales. In the past five years, two developments have raised hopes that national governments and multilateral institutions can be mobilized to address world poverty: the establishment of the **Millennium Development Goals** (MDGs) and the crafting of national **Poverty Reduction Strategies** (PRSPs). In this section we explore how the concepts of environmental income and pro-poor environmental governance apply to these efforts. A key link between MDG and PRSP processes and the world's poor is the environment. The central question is: Do the Millennium Development Goals and the current crop of Poverty Reduction Strategies incorporate the environment and governance as central features in fighting poverty? And if not, how can they be made to incorporate these themes?

THE MILLENNIUM DEVELOPMENT GOALS

A Break from the Past

In September 2000, the largest-ever gathering of world leaders adopted the United Nations Millennium Declaration. The cornerstone of the Millennium Declaration is a global agenda of eight development goals, known as the Millennium Development Goals (MDGs), for cutting world poverty in half by 2015. The MDGs have been described as "the most broadly supported, comprehensive, and specific poverty reduction targets the world has ever established" and the "fulcrum" on which international development policy pivots (UN Millennium Project 2005:2-4).

In many ways, the MDGs represent an innovative approach to ending poverty worldwide. They constitute a break with business-as-usual in the formulation of international development policy and the delivery of development aid. The MDGs address extreme poverty in many dimensions, including hunger, disease, and lack of adequate shelter, while also committing nations to take action to promote gender equality, education, and environmental sustainability. *(See Table 1.)* The Goals condense and refocus the as-yet-unrealized anti-poverty commitments of the past several decades into an action-oriented agenda.

Perhaps the most important contribution of the MDGs is their infusion of accountability into the global campaign against poverty. The establishment of quantified, time-bound targets and measurable indicators creates a benchmark for tracking progress in reaching the Goals. The requirement for countries to produce periodic MDG progress reports introduces a modicum of transparency that has been conspicuously absent from many international processes.

If these innovative aspects of the MDGs propel them to ultimate success by 2015, the world will look quite different than it might otherwise have looked, given the disappointing development trajectory of the 1990s. Reaching the MDGs and their associated development targets would mean lifting 500 million of the world's people out of extreme poverty, liberating 300 million from the suffering of hunger, and providing 350 million additional people with a reliable, sustainable source of safe drinking water (UN Millennium Project 2005:1).

How is the world faring with efforts to attain the MDGs? The results so far have been mixed. In early 2005, the findings of several monitoring studies were published as part of a five-year stock-taking of MDG progress. These reports generally portray a spotty track record that differs by global region and across the various Goals. With respect to halving income poverty (MDG-1), one study noted that East Asia had already achieved the Goal, and South Asia is on target, but in Sub-Saharan Africa, most countries are in danger of falling far short (IMF and World Bank 2005:2). Another report concluded that much of the sub-Saharan region—faced with continuing hunger and malnourishment as well as high levels of child and maternal mortality—is seriously off track for reaching most of the Goals. Even in Asia, where progress has been most rapid, hundreds of millions of people still live in extreme poverty. Other global regions—such as Latin America, North Africa and the Middle East, and the transitional economies of the former Soviet Union—have mixed records, with slow or no progress on some of the Goals (UN Millennium Project 2005:15). *(See Figure 1.)*

For Environment and Governance, More of the Same

Despite the innovative aspects of the MDG approach, the treatment of the environment and governance in the MDGs harkens back to old, outmoded ways of thinking. The environment is seen as an add-on rather than the essential foundation of all human well-being and economic production. From an operational perspective, environmental sustainability is more of an afterthought than a cross-cutting concept that provides a point of orientation for all of the MDGs.

The seventh of the eight MDGs commits nations to "ensure environmental sustainability," but this vaguely worded goal does little to focus the attention of the world on the central role of the environment in supporting pro-poor economic growth. As currently stated, Millennium Development Goal 7 (MDG-7) may actually be doing more harm than good by making it difficult for nations to perceive, much less act on, crucially important links between poverty reduction and environmental sustainability. Many believe that environmental issues have in fact lost ground in international development circles in the past decade or so, precisely because of the difficulty in pinning down the concept of environmental sustainability in a way that governments can understand and put to use in decision-making. In its current construction, MDG-7 only exacerbates this dilemma.

Focused on the Wrong Nature

To track progress toward reaching MDG-7 on environmental sustainability, the MDG framework establishes three *global targets* and eight *global indicators*. Unfortunately, these targets and indicators fail to capture the aspects of the environment that exert the most powerful impacts on the lives of the poor or that show the most promise for ending extreme poverty.

Target 9, the first of the three MDG environmental targets, calls for countries to "integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources." Accompanying this rather vague, general statement are five quantitative indicators. *(See Table 2.)* One of these (Indicator 29: Proportion of population using solid fuels) is directly relevant to how the poor use the environment. But the other Target 9 indicators fail to shed much light on aspects of environmental sustainability that matter most to the poor. Instead, some of the current indicators track issues of global environmental concern, such as per capita carbon

TABLE 1 THE MILLENIUM DEVELOPMENT GOALS

Goal 1: Eradicate extreme poverty and hunger	**Target 1:** Halve, between 1990 and 2015, the proportion of people whose income is less than $1 per day **Target 2:** Halve, between 1990 and 2015, the proportion of people who suffer from hunger
Goal 2: Achieve universal primary education	**Target 3:** Ensure that by 2015 children everywhere, boys and girls alike, will be able to complete a full course of primary schooling
Goal 3: Promote gender equality and empower women	**Target 4:** Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015
Goal 4: Reduce child mortality	**Target 5:** Reduce by two thirds, between 1990 and 2015, the under-five mortality rate
Goal 5: Improve maternal health	**Target 6**: Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio
Goal 6: Combat HIV/AIDS, malaria, and other diseases	**Target 7:** Have halted by 2015 and begun to reverse the spread of HIV/AIDS **Target 8:** Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases
Goal 7: Ensure environmental sustainability	**Target 9:** Integrate the principles of sustainable development into country policies and programs, and reverse the loss of environmental resources **Target 10:** Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation **Target 11:** Have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers
Goal 8: Develop a global partnership for development	**Target 12:** Develop further an open, rule-based, predictable, nondiscriminatory trading system (includes a commitment to good governance, development, and poverty reduction—both nationally and internationally) **Target 13:** Address the special needs of the Least Developed Countries (includes tariff- and quota-free access for Least Developed Countries' exports, enhanced program of debt relief for heavily indebted poor countries [HIPCs] and cancellation of official bilateral debt, and more generous official development assistance for countries committed to poverty reduction) **Target 14:** Address the special needs of landlocked developing countries and small island developing states (through the Program of Action for the Sustainable Development of Small Island Developing States and 22nd General Assembly provisions) **Target 15:** Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term **Target 16:** In cooperation with developing countries, develop and implement strategies for decent and productive work for youth **Target 17:** In cooperation with pharmaceutical companies, provide access to affordable drugs in developing countries **Target 18:** In cooperation with the private sector, make available the benefits of new technologies, especially information and communications technologies

Source: United Nations 2000a

dioxide emissions and consumption of ozone-depleting chemicals. Others touch on issues of importance to the poor, such as land area covered by forests and land area set aside to protect biodiversity, but do not measure directly the ability of the poor to access key ecosystems as a source of environmental income and sustainable livelihoods or to protect the ecosystems on which they depend from depredation and damage by outside interests and powerful elites.

Targets 10 and 11, the second and third MDG environmental targets, commit nations to "halve by 2015 the proportion of people without sustainable access to safe drinking water and sanitation" and to "have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers." These targets and their accompanying indicators are more directly propoor, but they too fall short when it comes to establishing broad markers for progress based on an explicit recognition of ecosystem integrity as the touchstone for sustainability. For instance, under Target 10, countries should focus not just on the numbers of people hooked up to water and sanitation services, but also on the need for integrated water resource planning and policies that take account of a wide range of other considerations. These include water demand, water supply, and water quality issues, as well as water-project impacts on other community objectives and on environmental management goals. Other suitable indicators could focus on governance issues that relate to the poor's access to water, such as the reliability of water service or the pricing of water service relative to income.

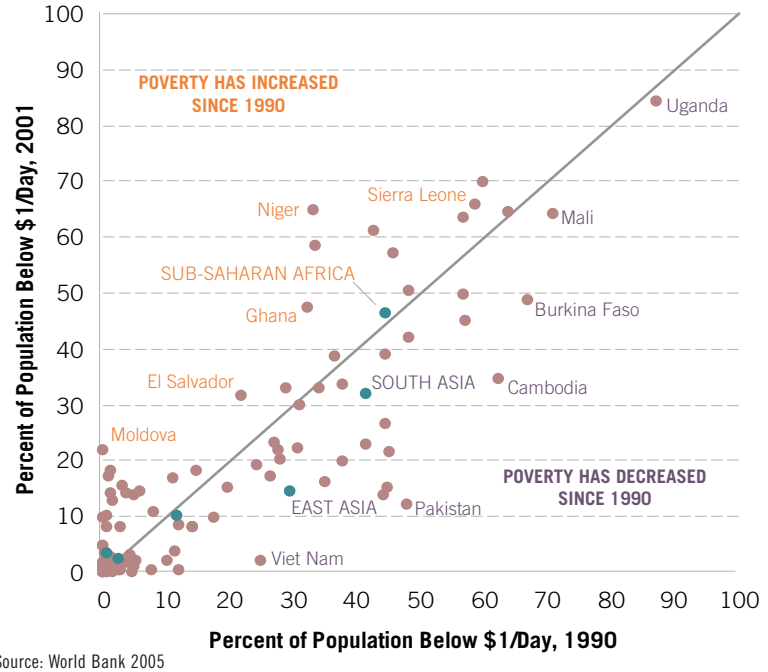
At the 2002 World Summit on Sustainable Development in Johannesburg, the international community created additional targets related to environmental sustainability, sometimes

referred to as "MDG-Plus" targets. *(See Table 3.)* These targets specifically incorporate pro-poor elements related to sustainable management and use of ecosystems, such as application of the ecosystem approach in conserving biodiversity as well as maintaining or restoring fish stocks to levels that can support sustainable yields.

Realizing that the MDG targets were broad in their outlines, the MDG framers encouraged countries to modify the global MDG-7 targets to suit their local conditions, as well as to establish new, country-specific targets and indicators. A recent UNDP review shows that about half the 100 reporting countries have set one or more MDG-7 targets that modify or add to the global targets (UNDP 2005a:3). For example, several nations have set specific goals for maintaining or increasing forest cover, or expanding the network of protected areas for biodiversity conservation.

But despite these worthy efforts, countries are not, for the most part, paying sufficient attention to developing and reporting on a broad set of targets and indicators that would accurately gauge their progress toward the goal of MDG-7 of ensuring environmental sustainability. UNDP's analysis of MDG-7 implementation suggests that environmental monitoring and reporting are not being undertaken systematically. Lack of available data is a significant constraint for some

FIGURE 1 PROGRESS TOWARD MDG-1: HALVE EXTREME POVERTY BY 2015



This graph shows changes in poverty from 1990 to 2001. In countries below the line, extreme poverty has decreased during that period. Countries above the line have seen an increase in those living on a dollar a day. Selected outlying countries and regions are identified.

Source: World Bank 2005

TABLE 2 MDG-7 (MILLENNIUM DEVELOPMENT GOAL #7): GLOBAL TARGETS AND INDICATORS

Targets	Indicators
Target 9. Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources	25. Proportion of land area covered by forests 26. Ratio of area protected to maintain biological diversity to surface area 27. Energy use per $1 GDP 28. Carbon dioxide emissions (per capita) and consumption of ozone-depleting chlorofluorocarbons 29. Proportion of population using solid fuels
Target 10. Halve, by 2015, the proportion of people without sustainable access to safe drinking water and sanitation	30. Proportion of population with sustainable access to an improved water source (urban and rural) 31. Proportion of population with access to improved sanitation
Target 11. Have achieved, by 2020, a significant improvement in the lives of at least 100 million slum dwellers	32. Proportion of households with access to secure tenure

Source: United Nations 2000b

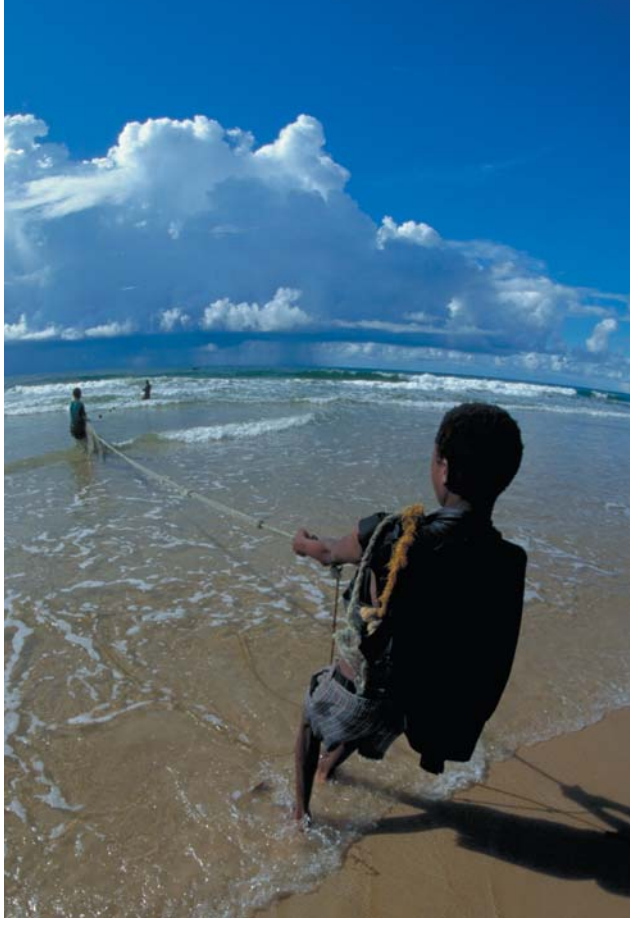


TABLE 3 ADDITIONAL TARGETS AGREED TO AT THE WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT

Biodiversity	■ Encourage by 2010 the application of the ecosystem approach (Paragraph 30) ■ Establish representative marine protected area networks by 2012 (Paragraph 32) ■ Achieve by 2010 a significant reduction in the current rate of loss of biodiversity (Paragraph 44)
Fisheries	■ Maintain or restore fish stocks to a level that can produce a sustainable yield by 2015 (Paragraph 31)
Water	■ Develop integrated water resources management and water efficiency plans by 2005 (Paragraph 26)
Chemical Pollution	■ By 2020, minimize significant adverse effects on human health and the environment associated with the production and use of toxic chemicals, via use of transparent, science-based risk assessment and risk management procedures, and taking account of the precautionary principle (Paragraph 23)

Source: United Nations 2002, Johannesburg Plan of Implementation

countries. But at the same time, many countries have not drawn on existing data from other environment-related efforts, such as National Strategies for Sustainable Development, State of the Environment Reports, and National Biodiversity Action Plans (UNDP 2005b:5).

Getting the Targets and Indicators Right

One of the most important innovations of the MDG approach is its ability to make governments more accountable for their performance in improving human well-being. By stating goals and measuring progress in clear, straightforward language, the MDGs make it easy for civil-society groups to evaluate progress toward human development goals and to issue a public "report card" on a government's success or failure. Unfortunately, the lack of clear, comprehensive targets and indicators for measuring the capacity of ecosystems to provide sustainable environmental income for the poor means that the "accountability effect" of the MDG approach is not yet applicable to the world's environmental goals. Until the environmental framework of the MDGs is fixed, short-run progress towards the other goals is at risk of being unsustainable.

Realigning the MDG framework to correct its environmental shortcomings begins with an acceptance of ecosystems as the key to environmental income, the most direct way that nature affects the poor. This realignment should be guided by the recent findings of the Millennium Ecosystem Assessment, a four-year study conducted by more than 1,300 scientists from 95 countries to ascertain the consequences of ecosystem change for human well-being (MA 2005a). The scientists determined that in all regions, and particularly in Sub-Saharan Africa, the condition and management of ecosystems is a "dominant factor" affecting the chances of success in fighting poverty. They concluded that the degradation of ecosystems is already a "significant barrier" to achieving the MDGs. In fact, many of the regions facing the biggest hurdles in reaching the MDGs coincide with those experiencing significant ecosystem degradation (MA 2005a:18).

Reconceptualizing Target 9

Reframing MDG-7 requires that the wording of Target 9—not to mention its conceptual underpinnings—should make clear the importance of ecosystems to the poor, and be grounded in an appreciation of the central role of healthy, well-functioning ecosystems in ensuring sustainability.

The current wording of Target 9 has two quite distinct pieces:

Target 9: (1) **"Integrate the principles of sustainable development into country policies and programs and** (2) **reverse the loss of environmental resources."**

Both pieces need to be treated separately and reworded. In addition, another component needs to be added to Target 9 to capture the importance of natural resource access to the poor. *(See Table 4 for a summary of suggested changes in the wording and indicators of Target 9, as discussed below.)*

1. Focus on ecosystem capacity

Let's first deal with the second half of Target 9: "reverse the loss of environmental resources." Conceptually, this is the most

TABLE 4 SUGGESTED REWORDING OF MDG-7, TARGET 9

Targets	Indicators
Target 9 (original wording). Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources	■ Proportion of land area covered by forests ■ Ratio of area protected to maintain biological diversity to surface area ■ Energy use per $1 GDP ■ Carbon dioxide emissions (per capita) and consumption of ozone-depleting chlorofluorocarbons ■ Proportion of population using solid fuels
Target 9a (reworded). Maintain or restore the capacity of ecosystems to provide critical ecosystem services, and Integrate the principles of sustainable development into local, national, and international policies and programs	■ Extent and condition of communal fisheries (coastal and inland) ■ Extent and condition of forested areas held in common ■ Watershed conditions on communally held lands (e.g. vegetative cover; water availability; groundwater trends) ■ Soil fertility on private farmlands ■ Land degradation
Target 9b (new). Ensure the poor access to environmental resources and decision-making	■ Proportion of rural households with access to secure tenure ■ Proportion of rural households with access to environmental information (e.g. extension services; pollution or environmental health alerts; environmental impact studies on proposed concessions or developments) ■ Participation in local environmental decision-making

important section of the target. To refocus this section of the target on ecosystems—the primary "environmental resources" used by the poor—the current wording should be replaced with the following: **"maintain or restore the capacity of ecosystems to provide critical ecosystem services."**

As the Millennium Ecosystem Assessment demonstrates, humans have changed ecosystems extensively over the past 50 years. Most ecosystem services are being used unsustainably, and the capacity of ecosystems to deliver these services is being persistently eroded. This growing pressure on ecosystems risks sudden, potentially irreversible changes, such as the collapse of fisheries or the creation of "dead zones" in coastal waters. Also, because the costs of the damage are borne disproportionately by the poor, ecosystem degradation contributes to inequities across social and ethnic groups and is sometimes the principal factor behind poverty and social conflict (MA 2005a:17).

Environmental sustainability, then, is defined by maintaining the ability of ecosystems to deliver the ecosystem services that rich and poor depend on. Some degree of tradeoff between different kinds of ecosystem services is inevitable as human populations expand and as poor people around the world aspire to higher standards of living. However, the key is to ensure that these tradeoffs are managed in ways that preserve the overall integrity of ecosystems and their capacity to provide the full range of services valued by humans.

2. Reconceptualize Target 9 indicators

Indicators for a realigned MDG Target 9 should be focused around those aspects of ecosystem function and integrity that bear most directly on the livelihoods of the poor. For example, the rural poor in developing countries rely on common pool resources to generate significant amounts of environmental income as an important component of their livelihoods. At least some of the indicators for MDG Target 9 should capture this. Potential indicators that would reflect the state of common pool resources and the associated income opportunities they afford include:

- extent and condition of communal fisheries (coastal and inland);
- extent and condition of forested areas held in common;
- watershed conditions on communally held lands (e.g., vegetative cover and water availability, including groundwater trends).

Cambodia provides an example of good practice here. Officials were thinking along these lines when they created their own MDG-7 targets and indicators, which track communally held resources of direct importance to the rural poor (UNDP 2005c:6). Their indicators include:

- the proportion of fishing lots released to local communities (targeted to reach 60 percent by 2015, up from 56 percent in 1998), and
- the number of community-based fisheries (targeted to reach 589 in 2015, up from 264 in 2000).

In addition to tracking common pool resources, Target 9 indicators should acknowledge the reliance poor households place on small-scale farming. Relevant indicators would include:

- soil fertility (such as nutrient availability or percentage of organic matter in top soil;
- land degradation (such as salinization; waterlogging; soil loss).

3. Include all institutions; add targets and time-tables

As currently worded, the first half of Target 9 states: "Integrate

the principles of sustainable development into country policies and programs." This component of Target 9 should be widened to explicitly encompass key institutions at other levels of governance, including local, provincial, and international agencies. In other words, this section of Target 9 should be worded: **"Integrate the principles of sustainable development into local, national, and international policies and programs."** MDG-7 commits institutions at all levels of governance to make environmental sustainability a reality on the ground, and the wording of Target 9 should clearly reflect this. All such institutions, and not just national-level ones, should be accountable for their performance in this respect, and should report regularly on their progress.

In addition, the general intent of this target needs to be translated into specific, time-framed actions that can be monitored from year to year. Revamping Target 9 to make this element verifiable and time-bound is crucial to the ability of civil society to hold government accountable and exert pressure for improved performance.

4. Add a target that ensures resource access

Target 9, as currently worded, does not capture the importance of access—both physical access to resources as well as access to information and participation in environmental decision-making—to the livelihoods of the poor. The importance of access, manifest in secure tenure and community-level institutions that are poor-friendly, is one of the principal conclusions of Chapter 3. When we say that the MDGs should better reflect the importance of environmental governance to the poor, this is the governance we mean. The "sustainability" that MDG-7 is meant to ensure is only meaningful if the poor share "environmental access"—the combination of physical access and environmental empowerment. This kind of environmental access is the basis of equity in the use of ecosystems—certainly one of the components of sustainability.

Target 9 cannot really accommodate these concepts; they should be captured in a separate Governance Target that could read: **"Ensure the poor access to environmental resources and decision-making."** Such a target would be directed at institutions of governance at all levels: national, sub-national, and international.

Indicators for this target should revolve around:

- tenure (proportion of rural households with secure tenure to the resources on which their livelihoods are based),
- access to environmental information (proportion of rural households with access to official information, such as extension services on ecosystem-based agricultural management), and
- participation in local environmental decisions (indicators of pro-poor decentralization of decision-making on environmental management).

Monitoring and developing indicators of environmental governance is still a relatively new field, and such indicators might have to be adjusted for each nation. However, Cambodia again offers an example of best practice. Officials have set targets and indicators encompassing rural tenure, including an overall target of increasing the proportion of the population in both urban and rural areas with access to land security, as well as increasing the percentage of land parcels having titles in both urban and rural areas from 15 percent in 2000 to 65 percent in 2015 (UNDP 2005c:6).

Encouraging Environment and Governance as Cross-Cutting Themes

Environment and governance must be used as screens and points of orientation for all the other Goals, not just MDG-7. The MDGs are designed to be a collection of interdependent goals that must be pursued in concert with one another. Integrated strategies featuring interventions that advance multiple goals and targets simultaneously will have faster, deeper, more cost-effective, and more lasting impact on human well-being than sequential measures addressing individual goals in isolation. However, all too often, governments operate as if the goals were separate, independent entities, resulting in little coordination or cooperation between various ministries and agencies whose actions bear importantly on the likelihood of reaching MDG targets by 2015.

To be effective, MDG-7 on ensuring environmental sustainability must prompt us to raise questions about how strategies and activities under each of the other goals affect the environment and the long-term capacity of ecosystems to provide the fundamental services required for human survival and well-being. Governments and institutions that fail to recognize this reality and act upon it are at high risk that the investments and reforms they advocate for reaching one goal are likely to undermine efforts to reach another goal. Nowhere is this more true than in the case of the environmental assets of the poor and the potential for environmental income to contribute to poverty reduction.

An integrated approach to meeting the MDG targets should be focused on improved management of ecosystems and their capacity to sustainably deliver multiple types of ecosystem services (MA 2005b:19.2). A goal-by-goal analysis of the implications of ecosystem conditions for achieving the 2015 MDG targets indicates that most of them depend directly on ecosystem services, including the targets on poverty, hunger, gender equality, child mortality, disease, and sustainable development. Moreover, multiple MDGs depend on the same ecosystem services (MA 2005b:19.4-5).

To reach all the MDGs simultaneously, it is crucially important to look carefully across the board at the required investments in ecosystem services (that is, the continued capacity of ecosystems to provide provisioning, supporting, and regulating services) and the necessary governance reforms and institutional capacity-building. For instance, interventions to reach MDG Target 1 on eradicating extreme poverty must fully explore and integrate the role that ecosystems and their services can play in improving livelihoods. Similarly, efforts to reach

TABLE 5 SOME EXAMPLES OF COUNTRY/CONTEXT-SPECIFIC MDG-7 TARGETS

Global Target 9	Modified or New Targets
Forest cover	■ Maintain at least 60% of the country under forest cover in perpetuity (Bhutan) ■ Maintain forest cover at 60% (2000 level) through 2015 (Cambodia) ■ Increase forest cover from 8.2% in 2000 to 9.0% in 2015 (Mongolia) ■ Increase afforestation rate from 27% to 35% by 2040 (Romania) ■ Increase forest cover from 11.9 million ha in 2000 to 12.8 million ha in 2015 (Senegal) ■ Increase forest cover by 115,000 ha between 2002 and 2006 (Tunisia) ■ Extend forest cover to 43% by 2010 (Vietnam Nam)
Protected areas	■ Increase ratio of protected territories from 34.9% in 1990 to 35.9% in 2015 (Bulgaria) ■ Maintain 23 protected areas (3.3m ha, 1993) and 6 forest-protected areas (1.35m ha) through 2015 (Cambodia) ■ Increase proportion of areas covered by natural protectorates to 25% by 2015 (Egypt) ■ Protected areas and reserves to cover 10.8% of the national territory (Gabon) ■ Increase area protected to maintain biological diversity from 0.2% in 1990 to 1.9% in 2015 (Kyrgyzstan) ■ Increase land area protected to maintain biological diversity from 13.2% in 2000 to 30% in 2015 (Mongolia) ■ Increase proportion of protected land area from 2.56% in 1990 to 19% by 2015 (Romania) ■ Increase area protected for biological diversity from 8% in 1990 to 12% in 2015 (Senegal) ■ Expand network of national and biosphere reserves and national parks to 10.4% of overall territory (Ukraine)
Energy and climate change	■ Reduce CO_2 emissions against 1988 baseline in fulfillment of Kyoto Protocol obligations (Bulgaria) ■ Reduce greenhouse gas emissions by 8% of CO_2 equivalent between 2008 and 2012 (Romania) ■ Increase use of renewable energy in electricity generation from 29% in 1999 to 33.6% in 2015 (Slovenia) ■ Increase share of renewable energy to 8% of commercial primary energy by 2011 (Thailand)
Pollution	■ Decrease total discharge of major pollutants by 10% between 2000 and 2005 (China) ■ Stabilize ambient air pollution from stationary and mobile sources by 2015 (Ukraine) ■ Attain national standards in air and water pollution by 2005 (Vietnam)

Source: UNDP 2005b

MDG Target 2 on ending hunger need to be based on an ecosystem-focused analysis of how to most effectively maintain and improve soil fertility, water quality and supply, plant genetic resources, watershed management, and so forth.

To date, however, such assessments have rarely been undertaken in national and international planning for the MDGs. The IMF and World Bank have proposed a five-point agenda for accelerating progress toward the MDGs from which improved environmental management is conspicuously absent (IMF and World Bank 2005:3) Since this agenda was developed with particular reference to Sub-Saharan Africa—where ecosystem degradation is a principal constraint to lasting poverty reduction—the omission seems all the more glaring.

Investments in ecosystem services can produce synergistic effects across several targets: for instance, investments in watershed protection can provide multiple benefits in terms of safe drinking water, reduction of waterborne diseases, and flood protection (MA 2005b:19.39). Improved energy services will be a necessary input for reaching most of the MDGs, and a switch to modern, clean fuels and improved cookstove technology will produce multiple dividends related to improved indoor air quality, better child and maternal health, empowerment of women, and environmental sustainability (MA 2005b:19.40-41).

At the same time, some tradeoffs will be necessary, and it is vital to weigh these with reference to environmental and governance considerations. Although the UN Millennium Project is notable for devoting considerable attention to the role of environmental management in meeting the MDGs, its recommendations for reaching the 2015 targets stop short of fully integrating ecosystems as a cross-cutting orientation. For instance, rapid scale-up of MDG-based investments is a focal point for these recommendations, but they contain no discussion of the need to consider trade-offs in critical areas such as infrastructure development (UN Millennium Project 2005:31-35).

One constraint to a cross-cutting, ecosystems-based approach to reaching the MDGs is the inadequacy of environmental monitoring systems in many parts of the developing world. Documenting and assessing progress toward the 2015 targets and the sustainability of critical ecosystem functioning may require strengthening of monitoring systems for soil fertility, hydrological services (water filtration, aquifer recharging, flood prevention), maintenance of biodiversity, climate regulation, and other key ecosystem services (MA 2005b:19.3). Indicators should reflect how local people value ecosystems, including for food, medicines, cultural purposes, and other uses. Most importantly, indicators need to better capture the impact of extracting a particular bundle of services from an ecosystem on its resilience and capacity to provide future services. Investments in measuring, monitoring, and mapping poverty and ecosystem services will give policymakers at local and national levels access to indicators reflecting the linkages between poverty and the environment, which can be used to shape pro-poor growth strategies.

The slow progress that countries and institutions have made on integrating sustainability into their operations is an indication

not of an idea whose time has passed, but rather of the deep structural changes that it requires. In the context of the MDGs, this means that rich countries and international institutions need to lead by example. New and increased long-term financing mechanisms are needed to strengthen environmental capacities and support integrated, ecosystem-based implementation of the MDGs in developing countries. Countries will likely see faster progress on targets aimed at areas such as hunger, water, and sanitation that respond more directly to increased financial and technical inputs (Clemens et al. 2004:26). The experiences gained in these areas of quick response will be an important foundation for longer-term efforts to design and implement national sustainable development strategies.

POVERTY REDUCTION STRATEGIES (PRSPs)

Also in Need of an Environmental Overhaul

Countries seeking debt relief and concessional loans from the World Bank and the International Monetary Fund (IMF) must prepare a Poverty Reduction Strategy Paper (PRSP)—a document detailing the nation's philosophy and plan for achieving substantive cuts in national poverty. PRSPs have also emerged as a principal policy instrument and process for directing aid from developed countries and international agencies to help developing countries implement the Millennium Development Goals.

Unfortunately, like the Millennium Development Goals, the PRSP process suffers from critical shortcomings when it comes to acknowledging the central role of ecosystems in the lives of the poor, and their potential to reduce rural poverty. Among the current crop of PRSPs, the strategies of most countries fall short of a full commitment to better ecosystem management that benefits the poor. Maximizing environmental income opportunities for the poor requires that PRSPs and other formal poverty-reduction plans recognize the importance of their environmental assets, and embody an ecosystem-based perspective to ensure long-term sustainability of rural livelihoods.

CORE PRINCIPLES AND KEY ELEMENTS OF THE PRSP APPROACH

The World Bank has set out five core principles underpinning the development and implementation of Poverty Reduction Strategy Papers (PRSPs):

Country-driven and country-owned. PRSPs should involve broad-based participation by civil society and the private sector at all stages, including formulation, implementation, and outcome-based monitoring.

Results-oriented. PRSPs should focus on outcomes that will benefit the poor.

Comprehensive. PRSPs should recognize the multidimensional nature of poverty and the scope of actions needed to effectively reduce poverty.

Partnership-oriented. PRSPs should involve the coordinated participation of development partners, including bilateral and multilateral agencies and nongovernmental organizations.

Based on medium- and long-term perspectives. PRSPs should recognize that sustained poverty reduction will require action over the medium and long terms as well as in the short run.

The Bank also specifies four key areas of content for PRSPs:

1. Macroeconomic and structural policies to support sustainable growth in which the poor participate.
2. Improvements in governance, including public-sector financial management.
3. Appropriate sectoral policies and programs.
4. Realistic costing and appropriate levels of funding for major programs.

A New Approach to Development?

PRSPs were established in 1999 by the World Bank and IMF as a response to the shortcomings of their earlier development approach centered on "structural adjustment"—an approach that made lending contingent on adoption of certain macroeconomic policies that would change the nation's basic economic structure and prime it for growth. Unfortunately, in many countries following the structural adjustment approach, the promised growth either did not appear or did not result in sufficient poverty alleviation. In fact, in many cases, the approach exacerbated existing inequalities, creating a "crisis of legitimacy" surrounding the lending approach of major development institutions by the mid-1990s (Reed 2004:7).

The intent behind PRSPs was to replace the approach in which the World Bank and IMF attempted to mold a nation's development policies along fixed lines as a condition for lending. Instead, the PRSP approach would let countries decide for themselves which development policies to pursue, so long as the policies were aimed at achieving significant, broad-based reductions in poverty and also emphasized governance reforms, including increased transparency and accountability of government decision-making (Oksanen and Mersmann 2003:126).

Six years after their adoption by the World Bank and IMF, PRSPs are now in transition from the preparation stage to implementation. About 70 countries are expected to eventually prepare PRSPs (Levinsohn 2003:2); as of 2004, 53 PRSPs had been produced, including 39 full PRSPs and 14 preliminary versions (Bojö et al. 2004:5). Besides heavily indebted and aid-dependent countries, other countries have also chosen to prepare PRSPs, including many Central European countries as well as middle-income countries like Brazil (Driscoll and Evans 2004a:3).

PRSPs are becoming increasingly important in shaping the planning, policy, and budget priorities of developing countries, as well as in directing the aid flows from richer countries. The PRSP process is credited with focusing the attention of governments and donor agencies on poverty reduction as a central, priority concern rather than a special, marginal activity (Driscoll and Evans 2004b:3). In addition, PRSPs represent a more "upstream" approach to development aid, that is, an approach that redirects donor assistance from specific, discrete projects towards integrated support for sector-wide plans and even general budget support. Already, in eight African countries, up to one-fifth of aid flow is now for general budget support (Chiche and Hervio 2004 in Driscoll and Evans 2004b:5). PRSPs are also intended to draw increased attention to the non-income dimensions of poverty, such as empowerment of poor and marginalized communities, as well as addressing gender disparities (Levinsohn 2003:3).

How Is the PRSP Approach Faring?

PRSPs improve on the previous, structural adjustment approach of the World Bank and IMF in several important respects. For one, developing-country governments are the principal architects of their own development strategies. They are ostensibly free to decide for themselves how to use external aid flows, which in theory should increase national ownership of the plans and lessen the potential for problems caused by lack of country buy-in. PRSPs are also intended to be subject to continual revision and improvement over the years, serving as an umbrella for coordinating the efforts of various agencies in different economic and social sectors. In addition, the PRSP process was designed to promote increased transparency by governments and international agencies alike, as well as to feature meaningful involvement by civil society in the choice of development priorities (Reed 2004:8).

How well is the PRSP approach working in practice? The reviews are decidedly mixed. Assessments have been undertaken by many different actors, including the World Bank and IMF themselves. The consensus seems to be that PRSP processes have somewhat increased transparency, helped sharpen the focus on investments and institutions designed to reduce poverty, and provided greater opportunities for civil-society input and participation in some countries (Reed 2004:9). Some evidence indicates increased expenditures on health, education, and transport (as a percentage of GDP) in PRSP countries (OED 2004:30), and some assessments point to PRSPs as a catalyst for improvements in public financial management (World Bank and IMF 2003:28,32-33).

However, PRSPs have also been heavily criticized for shortcomings inherent in the PRSP approach as well as problems with how the process has actually unfolded in developing countries. Critics say that PRSPs have helped provide general budget support to poor countries without adequate commitments from these countries to specific poverty reduction outcomes, identification of the populations who will benefit from proposed anti-poverty programs, and provisions for monitoring and evaluation of expected outcomes (Reed 2004:9). Others note that, since PRSPs are prerequisites for debt relief and concessional lending, countries have strong incentives to tell donors what they think the donors want to hear rather than what the country is truly committed to doing to help reduce poverty (Tharakan and MacDonald 2004:7). In addition, the initial crop of PRSPs was not very clear about priorities or costs for anti-poverty measures (World Bank and IMF 2003:15,42).

"Mainstreaming" the Environment in PRSPs: The Unfulfilled Promise

Another important criticism of PRSPs has been their failure to adequately "mainstream" environmental issues, that is, to account for the role of resource access and environmental management in the lives of the poor, and their potential contribution to poverty reduction programs. Several studies have assessed the extent to which PRSPs integrate poverty-environment relationships—in general or in specific sectors, such as forestry, biodiversity, and water. In most of these assessments, the texts of PRSPs were analyzed and scores were assigned to indicate whether key issues were mentioned in the PRSP text and how fully these issues were analyzed or discussed.

- Within the Environment Department of the World Bank, a team of analysts has conducted several studies of environmental mainstreaming in PRSPs (Bojö and Reddy 2002, 2003a, 2003b; Bojö et al. 2004). Based on textual analysis of all available PRSPs, the authors found that the extent of environmental mainstreaming varies widely, with final versions of PRSPs tending to reflect better mainstreaming than initial (so-called interim) versions. They also concluded that issues related to the environmental health targets of the MDGs (safe drinking water and sanitation) receive more attention in PRSPs than do issues of natural resources management.

- A separate study of forest-related issues in 36 PRSPs (full and interim) found that treatment of forest issues was generally weak. Especially lacking was analysis of causal links between poverty and forest resources, as well as the role of natural resources and ecosystem services in determining human well-being. Given these shortcomings, the PRSPs analyzed included surprisingly many forest-related policies and programs in their agendas for action, most of which were apparently drawn from pre-existing national forest strategies and plans. For example, the PRSPs of Malawi and Mozambique were particularly strong in integrating forest-

sector activities based on national forest planning processes (Oksanen and Mersmann 2003:123,136-7). *(See Figure 2.)*

- Assessment of the mainstreaming of biodiversity-related themes in 15 PRSPs found that while declines in biodiversity were analyzed in 12 of the strategies, only one PRSP (Zambia) developed a policy prescription that integrated biodiversity conservation and poverty reduction. Most of the PRSPs analyzed called for efforts to diversify agricultural *species*, but only two PRSPs (Ethiopia and Mozambique) mentioned using different *varieties* of agricultural crops (Bindraban et al. 2004:19, 21). This is an important distinction, since using diverse varieties of the same crop species is a key strategy for reducing agricultural risk by improving disease resistance and enhancing tolerance of harsh environmental conditions.

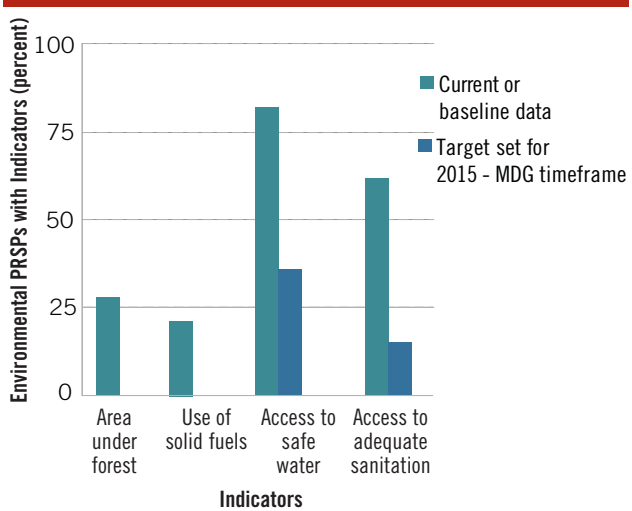
- A study of water issues in 10 PRSPs concluded that these issues were inadequately and inconsistently incorporated in PRSPs, especially with respect to integrating the need for close links between strategies for developing additional water-supply and sanitation infrastructure and strategies for managing water resources for productive uses by the poor, including agriculture, small-scale fishing, and small industry (Slaymaker and Newborne 2004:1-2).

Such weaknesses in integrating environmental issues into PRSPs seem to be more often a genuine oversight rather than the result of conscious priority-setting. In a study by the World Bank Environment Department, many PRSPs that scored low for attention to environmental issues were produced by countries where the poverty-environment linkage is strong—places with heavy dependence on natural resources for rural livelihoods, high levels of traditional fuel use, or low levels of access to safe water and sanitation (Bojö and Reddy 2003b:14).

This finding is supported by experiences from the field. For example, reports from Nigeria indicate that environmental concerns were barely mentioned in initial drafts of its "home-grown" version of the PRSP (known as the National Economic Empowerment and Development Strategy, or NEEDS), and efforts were made to incorporate environmental issues only after the draft was distributed to stakeholders, "more or less [as] an afterthought" (Oladipo 2004).

Most assessments concluded that the degree of environmental mainstreaming in PRSPs is strongly influenced by the nature of civil-society participation in their preparation. For

FIGURE 2 PRESENCE OF MDG-7 INDICATORS IN FULL PRSPs



A 2004 World Bank assessment of 39 full PRSPs found that, aside from access to safe water and adequate sanitation, most PRSPs did not make use of indicators for MILLENNIUM Development Goal 7 (Environmental Sustainability). Fewer still included targets for future progress.

Source: Bojö et al. 2004

example, the top-scoring cluster of PRSPs in the World Bank studies of environmental mainstreaming also scored high on public participation in PRSP development (Bojö et al. 2004:15).

Many studies also note that inclusion of environmental issues in PRSPs sometimes appears to be driven more by donor concerns rather than domestic political priorities. In several cases, donors have pressed reluctant governments to provide opportunities for significant engagement of civil society in PRSP processes. Indeed, closer relationships between civil society and donors has been an outgrowth of the evolution of PRSP processes in several countries (PRSP Monitoring and Synthesis Project 2002:5).

In the PRSPs of many countries, poverty diagnosis and analysis emphasize technical solutions to poverty-environment issues. Less frequently do PRSPs address more controversial, politically charged issues of access, ownership, control, and rights to environmental resources and how these impact the poor's capacity to derive environmental income from productive assets. However, in a few instances, participation by activist NGOs has begun to shape the content of poverty analysis in PRSPs; for example, the PRSPs of Uganda and Honduras have begun to address issues of access to and control of natural resources in response to concerns expressed in consultations with civil society (Waldman et al. 2005:32).

Another oversight in many PRSPs is the failure to assess the potential impacts of proposed growth policies on environmental sustainability, maintenance of critical ecosystem functioning, and key natural resources relied on by the poor for their livelihoods (Oksanen and Mersmann 2003:137). For example, PRSPs frequently propose incentives to encourage high-input, export-oriented agriculture to stimulate economic growth, yet rarely do they analyze the risks of this approach for harming small-scale rural farmers and weakening their ability to manage local natural resources (Tharakan and MacDonald 2004:25).

The PRSP of Nicaragua refers to intensive production of cash crops, including coffee, for export, but this discussion does not include measures to improve food security or to diversify rural incomes through nonfarm activities (Tharakan and MacDonald 2004:32). The PRSP of Sri Lanka presents goals for rapid economic growth through expansion of cash-crop agriculture, plantation activity, and fisheries, but provides no analysis of the implications of such growth on natural-resource depletion or waste generation (Tharakan and MacDonald 2004:38-9).

Several countries have begun to carry out their PRSPs and thus have been required to submit annual progress reports on PRSP implementation. In general, these annual reports give even less attention to environmental sustainability than the PRSPs themselves. In many cases, policies and programs proposed in a country's PRSP are absent entirely from discussions in its progress reports. Studies by the World Bank found that several countries whose PRSP was very highly rated for environmental mainstreaming submitted annual reports that reflected little progress in implementing environment-related measures (Bojö et al. 2004:19).

Upgrading the Treatment of Environmental Income in PRSPs

PRSPs have become one of the most powerful vehicles for carrying forward a commitment to better ecosystem management that benefits the poor. However, the processes and content of PRSPs in many countries falls far short of the potential. Even among strategies recognized within the development community for a relatively high degree of environmental mainstreaming, PRSPs rarely go far enough in proposing measures that would empower the poor with equitable and sustainable opportunities to derive income from their environmental assets.

ASSESSING ENVIRONMENTAL INCOME OPPORTUNITIES IN PRSPs

To assess the treatment of environmental income opportunities for the poor, *WRR 2005* examined 20 PRSPs that have been touted by the World Bank, the United Nations, and other development experts as the best examples to date of environmental mainstreaming. We found several examples of proposed policies and programs that, if effectively implemented, would genuinely improve the prospects for the poor to derive sustainable income from their environmental assets. Many of these examples are described in the text of this chapter.

Of course, whether these "paper promises" can or will be translated into progress on the ground is the crux of the matter. Our desk study suggests that PRSPs with the most extensive and successful mainstreaming of environment and environmental income opportunities were also the most impeccably presented documents, in some cases perhaps indicating that international consultants, provided through assistance from the donor community, had a large hand in their preparation. The strength of the political will behind these environmental proposals remains to be seen.

What can be done to ensure that PRSPs advance a pro-poor agenda for maximizing sustainable environmental income while maintaining the integrity of critical ecosystem functions? At least seven key issues need to be examined. *(See Framework for Upgrading PRSPs.)* In the discussion below, examples of good practice in crafting PRSPs are highlighted to show that adequate treatment of these issues in PRSPs is both possible and desirable.

1. Ecosystem Orientation and Importance of Environmental Income

PRSPs need to do a better job of recognizing the importance of environmental income and the role it can play in reducing poverty. The approach taken in PRSPs to enhancing rural livelihoods should be based on an awareness of the importance of ecosystems as the ultimate basis for all economic activity and a key contributor to human welfare, and should seek to ensure the long-term sustainability of ecosystem services and the livelihoods derived from them.

FRAMEWORK FOR UPGRADING PRSPs

How should poverty reduction strategies be evaluated for their treatment of environmental income opportunities for the poor? The following questions can shed light on whether PRSPs adequately reflect the importance of environmental income and provide for sustainable and equitable ecosystem management.

ENVIRONMENTAL MAINSTREAMING

1. **Ecosystem orientation and environmental income.** Does the strategy recognize the importance of ecosystems as a source of income for the poor? Does it advocate an ecosystem approach to maintain and enhance this income source?

2. **Sustainability of income over time.** Does the strategy take a long-term approach to natural resource income, stressing sustainable ecosystem management? Does it integrate with existing national sustainability plans?

ENVIRONMENTAL GOVERNANCE

3. **Tenure and access to resources.** Does the strategy address issues of resource access of the poor and recognize their centrality to increasing income security? In particular, does it squarely confront the issue of tenure insecurity and advocate for pro-poor tenure reform?

4. **Decentralization and CBNRM.** Does the strategy address the devolution of power over resource management to competent local authorities, and does it make provision for building the governance capacity and transparency of these local institutions? Does the strategy support community-based natural resource management as an effective form of local empowerment and advocate for its clear recognition in law?

5. **Participation, procedural rights, and gender equality.** Is the strategy grounded in broad-based participation by civil society? Are the priorities identified in the consultation process incorporated into the final strategy? Does the strategy emphasize free and informed consent of communities to economic development activities that entail local environmental impacts? Does the strategy acknowledge and address gender issues?

ENVIRONMENTAL MONITORING AND ASSESSMENT

6. **Environmental monitoring.** Does the strategy include plans for monitoring environmental conditions to track the impacts of economic growth on environmental income and provide the basis for sound ecosystem management?

7. **Targets, indicators, and assessments.** Does the strategy contain quantifiable targets for improving outcomes with respect to the environmental income opportunities of the poor? Does it specify poverty and environmental indicators and how these will be used to shape pro-poor growth strategies? Does it describe plans for assessments to evaluate performance in implementing environment- and governance-related measures to improve the environmental income opportunities of the poor.

One of the strongest PRSPs in terms of recognizing the potential of environmental income for poverty reduction is that of Cambodia. The Cambodian PRSP identifies land, water, agriculture, forests, and fisheries as key to increasing rural incomes and sets out an 11-point program to improve rural livelihoods by increasing income from the development of small-scale aquaculture, establishing and strengthening community forestry, promoting sustainable, community-based management of fishery resources, and improving market access for small-scale farmers and rural producers (Cambodia 2002:v, 53, 61).

Similarly, Bolivia highlights the potential contribution of biodiversity to rural incomes and the economy as a whole. It cites preliminary studies indicating that within 15 years biodiversity-related activities (such as ecotourism, mitigation of climate change, and services related to biotechnology) could increase GDP about 10 percent (Bolivia 2001:133). Biodiversity resources could provide near-term gains to disadvantaged rural populations from projects featuring sustainable use of wild animal species, including vicuna, lizard, and peccary (Bolivia 2001:133). Bolivia also proposes to formally establish non-timber forest activities (e.g., gathering of brazil nuts and cultivation of palms) within the national forest system and municipal forest reserve areas, with the aim of creating new income generation activities for impoverished local communities (Bolivia 2001:134).

However, even among PRSPs that devote significant attention to opportunities for enhancing the poor's environmental income, few refer to the importance of ecosystems as fundamental units for managing natural resources and ensuring long-term environmental sustainability. Of the PRSPs reviewed, only Ghana mentioned the "ecosystem approach" by name and then only in the limited sense of using this approach to restore threatened habitats and ecosystems (Ghana 2003:75).

One exception is Cambodia, which has made some limited efforts to incorporate an ecosystems-based perspective or approach within specific sectors and activities. For instance, the Cambodian PRSP describes a national vision for water resources that explicitly encompasses healthy aquatic ecosystems as well as productive fisheries and provision of safe and affordable drinking water (Cambodia 2002:64). Cambodia also applies the concept of agroecosystems in agricultural development plans, including proposals to set up agricultural research centers in each of the country's principal agroecosystems that would be oriented to small-scale farmers. These centers would conduct research and extension, emphasizing intensification of agricultural production through improved water, soil, and nutrient management, with relatively few external inputs in the form of agrichemicals or improved seeds (Cambodia 2002:56).

2. Sustainability of Income Over Time

A concentration on environmental income is not by itself sufficient if this income stream is not sustainable. Nations thus need to take care that the strategies they promote in their

PRSPs for exploiting natural resources are viable over the long term. PRSPs frequently include expansions of the agriculture, forestry, or fisheries sectors, but rarely look at the implications of these activities for the future health of the resource. For example, of the 20 PRSPs reviewed, several targeted transformation of subsistence agriculture as a key means of reducing rural poverty. In many cases, however, plans for agricultural intensification, modernization, and commercialization did not explicitly address how this transformation could be achieved in ways that would ensure long-term sustainability of agricultural income and protection of the agricultural resource base. Likewise, few PRSPs described detailed plans to generate additional income and employment from forests and fisheries that were explicitly based on improved, sustainable management of these natural resources.

PRSPs might do a better job of incorporating the concepts of sustainability if they were more closely linked to existing environmental planning processes such as a national strategy for sustainability, or a national plan to meet the terms of the Convention on Biological Diversity. For instance, Nicaragua's PRSP highlights its National Strategy for Sustainable Development, which focuses on the implementation of policies and public investments to ensure more rational use of the country's natural resources. The strategy contains elements addressing several economic sectors and activities, including the Environmental Policy and Action Plan, the Forestry and Development Law, the Fisheries Law, and the Biodiversity Law (Nicaragua 2001:22, 25).

Sri Lanka's PRSP refers to the various environmental strategies and plans it has developed, including a national environmental action plan and a national strategy for sustainable development, as well as planning under international environmental agreements on biodiversity, climate change, and desertification (Sri Lanka 2002:97, 129). The PRSP also mentions revision of other environmental plans, including the national Rain Forest Law, coastal zone management plan, and regional plans for integrated forestry resource management (Sri Lanka 2002:19, 90).

3. Tenure and Access to Resources

Security of tenure, access, and user rights are central to achieving sustainable livelihoods for the rural poor, particularly in providing them with appropriate incentives to manage environmental assets for long-term productivity and income growth. Most PRSPs mention tenure and access to land and other productive resources; however, some treat the subject in only a cursory manner, while others present detailed discussions of tenure-related problems or plans for reform.

PRSPs should clearly identify the role of property and user rights as important factors shaping investments in agricultural productivity and the prospects for expanding rural incomes. More importantly, PRSPs must then indicate how they plan to deal with the nation's particular tenure challenges.

Zambia's PRSP points out that nearly 97 percent of Zambian farmers have no title to the land they cultivate, reducing incentives to invest in land improvements and agriculture-related infrastructure, preventing farmers from having access to credit, and depressing land productivity within a system where smallholders contribute about 60 percent of agricultural output (Zambia 2002:44). The PRSP also links the lack of secure title to disincentives for development of infrastructure for expanded tourism and eco-tourism opportunities (Zambia 2002:67). However, Zambia acknowledges that it has made little progress to date in setting up a land administration system, titling communally owned or state lands, or developing a market for land. The proposed remedy—a review of existing land law and tenure arrangements as well as discussions with traditional communities regarding incentives to open unused land for investment—may be realistic given political and budgetary constraints, but seems unlikely to bring about substantial progress in the foreseeable future (Zambia 2002:58).

On the other hand, Sri Lanka's PRSP presents detailed proposals for far-reaching land reform to provide the poor with greater access to land. The government plans to test a new land

titling program, designed to be fairer and more efficient, which is expected to reduce the cost of titling a parcel of land from US$110 to under $40. Proposed legal reforms would consolidate 25 different laws that directly affect land titling, and alternative dispute mechanisms will be used to resolve issues that prevent titling. Advanced information technologies, including digital mapping and integrated data management, will be used to accelerate land titling and registration and make the land-management system more transparent and accessible (Sri Lanka 2002:62).

Honduras outlines very specific actions, with associated budgets and deadlines, that will be carried out to improve equity and security in the poor's access to land. Key elements include completing a nationwide *cadastre* (survey) of forest and agricultural lands to strengthen the legal basis for land ownership, modernizing the rural property registry to provide a modern tool for guaranteeing the accuracy of land tenure arrangements and land transactions, and an expanded program for titling rural properties for small farmers, ethnic groups, and independent *campesinos* (Honduras 2001:70).

Bolivia plans to regularize the titles to all rural land by 2006, including measures to simplify the procedures for registering land titles and property rights by merging the systems for physical and legal registration of property (Bolivia 2001:110).

4. Decentralization and Community-Based Natural Resource Management

Almost all PRSPs refer to decentralization and its importance for improving governance and reducing poverty. Often the discussion is rather general, however, and mentions only one or two sectors—usually education and health. PRSPs should incorporate analysis of important aspects of decentralization issues that are directly related to natural resources management and opportunities to enhance environmental income for the poor.

Among the current crop of PRSPs, a few contain well-developed discussions of decentralization for the management of environmental resources. A few also outline ways in which the government proposes to work with local people to increase rural income through community-based management of forests, fisheries, and other environmental assets.

Bolivia's PRSP explicitly addresses the implications of decentralization for environmental management. The strategy refers to institution-strengthening initiatives aimed at ensuring that municipal governments will have the capacity to carry out new responsibilities to implement environmental policies and standards. It also highlights the ongoing role of Bolivia's central government in important environment-related planning functions, including the development of diagnostic assessments,

resource inventories, and soil and water-use plans, that will influence environmental investments (Bolivia 2001:131-2). Some innovative mechanisms are proposed for financing the environmental activities of local governments, including sharing revenues from a special hydrocarbon tax (Bolivia 2001:149).

Zambia designates development of a decentralization policy a matter of top priority to ensure citizen participation in their own affairs (Zambia 2002:35). The PRSP outlines decentralization measures that will enable communities to benefit from the commercial use of their lands, including shareholding arrangements with investors and tax-sharing arrangements (Zambia 2002:51).

Concerning community-based natural resource management, PRSPs should spell out in detail how the government proposes to work with local people to increase rural incomes through community-based management of forests, fisheries, and other environmental assets. For example, Cambodia notes that it is transitioning from state control to co-management of fisheries with local communities. In response to rising incidence of conflict between commercial fishing operators and subsistence and small-scale family fishers, Cambodia is releasing more than half of the country's fishing lots to local fishing communities. The PRSP notes that this change will empower local people to participate in conservation and management of the fishery resource, giving them an incentive to refrain from illegal fishing practices that have been degrading the aquatic environment (Cambodia 2002:59).

Also outlined in Cambodia's PRSP are initiatives related to community forestry to enhance local community participation in decision-making for forest management. In consultation with local user groups, the government will review the system of fees and permits on NTFPs and work toward removing barriers to marketing NTFPs, especially resin, that can be harvested without damaging the forest (Cambodia 2002:60).

Sri Lanka details several initiatives for community-driven development through sustainable management of natural resources. Community-based reef management projects will be undertaken as part of a 5-year public investment program to minimize coastal erosion, already affecting an estimated 55 percent of the Sri Lankan coast prior to the December 2004 tsunami. Community organizations will prepare coastal management plans, undertake reef stabilization and habitat conservation, implement measures to improve water exchange in affected lagoons, and help develop community fish hatcheries (Sri Lanka 2002:64, 89-90).

The PRSP also highlights plans to involve poor communities in decision-making for protected forests, providing funding to communities to replant degraded forest areas, manage buffer zones, and develop timber farms using conservation-oriented cultivation practices, with a goal of halving the rate of deforestation due to encroachment and illegal forest use (Sri Lanka 2002:90–91). The poor will be encouraged to participate in the development of Sri Lanka's ecotourism industry by forming community-based organizations in the buffer zones adjacent to national parks and wildlife sanctuaries, which will receive a share of ecotourism earnings and training to assist in wildlife conservation activities (Sri Lanka 2002:91).

Kenya also plans to promote pro-poor tourism by fostering community-based ecotourism in the northern and western areas of the country. The PRSP outlines efforts to strengthen community involvement in wildlife conservation, implement measures to reduce human-wildlife conflict, provide small and medium enterprises with access to credit, review the structure of park tariffs to expand tourism in less-visited parks, and establish certification schemes for environmentally friendly resorts (Kenya 2004:49).

5. Participation, Procedural Rights, and Gender Equality

Guidelines for preparing PRSPs require that these strategies be prepared with extensive input from a broad range of stakeholders and that countries provide detailed explanations of processes used to secure such participation. Evidence to date indicates that PRSP mechanisms to promote participation often emphasize stakeholders that are urban-based, with relatively sophisticated analytical capabilities, and exclude organizations representing largely rural constituents, especially indigenous peoples.

Governments have sometimes barred stakeholders critical of their policies from participating in PRSP consultations (Waldman et al. 2005). Moreover, governments, NGOs, and international donors often have very different ideas of what constitutes "participation." Some governments have sought to limit participation merely to dissemination of information to NGOs and other stakeholders, rather than substantive input. NGOs and some donors have pressed for more authentically democratic exercises in which civil society has opportunities to shape the agenda and contribute meaningfully to the design of PRSPs (PRSP Monitoring and Synthesis Project 2002:2-6). The PRSPs reviewed here varied considerably with respect to the efforts made to involve environmental stakeholders and to incorporate input from civil society.

One of the stronger efforts was that of Cambodia, which devotes an entire chapter of its PRSP to describing its participatory processes, including four national workshops. The chapter also describes consultations held by sector and line ministries, provincial consultations, a forum on monitoring and evaluation aspects, an NGO forum, meetings with the private sector, donor involvement, meetings with parliamentarians, and consultations with trade unions. It also acknowledges the need for ongoing consultations as it prepares subsequent versions of the plan (Cambodia 2002:8-12, 164).

Ghana presents an appendix that lists specific comments offered on various drafts of the PRSP and indicates how these comments were addressed. For instance, environment-related issues that were addressed in response to outside input include:

the need for greater mainstreaming of environment in the PRSP, the imperative to improve natural resources management as a prerequisite to sustainable production, the role of tenure insecurity as a cause of poverty, the importance of small-scale irrigation and access to land to support farmers, and the need to develop alternative sources of energy (Ghana 2003:216-225).

In Rwanda and Vietnam, dissemination of key documents in local languages helped improve awareness of the PRSP process (Bojö and Reddy 2003b:26).

Addressing disparities in women's rights and access to land and other productive assets has been shown to be a fundamental aspect of effective poverty reduction strategies. A few of the PRSPs reviewed presented detailed analysis of the impacts of gender on environmental income opportunities as well as detailed proposals for remedying gender-based inequities in countries where women traditionally have not been accorded equal rights and access to ecosystems.

Cambodia notes that, with women accounting for 65 percent of agricultural labor and 75 percent of fisheries production, poverty reduction cannot succeed unless it addresses the roles and needs of women (Cambodia 2002:127). The PRSP sets an explicit goal of ensuring that women and girls receive full legal protection and education about their legal rights to access to land and natural resources. Equal numbers of women and men are to be included in all consultative processes and on all monitoring and evaluation teams (Cambodia 2002:vii). Cambodia sets a goal of ensuring that women, the primary collectors and users of water, ultimately make up half of all members of water-user associations, and at least 20 percent of such members within three years (Cambodia 2002:113, 128). The government also pledges to address gender disparities through budget allocations as well as policies and programs (Cambodia 2002:136).

Sri Lanka highlights plans for legal reforms to ensure women's equal rights to inherit land and proposes to encourage women's self-employment in small-scale fishing through training and extension activities (Sri Lanka 2002:200,213).

Zambia proposes to mainstream gender in its land policies, including the introduction of legal reforms to provide equal land rights for women and ensure women's access to natural resources. Women's traditional knowledge of sustainable resource use and management will be integrated into the development of environmental management and extension programs, and 30 percent of all land allocations will be reserved for women applicants (Zambia 2002:54, 114).

6. and 7. Environmental Monitoring, Targets, Indicators, and Assessments

PRSPs are notoriously weak in their provisions for monitoring and evaluating the impacts of the policies and programs they propose. In many cases, provisions for monitoring and evaluating environment-related impacts are particularly inadequate. The World Bank's review of environmental mainstreaming in PRSPs found that few were structured for effective monitoring of progress towards proposed outcomes; that is, few contained realistic, quantified, time-bound, costed targets coupled with a sufficient suite of specific, relevant, quantitative indicators for measuring progress towards these targets (Bojö and Reddy 2003b:25).

Among the PRSPs reviewed, a few clearly identified targets and indicators that will be used to gauge the impact of proposed interventions related to environment and natural resources management. Bolivia presents several targets and indicators related to enhancing environmental income for the poor, including increases in the extent of land brought under secure title. The PRSP proposes to complete the process of securing clear title to rural property in Bolivia by 2006, which would involve regularizing the ownership of more than 7 million ha per year from 2001 to 2006 (Bolivia 2001:183). Other indicators established by Bolivia include annual increases in resources allocated to local communities from the revenues of protected areas, as well as increases in income from sustainable wildlife management programs (Bolivia 2001:186).

Cambodia's PRSP presents an action-plan matrix with numerous strategic objectives, actionable measures, estimated costs, targets and indicators, and the responsible implementing agency. Among the targets and indicators related to environmental income opportunities are increases in the number of land titles issued (including the number of titles held by women) and establishing specific numbers of community forest, fisheries, and small-scale aquaculture projects in various provinces. Quantitative goals are also set for the numbers of women receiving agricultural training on such topics as soil fertility and management, prevention of soil degradation, and safe pesticide use, as well as the percentage of women members in farmers associations (Cambodia 2002:172-80, 229).

Steps toward More Effective PRSPs

One emerging area of debate surrounding PRSPs is whether these strategies will enable countries to successfully meet the MDGs. The UN suggests that existing PRSPs often are not adequate for this purpose and has called for so-called "MDG-based poverty reduction strategies" that are more ambitious, scaled-up, and focused on a longer planning horizon, laying out a path to achievement of the MDGs by 2015. A pivotal step in ramping up PRSPs will be identifying additional sources of capital, since lack of existing capital to finance needed national investments is one of the reasons that interventions described in current PRSPs generally are not ambitious enough to meet the MDGs.

Increased capital to spark poverty-reducing growth could come from various sources, including mobilizing developing countries' own domestic sources of natural wealth as well as expanded development aid and private sector-led trade and investment. Key challenges will be to understand the strategic

and policy elements necessary to scale up investment to meet the MDGs and to strike a thoughtful balance between ambition and realism in PRSPs.

To this end, stakeholders could take several important steps toward PRSPs that emphasize scaled-up investment for pro-poor growth while also protecting the ability of ecosystems to provide sustainable services that underlie human well-being and the livelihoods of the poor.

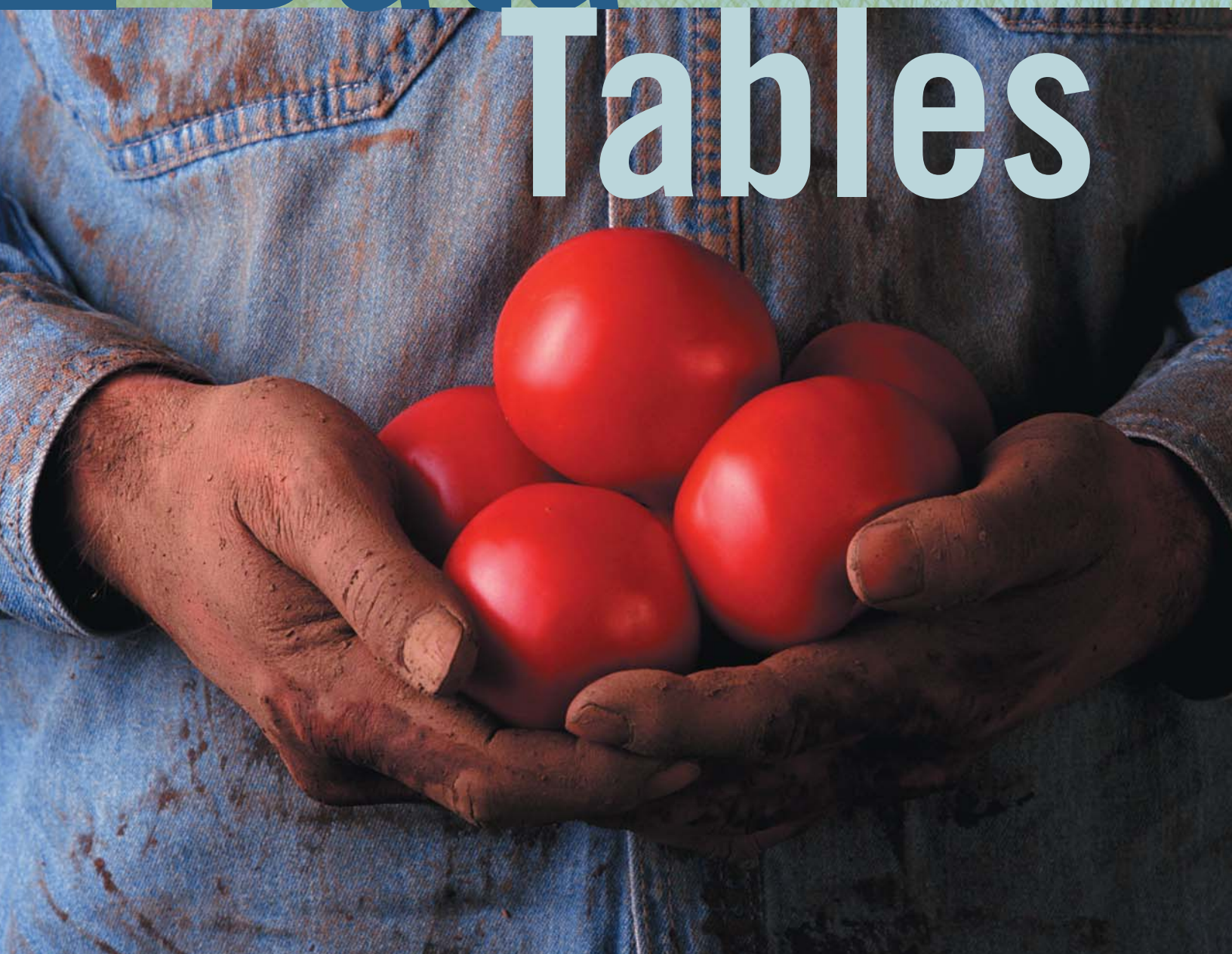
- The World Bank and IMF can support efforts to achieve the MDGs by adapting macroeconomic frameworks for PRSPs according to specific country circumstances. For example, the Bank can encourage countries to work with the poor to invest in ecosystem services such as water resources, soil conservation, and forests and woodlands that generate needed provisioning services such as food, fiber, and fuel. These investments, as shown by the Millennium Ecosystem Assessment, also provide regulating services such as water regulation, erosion control, pest control, and natural-hazard regulation which reduce vulnerability of the poor to damaging effects of drought, floods, loss of soil productivity, and crop failures.

- The United Nations can provide support to developing countries to help them strategically link Poverty Reduction Strategies to efforts to meet the MDGs. This assistance can take several forms, including building national capacities to develop and implement scaled-up investment programs and encouraging the exchange of experiences and lessons learned between countries.

- Developing countries can contribute to the process by ensuring that their PRSP-related efforts emphasize transparency and inclusion and by being accountable for measurable progress in reducing poverty. To this end, monitoring and assessment of poverty and environment outcomes using appropriate data and benchmarks is essential.

- Donor countries can help by ramping up the levels of assistance provided to developing countries to help them reach the MDGs. Development aid needs to be delivered in a stable and predictable manner to facilitate effective planning as well as to avoid destabilizing macroeconomic impacts. Donors should complement development assistance with rapid and significant debt relief to create fiscal "space" for pro-poor, MDG-based investments.

Data Tables



PART II

WORLD RESOURCES 2005 Data Tables

Each edition of *World Resources* includes a statistical appendix, a compilation of country-level data culled from a variety of sources. This section presents some of the data required to build a basic picture of the state of the Earth in its human, economic, and environmental dimensions. In an increasingly interdependent, globalized world, a picture of the whole is needed to understand the interactions of human development, population growth, economic growth, and the environment. In addition, *World Resources 2005* provides a selection of data on global poverty and, in particular, on how the poor use natural resources.

The 12 data tables that follow are a subset of a larger online data collection: the *EarthTrends* database of the World Resources Institute. Based on the *World Resources* series, *EarthTrends* is a free, online resource that highlights the environmental, social, and economic trends that shape our world. The website offers the public a comprehensive collection of vital statistics, maps, and graphics viewable by watershed, district, country, region, or worldwide.

General Notes

The *World Resources 2005* data tables present information for 155 countries. These countries were selected from the 191 official member states of the United Nations based on their population levels, land area, and the availability of data. Many more countries are included in the *EarthTrends* online database. Country groupings are based on lists developed by the Food and Agriculture Organization of the United Nations (for developed and developing countries), the World Bank (for low-, medium-, and high-income countries), and the World Resources Institute (for regional classifications). See pages 224-226 for a full listing.

Several general notes apply to all the data tables in the report (except where noted otherwise):

- ".." in a data column signifies that data are not available or are not relevant (for example, country status has changed, as with the former Soviet republics).
- Negative values are shown in parentheses.
- 0 appearing in a table indicates a value of either zero or less than one-half the unit of measure used in the table; (0) indicates a value less than zero and greater than negative one-half.
- Except where identified by a footnote, regional totals are calculated using regions designated by the World Resources Institute. Totals represent either a summation or a weighted average of available data. Weighted averages of ratios use the denominator of the ratio as the weight. Regional totals are published only if more than 85 percent of the relevant data are available for a particular region. Missing values are not imputed.
- The regional totals published here use data from all 222 countries and territories in the *World Resources/EarthTrends* database (some of these countries are omitted from the current tables). Regional summations and weighted averages calculated with only the 155 countries listed in these data tables will therefore not match the published totals.
- Except where identified with a footnote, world totals are presented as calculated by the original data source (which may include countries not listed in WRI's database); original sources are listed after each data table.
- When available data are judged too weak to allow for any meaningful comparison across countries, the data are not shown. Please review the technical notes for further consideration of data reliability.
- Comprehensive technical notes are available in the pages following each data table.

More Data Tables available on-line at *EarthTrends,* http://earthtrends.wri.org

EarthTrends: The Environmental Information Portal

Much of the environmental information on the internet is fragmented, buried, or only available at a price. World Resources Institute's *EarthTrends* data portal gathers information from more than 40 of the world's leading statistical agencies, supplemented with WRI-generated maps and analyses, into a single, free repository for rapid searching and retrieving. *EarthTrends* supplements its content with detailed metadata that report on research methodologies and information reliability.

The *EarthTrends* online data source includes more than 40 data tables, similar to those on the following pages. *EarthTrends* also features over 2,000 two-page country profiles that highlight country-level statistics on key topics in sustainable development, as well as hundreds of maps and feature stories. The core of *EarthTrends* is a searchable database with over 600 time-series indicators, spanning 30-plus years: a corpus of statistical knowledge from which the data tables in this volume are drawn.

Two new additions to *EarthTrends* will be of particular interest to readers of this book. *EarthTrends* now features the *EarthTrends Poverty Resource* and the *EarthTrends Global Watersheds Collection.* The *EarthTrends Poverty Resource,* released in December 2004, provides a starting point for research on the nexus of poverty, governance, and ecosystems. It brings together a unique collection of data, maps, and other resources to help readers comprehend and analyze developing world poverty. In addition, the Poverty Resource contains dozens of subnational maps depicting the distribution of poverty and human well-being within countries. The *Global Watersheds Collection,* an updated version of the 1998 report *Watersheds of the World,* provides maps of land cover, population density, and biodiversity for 154 river basins and sub-basins around the world.

Since 2001, *EarthTrends* has remained an authoritative, independent source of information for users in more than 190 countries and territories, demonstrating that carefully compiled web-based information can provide an important basis for decision-making and policy development. The information on *EarthTrends* is varied. While researchers will value the raw data (over 500,000 records), much of the information is available in easy-to-use, printable formats, and can be adapted for educational or policy-oriented presentations.

Additional Data Products

In addition to the main, graphics-intensive site, *EarthTrends* offers users additional ways to access our collection of environmental information.

EarthTrends for Low-Bandwidth Users

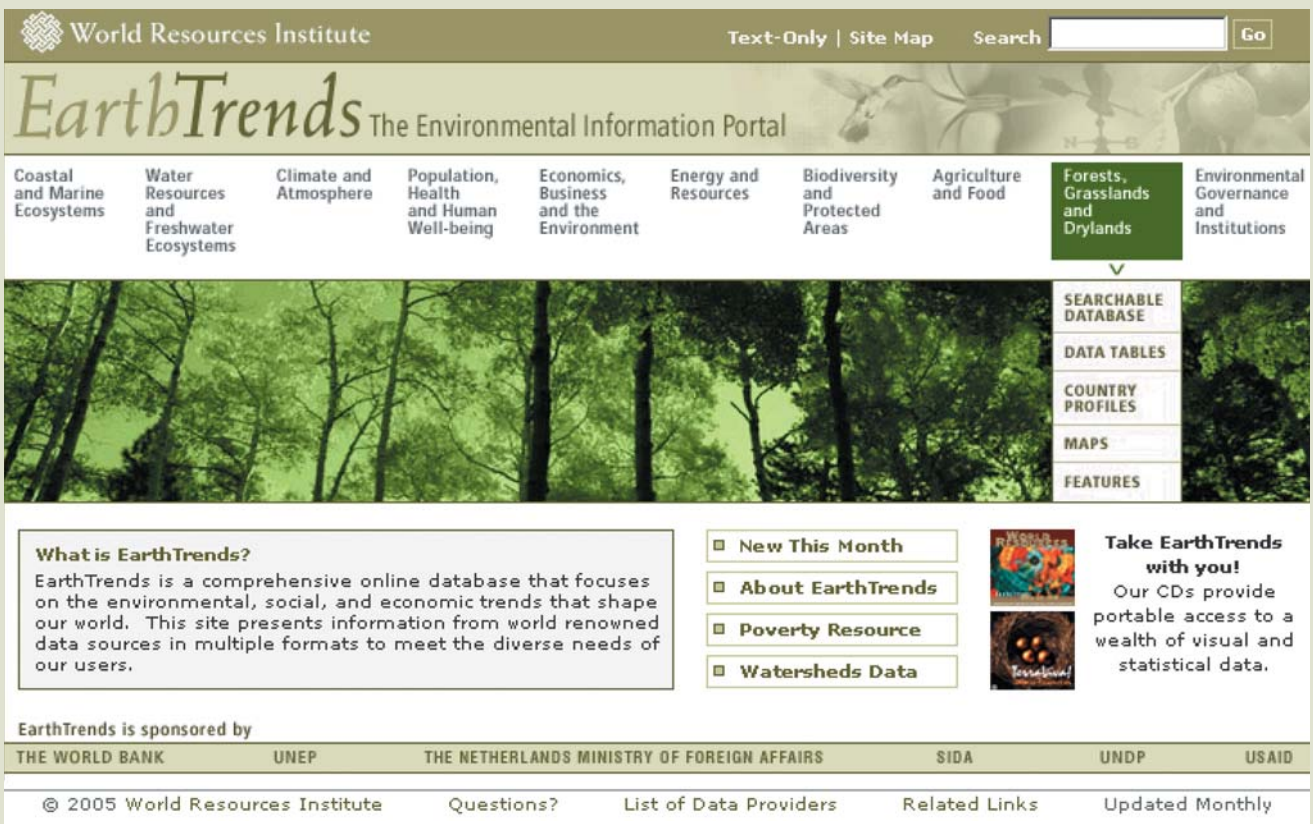
In an effort to broaden global access to sustainable development information, WRI has developed a low-bandwidth companion to the *EarthTrends* site. View the entire *EarthTrends* collection of information without high-resolution graphics at **http://earthtrends.wri.org/text.**

World Resources/*EarthTrends* Data CD-ROM

Gain instant, portable access to the EarthTrends database on global conditions and trends with the *EarthTrends* CD-ROM. This time-saving research and reference tool contains all of the economic, population, natural resource, and environmental statistics contained in the *EarthTrends* website and the print edition of *World Resources 2005.* Available for order at **http://www.wristore.com**.

TerraViva! World Resources

Need more power and flexibility in arranging and understanding data? View the World Resources/EarthTrends database through state-of-the-art mapping, analytical, and statistical tools. Compare hundreds of environmental, social, and economic variables, generating maps, graphics, tables, or text as output. Available for order at **http://www.wristore.com.**



REGIONS

Classifications by the World Resources Institute

ASIA
(excluding the Middle East)
Armenia
Azerbaijan
Bangladesh
Bhutan
Brunei Darussalam
Cambodia
China
Georgia
Hong Kong
India
Indonesia
Japan
Kazakhstan
Korea, Dem People's Republic
Korea, Republic
Kyrgyzstan
Lao People's Dem Republic
Macau
Malaysia
Maldives
Mongolia
Myanmar
Nepal
Pakistan
Philippines
Singapore
Sri Lanka
Taiwan
Tajikistan
Thailand
Timor-Leste
Turkmenistan
Uzbekistan
Viet Nam

EUROPE
Albania
Andorra
Austria
Belarus
Belgium
Bosnia and Herzegovina
Bulgaria
Channel Islands
Croatia
Czech Republic
Denmark
Estonia
Faeroe Islands
Finland
France
Germany
Gibraltar
Greece
Hungary
Iceland
Ireland
Isle of Man
Italy
Latvia
Liechtenstein
Lithuania
Luxembourg
Macedonia, FYR
Malta
Moldova, Republic
Monaco
Netherlands
Norway
Poland
Portugal
Romania
Russian Federation
San Marino
Serbia and Montenegro
Slovakia
Slovenia
Spain
Sweden
Switzerland
Ukraine
United Kingdom

MIDDLE EAST AND NORTH AFRICA
Afghanistan
Algeria
Bahrain
Cyprus
Egypt
Iran, Islamic Republic
Iraq
Israel
Jordan
Kuwait
Lebanon
Libyan Arab Jamahiriya
Morocco
Oman
Palestinian Territories
Qatar
Saudi Arabia
Syrian Arab Republic
Tunisia
Turkey
United Arab Emirates
Western Sahara
Yemen

SUB-SAHARAN AFRICA
Angola
Benin
Botswana
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Comoros
Congo
Congo, Dem Republic
Côte d'Ivoire
Djibouti
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mozambique
Namibia
Niger
Nigeria
Réunion
Rwanda
Saint Helena
Sao Tome and Principe
Senegal
Seychelles
Sierra Leone
Somalia
South Africa
Sudan
Swaziland
Tanzania
Togo
Uganda
Zambia
Zimbabwe

NORTH AMERICA
Bermuda
Canada
Greenland
Saint Pierre and Miquelon
United States

CENTRAL AMERICAN AND CARRIBEAN
Antigua and Barbuda
Aruba
Bahamas
Barbados
Belize
British Virgin Islands
Cayman Islands
Costa Rica
Cuba
Dominica
Dominican Republic
El Salvador
Grenada
Guadeloupe
Guatemala
Haiti
Honduras
Jamaica
Martinique
Mexico
Netherlands Antilles
Nicaragua
Panama
Puerto Rico
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and Grenadines
Trinidad and Tobago
Turks and Caicos Islands
Virgin Islands

SOUTH AMERICA
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
Falkland Islands
French Guiana
Guyana
Paraguay
Peru
Suriname
Uruguay
Venezuela

OCEANIA
American Samoa
Australia
Cook Islands
Fiji
French Polynesia
Guam
Kiribati
Marshall Islands
Micronesia, Fed States
Nauru
New Caledonia
New Zealand
Niue
Northern Mariana Islands
Palau
Papua New Guinea
Samoa
Solomon Islands
Tonga
Vanuatu

DEVELOPING AND DEVELOPED WORLD

Classifications by the Food and Agriculture Organization of the United Nations

DEVELOPING

Afghanistan
Algeria
American Samoa
Angola
Antigua and Barbuda
Argentina
Aruba
Bahamas
Bahrain
Bangladesh
Barbados
Belize
Benin
Bermuda
Bhutan
Bolivia
Botswana
Brazil
British Virgin Islands
Brunei Darussalam
Burkina Faso
Burundi
Cambodia
Cameroon
Cape Verde
Cayman Islands
Central African Republic
Chad
Chile
China
Colombia
Comoros
Congo
Congo, Dem Republic
Cook Islands
Costa Rica
Côte d'Ivoire
Cuba
Cyprus
Djibouti
Dominica
Dominican Republic
Ecuador
Egypt
El Salvador
Equatorial Guinea
Eritrea
Ethiopia
Falkland Islands
Fiji
French Guiana
French Polynesia
Gabon
Gambia
Ghana
Greenland
Grenada
Guadeloupe
Guam
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong
India
Indonesia
Iran, Islamic Republic
Iraq
Jamaica
Jordan
Kenya
Kiribati
Korea, Dem People's Republic
Korea, Republic
Kuwait
Lao People's Dem Republic
Lebanon
Lesotho
Liberia
Libyan Arab Jamahiriya
Macau
Madagascar
Malawi
Malaysia
Maldives
Mali
Marshall Islands
Martinique
Mauritania
Mauritius
Mexico
Micronesia, Fed States
Mongolia
Morocco
Mozambique
Myanmar
Namibia
Nauru
Nepal
Netherlands Antilles
New Caledonia
Nicaragua
Niger
Nigeria
Niue
Northern Mariana Islands
Oman
Pakistan
Palau
Palestinian Territories
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Puerto Rico
Qatar
Réunion
Rwanda
Saint Helena
Saint Kitts and Nevis
Saint Lucia
Saint Pierre and Miquelon
Samoa
Sao Tome and Principe
Saudi Arabia
Senegal
Seychelles
Sierra Leone
Singapore
Solomon Islands
Somalia
Sri Lanka
Saint Vincent and Grenadines
Sudan
Suriname
Swaziland
Syrian Arab Republic
Taiwan
Tanzania
Thailand
Timor-Leste
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turks and Caicos Islands
Uganda
United Arab Emirates
Uruguay
Vanuatu
Venezuela
Viet Nam
Virgin Islands
Western Sahara
Yemen
Zambia
Zimbabwe

DEVELOPED

Albania
Andorra
Armenia
Australia
Austria
Azerbaijan
Belarus
Belgium
Bosnia and Herzegovina
Bulgaria
Canada
Channel Islands
Croatia
Czech Republic
Denmark
Estonia
Faeroe Islands
Finland
France
Georgia
Germany
Gibraltar
Greece
Hungary
Iceland
Ireland
Isle of Man
Israel
Italy
Japan
Kazakhstan
Kyrgyzstan
Latvia
Liechtenstein
Lithuania
Luxembourg
Macedonia, FYR
Malta
Moldova, Republic
Monaco
Netherlands
New Zealand
Norway
Poland
Portugal
Romania
Russian Federation
San Marino
Serbia and Montenegro
Slovakia
Slovenia
South Africa
Spain
Sweden
Switzerland
Tajikistan
Turkmenistan
Ukraine
United Kingdom
United States
Uzbekistan

LOW-, MIDDLE-, AND HIGH-INCOME

Classifications by the World Bank

LOW INCOME

Afghanistan
Angola
Azerbaijan
Bangladesh
Benin
Bhutan
Burkina Faso
Burundi
Cambodia
Cameroon
Central African Republic
Chad
Comoros
Congo
Congo, Dem Republic
Côte d'Ivoire
Equatorial Guinea
Eritrea
Ethiopia
Gambia
Georgia
Ghana
Guinea
Guinea-Bissau
Haiti
India
Indonesia
Kenya
Korea, Dem People's Republic
Kyrgyzstan
Lao People's Dem Republic
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritania
Moldova, Republic
Mongolia
Mozambique
Myanmar
Nepal
Nicaragua
Niger
Nigeria
Pakistan
Papua New Guinea
Rwanda
Sao Tome and Principe
Senegal
Sierra Leone
Solomon Islands
Somalia
Sudan
Tajikistan
Tanzania
Timor-Leste
Togo
Uganda
Uzbekistan
Viet Nam
Yemen
Zambia
Zimbabwe

MIDDLE INCOME

Albania
Algeria
American Samoa
Argentina
Armenia
Belarus
Belize
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Bulgaria
Cape Verde
Chile
China
Colombia
Costa Rica
Croatia
Cuba
Czech Republic
Djibouti
Dominica
Dominican Republic
Ecuador
Egypt
El Salvador
Estonia
Fiji
Gabon
Grenada
Guatemala
Guyana
Honduras
Hungary
Iran, Islamic Republic
Iraq
Jamaica
Jordan
Kazakhstan
Kiribati
Latvia
Lebanon
Libyan Arab Jamahiriya
Lithuania
Macedonia, FYR
Malaysia
Maldives
Marshall Islands
Mauritius
Mexico
Micronesia, Fed States
Morocco
Namibia
Northern Mariana Islands
Oman
Palau
Palestinian Territories
Panama
Paraguay
Peru
Philippines
Poland
Romania
Russian Federation
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and Grenadines
Samoa
Saudi Arabia
Serbia and Montenegro
Seychelles
Slovakia
South Africa
Sri Lanka
Suriname
Swaziland
Syrian Arab Republic
Thailand
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Ukraine
Uruguay
Vanuatu
Venezuela
Western Sahara

HIGH INCOME

Andorra
Antigua and Barbuda
Aruba
Australia
Austria
Bahamas
Bahrain
Barbados
Belgium
Bermuda
Brunei Darussalam
Canada
Cayman Islands
Channel Islands
Cyprus
Denmark
Faeroe Islands
Finland
France
French Guiana
French Polynesia
Germany
Greece
Greenland
Guadeloupe
Guam
Hong Kong
Iceland
Ireland
Isle of Man
Israel
Italy
Japan
Korea, Republic
Kuwait
Liechtenstein
Luxembourg
Macau
Malta
Martinique
Monaco
Netherlands
Netherlands Antilles
New Caledonia
New Zealand
Norway
Portugal
Puerto Rico
Qatar
Réunion
San Marino
Singapore
Slovenia
Spain
Sweden
Switzerland
United Arab Emirates
United Kingdom
United States
Virgin Islands

Population and Education

Sources: United Nations Population Division, United Nations Children's Fund, United Nations High Commissioner for Refugees, Global IDP Project, United Nations Educational, Scientific, and Cultural Organization

	Total Population Estimates and Projections (thousands of people) (a)			Percent of Population in Specific Age Groups 2005		Estimated Total Fertility Rate (a) (children per woman)	Estimated Mortality Under Age 5 (per 1000 live births)	Refugees (b) (thousands)		Internally Displaced Persons (thousands)	Estimated Literacy Rate 2004 (percent)		Net School Enrollment (percent) 2001-2002	
				Under	65 &			Granted Asylum Elsewhere	Repatri-ations		Adults Over Age	Youths Ages		
	1980	2005	2030	15	Over	2000-2005	2002	2003	2003	2004	15	15-24	Primary	Secondary
World	**4,434,682**	**6,453,628**	**8,130,149**	**28**	**7**	**2.7**	**81**	**9,672**	**1,095**	**25,000**	**77**	**89**	**..**	**..**
Asia (excl. Middle East)	**2,477,179**	**3,624,244**	**4,436,079**	**28**	**7**	**2.5**	**..**	**1,327**	**9**	**..**	**76**	**91**	**..**	**..**
Armenia	3,096	3,043	2,786	18	10	1.2	35	13	..	50	99	100	85	85
Azerbaijan	6,161	8,527	10,486	27	7	2.1	105	253	..	570	..	..	80	76
Bangladesh	85,004	152,593	220,321	37	3	3.5	73	6	..	150-520	41	50	87	44
Bhutan	1,318	2,392	4,030	40	4	5.0	94	104	..	..	..	..	..	..
Cambodia	6,613	14,825	23,555	41	3	4.8	138	31	..	..	69	80	86	21
China	998,877	1,322,273	1,450,521	22	8	1.8	38	132	..	..	91	99	93 c	..
Georgia	5,073	5,026	4,258	17	15	1.4	29	12	< 0.5	260	..	..	91	..
India	688,856	1,096,917	1,416,576	32	5	3.0	90	14	..	650	61	..	83 c	..
Indonesia	150,128	225,313	277,567	29	5	2.4	43	13	..	535	88	98	92	48 d
Japan	116,807	127,914	121,017	14	20	1.3	5	< 0.5	..	..	..	..	100	100
Kazakhstan	14,919	15,364	15,258	23	9	2.0	76	7	..	..	99	100	90	84
Korea, Dem People's Rep	17,196	22,876	24,974	25	7	2.0	55	< 0.5	..	..	..	..	..	..
Korea, Rep	38,124	48,182	50,042	19	9	1.4	5	< 0.5	..	..	..	..	100	89
Kyrgyzstan	3,628	5,278	6,711	31	7	2.6	61	3	..	..	..	..	90	..
Lao People's Dem Rep	3,205	5,918	9,282	41	4	4.8	100	10	..	..	66	79	83	31
Malaysia	13,763	25,325	35,191	32	5	2.9	8	< 0.5	..	..	89	97	95	69
Mongolia	1,663	2,667	3,491	30	4	2.4	71	< 0.5	..	..	98	98	87	71
Myanmar	33,705	50,696	61,308	31	5	2.9	108	147	3	600-1,000	85	91	82	35
Nepal	14,881	26,289	40,740	39	4	4.3	87	1	..	100-200	44	63	70 c	..
Pakistan	80,781	161,151	271,600	41	4	5.1	104	24	< 0.5	45	42	54	67 c	..
Philippines	48,088	82,809	113,795	35	4	3.2	37	< 0.5	..	>75	93	95	93	56
Singapore	2,414	4,372	4,934	20	8	1.4	4	< 0.5	..	..	93	100	..	..
Sri Lanka	14,543	19,366	21,670	24	7	2.0	19	122	5	430- 500	92	97	100	..
Tajikistan	3,953	6,356	8,548	34	5	3.1	72	59	< 0.5	..	100	100	98	79
Thailand	46,342	64,081	75,424	25	6	1.9	28	< 0.5	..	..	93	98	86	..
Turkmenistan	2,861	5,015	6,825	32	5	2.7	98	1	..	..	99	100	..	..
Uzbekistan	15,952	26,868	35,031	32	5	2.4	68	7	..	3	99	100	..	..
Viet Nam	53,005	83,585	108,374	29	5	2.3	26	363	..	..	90	..	94	65
Europe	**692,430**	**724,720**	**685,441**	**16**	**16**	**1.4**	**..**	**1,098**	**36**	**..**	**99**	**..**	**..**	**..**
Albania	2,671	3,220	3,680	27	7	2.3	30	10	..	..	99	99	97 c	74 c
Austria	7,549	8,120	7,911	15	16	1.3	5	< 0.5	..	..	..	..	91 c	88 c
Belarus	9,659	9,809	8,678	15	15	1.2	20	8	..	..	100	100	94	78
Belgium	9,859	10,359	10,512	17	18	1.7	6	< 0.5	..	..	..	..	100 d	..
Bosnia and Herzegovina	3,914	4,209	4,089	16	12	1.3	18	300	14	330	95	100	..	..
Bulgaria	8,862	7,763	6,335	14	16	1.1	16	3	..	..	99	100	93 c	86 c
Croatia	4,377	4,405	3,990	17	17	1.7	8	230	10	11	98	100	88	86
Czech Rep	10,283	10,216	9,608	15	14	1.2	5	7	..	..	..	..	88	89
Denmark	5,123	5,386	5,469	18	15	1.8	4	< 0.5	..	..	..	..	99 d	89 d
Estonia	1,473	1,294	943	15	17	1.2	12	1	..	..	100	100	98 c	92 c
Finland	4,780	5,224	5,253	17	16	1.7	5	< 0.5	..	..	..	..	100 c	95 c
France	53,880	60,711	64,577	18	16	1.9	6	< 0.5	..	..	..	..	100 c	92 c
Germany	78,289	82,560	81,511	14	19	1.4	5	1	..	..	..	..	83	88
Greece	9,643	10,978	10,567	14	19	1.3	5	< 0.5	..	..	..	..	95 c	85 c
Hungary	10,707	9,784	8,636	16	15	1.2	9	3	..	..	..	..	91	92
Iceland	228	294	330	22	12	2.0	4	< 0.5	..	..	..	..	100 c	82 c
Ireland	3,401	4,040	4,762	20	11	1.9	6	< 0.5	..	..	..	..	94 c	82 c
Italy	56,434	57,253	51,546	14	20	1.2	6	< 0.5	..	..	..	..	100 c	88 d
Latvia	2,512	2,265	1,750	14	17	1.1	21	3	..	..	100	100	91 c	89 c
Lithuania	3,413	3,401	2,935	18	15	1.3	9	2	..	..	100	100	97 c	92 c
Macedonia, FYR	1,795	2,076	2,205	21	11	1.9	26	6	2	3	..	..	93 c	..
Moldova, Rep	4,010	4,259	4,011	19	10	1.4	32	11	..	1	99	100	78 c	68
Netherlands	14,150	16,300	17,224	18	14	1.7	5	< 0.5	..	..	..	..	99 c	90 c
Norway	4,086	4,570	4,913	19	15	1.8	4	< 0.5	..	..	..	..	100 c	95 c
Poland	35,574	38,516	36,680	16	13	1.3	9	15	..	..	..	..	98	91 c
Portugal	9,766	10,080	9,721	17	16	1.5	6	< 0.5	..	..	..	..	..	85 c
Romania	22,201	22,228	20,328	16	14	1.3	21	8	..	..	97	98	93 c	80 c
Russian Federation	138,660	141,553	119,713	14	14	1.1	21	96	< 0.5	330	100	100	..	..
Serbia and Montenegro	9,522	10,513	10,094	18	14	1.7	19	297	9	250	..	..	75 c	..
Slovakia	4,976	5,411	5,344	17	12	1.3	9	1	..	..	100	100	87	87
Slovenia	1,832	1,979	1,814	14	15	1.1	5	1	..	..	100	100	93 c	96 c
Spain	37,542	41,184	39,951	14	17	1.2	6	< 0.5	..	..	..	..	100	94
Sweden	8,310	8,895	9,033	17	18	1.6	3	< 0.5	..	..	..	..	100	99
Switzerland	6,319	7,157	6,655	15	17	1.4	6	< 0.5	..	..	..	..	99 c	88 c
Ukraine	50,044	47,782	38,925	15	16	1.2	20	94	..	..	100	100	82	91
United Kingdom	55,530	59,598	64,183	18	16	1.6	7	< 0.5	..	..	..	..	100 c	95 c
Middle East & N. Africa	**246,845**	**448,715**	**667,291**	**34**	**4**	**3.3**	**58 e**	**3,488**	**705**	**..**	**70**	**85**	**..**	**..**
Afghanistan	15,117	25,971	49,987	43	3	6.8	257	2,136	646	180-300	..	..	..	..
Algeria	18,740	32,877	44,120	31	4	2.8	49	12	< 0.5	1,000	69	90	95	62
Egypt	43,915	74,878	109,111	34	5	3.3	39	6	..	..	56	73	90	81
Iran, Islamic Rep	39,343	70,675	94,441	30	5	2.3	41	132	4	..	..	..	87	..
Iraq	12,962	26,555	45,338	40	3	4.8	125	368	55	900	..	..	91 d	33 d
Israel	3,764	6,685	8,970	27	10	2.7	6	1	..	150-300	95	100	100	89
Jordan	2,225	5,750	8,643	37	3	3.6	33	1	..	..	91	99	91	80
Kuwait	1,375	2,671	4,198	25	2	2.7	10	1	..	..	83	93	85	77
Lebanon	2,669	3,761	4,692	28	6	2.2	32	25	..	300	..	..	90	..
Libyan Arab Jamahiriya	3,043	5,768	8,123	30	4	3.0	19	2	..	..	82	97	..	..
Morocco	19,382	31,564	42,505	30	5	2.8	43	1	..	..	51	70	88	31 d
Oman	1,187	3,020	5,223	37	2	5.0	13	< 0.5	< 0.5	..	74	99	75	68
Saudi Arabia	9,604	25,626	43,193	38	3	4.5	28	< 0.5	..	..	78	94	59	53
Syrian Arab Rep	8,959	18,650	28,750	36	3	3.3	28	20	..	200-500	83	95	98	39
Tunisia	6,469	10,042	12,351	26	6	2.0	26	3	..	..	73	94	97	68
Turkey	46,132	73,302	91,920	29	6	2.4	41	186	< 0.5	>1,000	87	96	88	..
United Arab Emirates	1,015	3,106	4,056	24	2	2.8	9	< 0.5	..	..	77	91	81	72
Yemen	8,140	21,480	50,584	48	2	7.0	114	2	< 0.5	..	49	68	67 c	35 d

For more information, please visit http://earthtrends.wri.org/datatables/population

	Total Population Estimates and Projections (thousands of people) (a)			Percent of Population in Specific Age Groups 2005		Estimated Total Fertility Rate (a) (children per woman)	Estimated Mortality Under Age 5 (per 1000 live births)	Refugees (b) (thousands)		Internally Displaced Persons (thousands)	Estimated Literacy Rate 2004 (percent)		Net School Enrollment (percent) 2001-2002	
								Granted Asylum Elsewhere	Repatri-ations		Adults Over Age	Youths Ages		
	1980	2005	2030	Under 15	65 & Over	2000-2005	2002	2003	2003	2004	15	15-24	Primary	Secondary
Sub-Saharan Africa	**377,926**	**732,512**	**1,181,279**	**44**	**3**	**5.4**	**174** e	**3,306**	**345**	**..**	**62**	**77**	**..**	**..**
Angola	7,048	14,533	28,588	48	3	7.2	260	324	133	450	..	..	30 d	..
Benin	3,459	7,103	12,091	45	3	5.7	156	< 0.5	..	..	40	56	71 d	20 c
Botswana	987	1,801	1,562	39	3	3.7	110	< 0.5	..	..	79	89	81	55 c
Burkina Faso	6,820	13,798	27,910	49	3	6.7	207	1	..	..	13	19	35	8 c
Burundi	4,130	7,319	13,652	45	3	6.8	190	532	82	381	50	66	53	8
Cameroon	8,754	16,564	21,760	41	4	4.6	166	6	< 0.5	..	68	..	..	..
Central African Rep	2,306	3,962	5,475	43	4	4.9	180	35	5	200	49	59	..	..
Chad	4,505	9,117	17,722	47	3	6.7	200	52	1	..	46	70	58	8 d
Congo	1,804	3,921	7,558	47	3	6.3	108	29	2	100	83	98	..	..
Congo, Dem Rep	27,909	56,079	106,988	47	3	6.7	205	453	3	3,400	..	..	..	..
Côte d'Ivoire	8,427	17,165	23,258	40	3	4.7	191	34	17	500-800	..	60	63	..
Equatorial Guinea	219	521	888	44	4	5.9	152	1	< 0.5	..	..	..	85	26 d
Eritrea	2,381	4,456	7,942	45	2	5.4	89	124	10	59	..	..	43	21
Ethiopia	35,688	74,189	127,220	45	3	6.1	171	63	< 0.5	132	42	57	46	15
Gabon	695	1,375	2,044	40	4	4.0	91	< 0.5	..	..	..	..	78 c	..
Gambia	652	1,499	2,338	40	4	4.7	126	1	..	..	..	..	73	28
Ghana	11,043	21,833	32,648	39	3	4.1	97	16	..	..	74	92	60	32
Guinea	4,688	8,788	14,921	44	3	5.8	165	4	..	100	..	..	61	..
Guinea-Bissau	793	1,584	3,154	47	3	7.1	211	1	..	..	..	..	45 d	..
Kenya	16,368	32,849	41,141	40	3	4.0	122	3	< 0.5	350	84	96	70	24
Lesotho	1,277	1,797	1,555	39	5	3.8	87	< 0.5	..	..	81	..	84	22
Liberia	1,869	3,603	6,830	47	2	6.8	235	353	21	500	56	71	70 d	..
Madagascar	9,048	18,409	33,464	44	3	5.7	135	< 0.5	..	..	..	..	69	..
Malawi	6,183	12,572	19,834	47	4	6.1	182	< 0.5	..	..	62	73	81	29
Mali	7,044	13,829	29,572	49	2	7.0	222	< 0.5	..	..	19	24	..	..
Mauritania	1,609	3,069	5,482	43	3	5.8	183	31	..	..	41	50	67	15
Mozambique	12,084	19,495	26,620	44	3	5.6	205	< 0.5	..	..	47	63	60	11
Namibia	1,018	2,032	2,418	43	4	4.6	67	1	< 0.5	..	83	92	78	38
Niger	5,586	12,873	30,337	50	2	8.0	264	1	..	..	17	25	34	5
Nigeria	64,325	130,236	206,696	44	3	5.4	201	24	< 0.5	250	67	89	..	..
Rwanda	5,157	8,607	13,453	45	3	5.7	203	75	23	..	69	85	84	..
Senegal	5,538	10,587	16,926	42	2	5.0	138	8	< 0.5	5	39	53	58	..
Sierra Leone	3,239	5,340	8,206	44	3	6.5	284	71	33	..	..	..	..	..
Somalia	6,487	10,742	24,407	48	2	7.3	225	402	10	375	..	..	..	..
South Africa	29,140	45,323	42,170	32	4	2.6	65	< 0.5	..	..	86	92	90	62 c
Sudan	19,387	35,040	50,525	39	4	4.4	94	606	< 0.5	4,000	60	79	46 d	..
Tanzania, United Rep	18,838	38,365	56,903	44	2	5.1	165	1	< 0.5	..	77	92	54	..
Togo	2,519	5,129	8,117	43	3	5.3	141	11	< 0.5	..	60	77	92	..
Uganda	12,465	27,623	63,953	50	2	7.1	141	35	4	1,600	69	80	..	14 c
Zambia	5,977	11,043	15,224	47	3	5.6	182	< 0.5	< 0.5	..	80	89	66	20
Zimbabwe	7,226	12,963	12,773	42	4	3.9	123	7	..	100-200	90	98	83	40
North America	**256,068**	**332,156**	**407,530**	**21**	**12**	**2.0**	**..**	**< 0.5**	**..**	**..**	**..**	**..**	**..**	**..**
Canada	24,516	31,972	36,980	17	13	1.5	7	< 0.5	..	..	..	..	100 c	98 c
United States	231,428	300,038	370,396	21	12	2.1	8	< 0.5	..	..	..	..	93	85
C. America & Caribbean	**119,135**	**186,222**	**239,093**	**32**	**6**	**2.7**	**34** e	**43**	**< 0.5**	**..**	**86**	**93**	**..**	**..**
Belize	144	266	373	36	4	3.2	40	< 0.5	..	..	77	84	96 c	60 c
Costa Rica	2,347	4,327	5,872	28	6	2.3	11	< 0.5	..	..	96	98	91	51
Cuba	9,710	11,353	11,338	19	11	1.6	9	16	..	..	97	100	96	83
Dominican Rep	5,696	8,998	11,290	31	5	2.7	38	< 0.5	..	..	84	92	97	41
El Salvador	4,586	6,709	8,802	34	5	2.9	39	6	< 0.5	..	80	89	89	46
Guatemala	6,820	12,978	21,002	42	4	4.4	49	7	< 0.5	250	70	80	85	29
Haiti	5,453	8,549	11,094	37	4	4.0	123	8	< 0.5	..	52	66	..	..
Honduras	3,568	7,257	10,715	39	4	3.7	42	1	< 0.5	..	80	89	87	..
Jamaica	2,133	2,701	3,380	30	7	2.4	20	< 0.5	..	..	88	95	95	75
Mexico	67,569	106,385	133,591	31	5	2.5	29	2	..	10-12	91	97	99	60
Nicaragua	2,919	5,727	8,929	41	3	3.8	41	4	< 0.5	..	77	86	82	37
Panama	1,949	3,235	4,514	30	6	2.7	25	< 0.5	< 0.5	..	92	97	99	62
Trinidad and Tobago	1,082	1,311	1,327	21	7	1.6	20	< 0.5	..	..	99	100	94	..
South America	**242,247**	**372,042**	**471,942**	**29**	**6**	**2.5**	**34** e	**48**	**< 0.5**	**..**	**89**	**96**	**..**	**..**
Argentina	28,094	39,311	48,611	27	10	2.4	19	1	..	..	97	99	100	81
Bolivia	5,355	9,138	13,275	38	5	3.8	71	< 0.5	< 0.5	..	87	97	94	67 c
Brazil	121,614	182,798	222,078	27	6	2.2	37	< 0.5	..	..	86	94	97	72
Chile	11,147	16,185	20,311	27	8	2.4	12	2	< 0.5	..	96	99	89 c	75 c
Colombia	28,447	45,600	60,843	31	5	2.6	23	38	< 0.5	3,100 d	92	97	87	54
Ecuador	7,961	13,379	17,335	32	5	2.8	29	1	..	..	91	96	99	50
Guyana	761	768	695	29	5	2.3	72	< 0.5	..	..	..	..	98 d	75 c
Paraguay	3,114	6,160	9,890	38	4	3.8	30	< 0.5	..	..	92	96	92	50
Peru	17,324	27,968	37,170	32	5	2.9	39	6	< 0.5	60	85	97	100	66 c
Suriname	355	442	489	30	6	2.5	40	< 0.5	..	..	..	..	97	63
Uruguay	2,914	3,463	3,958	24	13	2.3	15	< 0.5	..	..	98	99	90	72
Venezuela	15,091	26,640	36,991	32	5	2.7	22	1	..	..	93	98	92	57
Oceania	**22,808**	**32,969**	**41,437**	**24**	**10**	**2.3**	**..**	**1**	**..**	**..**	**..**	**..**	**..**	**..**
Australia	14,569	20,092	23,833	19	13	1.7	6	< 0.5	..	..	..	..	96	88
Fiji	634	854	982	32	4	2.9	21	1	..	..	93	99	100	76
New Zealand	3,113	3,932	4,457	22	12	2.0	6	< 0.5	..	..	..	..	98	92 c
Papua New Guinea	3,241	5,959	9,075	40	2	4.1	94	< 0.5	..	..	..	..	77	23
Solomon Islands	229	504	850	42	3	4.4	24	< 0.5	..	0.35	..	..	..	..
Developed	**1,171,410**	**1,336,153**	**1,383,167**	**18**	**14**	**1.6**	**8** e	**1,455**	**36**	**..**	**98**	**..**	**..**	**..**
Developing	**3,272,787**	**5,127,115**	**6,755,472**	**31**	**5**	**2.9**	**89** e	**7,865**	**1,059**	**..**	**75**	**88**	**..**	**..**

a. Medium variant population projections; please consult the technical notes for more information. **b**. Refugees are classified by their country of origin. "Granted asylum elsewhere" refers only to people who have been granted asylum outside of their home country. **c.** Data are from the 2000-2001 school year. **d**. Data are from the 1999-2000 school year. **e**. Regional totals are calculated by UNICEF and combine South America, Central America and the Caribbean; a list of countries classified in each region is available at http://www.unicef.org/files/Table9.pdf. **f.** Cumulative total since 1985.

Population and Education: Technical Notes

DEFINITIONS AND METHODOLOGY

Total Population refers to estimates and projections of de facto population as of July 1 of the year indicated.

Percent of Population under Age 15 is the proportion of the total population younger than 15 years of age.

Percent of Population Age 65 and Over is the proportion of the total population 65 years of age and older.

Total Fertility Rate is an estimate of the average number of children a woman would have over the course of her entire life if current age-specific fertility rates remained constant during her reproductive years.

The four variables defined above are estimated by the United Nations Population Division (UNPD) for the years 1950-2000 and forecasted based on the assumptions enumerated below for the years 2001-2050.

Past estimates are calculated using census and survey results from all countries. The UNPD compiles, evaluates, and adjusts these data when necessary. Adjustments incorporate data from civil registrations (in developed countries), population surveys (in developing countries), earlier censuses, and, when necessary, population models based on information from similar countries.

The projections reported here assume medium fertility (the "medium-fertility assumption"). All future population projections are based on estimates of the 2000 base-year population and incorporate the three main components of population growth: fertility, mortality, and migration. *Fertility* is estimated by applying age-specific fertility rates to the projected female population using models based on past trends in fertility to project future declines. *Mortality* is projected on the basis of the models of life expectancy that assume a medium pace of mortality decline. For countries affected by the HIV/AIDS epidemic, mortality rates are predicted using a model developed by the Joint United Nations Program on HIV/AIDS (UNAIDS). *Migration* rates are estimated on the basis of past international migration estimates and an assessment of the policy stance of countries with regard to future international migration flows. The UNPD incorporates information on official immigration and emigration, labor migration, undocumented migration, and refugees.

For more information on methodology, see *World Population Prospects,* 2002 Revision. Volume III: Analytical Report. Online at http://www.un.org/esa/population/publications/wpp2002/WPP2002_Vol3.htm.

Mortality under Age 5 is the probability of a child dying between birth and age five expressed per 1,000 live births. Data for estimating mortality of children under age 5 is typically obtained from population census information, civil registration records on deaths of young children, United Nations Childrens' Fund (UNICEF) Multiple Indicator Cluster Surveys (MICS) and Demographic and Health Surveys (DHS). For each country, UNICEF and its partners plotted all data from 1960 to the present on a graph; a curve was fitted through these data using a weighted least-squares regression model.

Refugees Granted Asylum Elsewhere is the number of refugees leaving a country who have been granted asylum status by a foreign government.

Refugees Repatriations is the number of refugees who have successfully returned (repatriated) to their home country.

In both columns, refugees are counted according to their home countries ("country of origin"), not their country of asylum. Data were collected in 2003 but include all persons that have migrated as refugees without returning to their home country. According to Article 1 of the 1951 Convention Relating to the Status of Refugees and the related 1967 Protocol, a refugee is a person who "owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable to or, owing to such fear, is unwilling to avail himself of the protection of that country." This variable reflects the number of refugees recognized by the United Nations High Commissioner for Refugees (UNHCR), which generally relies on host government reporting to obtain data, supplemented with information collected by aid workers.

Internally Displaced Persons (IDPs) are defined by the United Nations as "persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border." The UNHCR estimates that globally there are 25 million internally displaced people in over 50 countries. Since they have not crossed into another country, IDPs are generally not afforded the same protections and assistance given to refugees. Estimates are from the Global IDP Project and incorporate a wide variety of sources, including non-governmental organizations (NGOs), academic research, governments, and news agencies.

Literacy Rates measure the proportion of the population in a specific age group who can both read and write with understanding a short, simple statement on their everyday life. **Adult Literacy Rates** refer to all residents of a country or region over the age of 15; **Youth Literacy Rates** evaluate the population of a country between the ages of 15 and 24 in the year specified. Youth literacy rates are increasingly used to gauge the impact of primary education as well as the speed with which illiteracy can be eradicated.

Most literacy data are collected during national population censuses and supplemented by household surveys, labor force surveys, employment surveys, industry surveys, and agricultural surveys when they are available. UNESCO uses these data to graph a logistic regression model. When census and survey data are not available, literacy rates for a specific country are estimated based on neighboring countries with similar characteristics.

Net School Enrollment Ratio (NER) is defined as the enrollment of the official age group for a given level of education expressed as a percentage of the population from the same age group. The theoretical maximum value is 100 percent. A high NER denotes a high degree of participation of the official school-age population. If the NER is below 100 percent, users should not assume that the remaining school-age population is not enrolled in any school; they could be enrolled in school at other grade levels. **Primary Education** is defined by the International Standard Classification of Education (ISCED) as the "beginning of systematic apprenticeship of reading, writing and mathematics." Programs are typically six years long and represent the beginning of compulsory education in many countries. **Secondary education** follows primary education, and is characterized as being subject-oriented with specialized fields of learning. Students achieve a full implementation of basic skills. Programs may be academic, vocational, or technical in nature.

Net enrollment ratio is calculated by dividing the number of pupils enrolled who are of the official age group for a given level of education by the total population of the same age group. National governments provide the United Nations Educational, Scientific, and Cultural Organization (UNESCO) with enrollment data based on a series of electronic questionnaires. When data from national governments are not available or are of inferior quality, UNESCO will estimate enrollment ratios from background data, if available.

FREQUENCY OF UPDATE BY DATA PROVIDERS

UNPD publishes country-level statistics every two years with annual revisions of key estimates. UNICEF and UNHCR publish the most recently available data in an annual report, with more frequent updates online. Education, literacy and IDP data are updated irregularly. Most updates include revisions of past data.

DATA RELIABILITY AND CAUTIONARY NOTES

Total Population, Fertility, and Life Expectancy: Since demographic parameters are estimated on a country-by-country basis, reliability varies among countries. For some developing countries, estimates are derived from surveys rather than censuses, especially when countries lack a civil registration system or have one that does not achieve full coverage of all vital events. Also, for developing countries the availability of detailed information on fertility and mortality is limited and the data on international migration flows are generally inadequate. Although estimates are based on incomplete data and projections cannot factor in unforeseen events (i.e., famine, wars), U.N. demographic models are widely accepted and use well-understood principles, which make these data as comparable, consistent across countries, and reliable as possible.

Mortality Under Age 5: Estimates were calculated based on a wide variety of sources of disparate quality. For information on the underlying data for each country's regressions, refer to the country estimates and new country data available from UNICEF online at http://www.childinfo.org/cmr/kh98meth.html.

Refugees: Since the determination of refugee status varies among countries, UNHCR will estimate numbers in order to provide a normalized dataset. Data are "provisional and subject to change," and accuracy is limited by the politically sensitive nature of refugee estimates and the circumstances under which many refugees live. UNHCR attempts to harmonize the data in order to allow cross-country comparisons.

Internally Displaced Persons: Due to the highly political nature of displacement and the conditions in which many displaced peoples find themselves, accurate data are difficult to collect. While the numbers presented are broad estimates, these data are the best online on the topic.

Adult Literacy Rate: The availability and quality of national statistics on literacy vary widely. National census and survey data are typically collected only once every decade. In addition, many industrialized countries have stopped collecting literacy data in recent years, based on the sometimes incorrect assumption that universal primary education means universal literacy. When census and survey data are not available for a particular country, estimates are sometimes made based on neighboring countries. Actual definitions of adult literacy are not strictly comparable among countries. Some countries equate persons with no schooling with illiterates, or change definitions between censuses. In addition, UNESCO's definition of literacy does not include people who, though familiar with the basics of reading and writing, do not have the skills to function at a reasonable level in their own society.

Net School Enrollment: Even though UNESCO has applied the same methodology to analyze all of the country data, definitions of "schooling" and "enrollment" are not strictly comparable among countries. As net enrollment ratios approach 100 percent, inconsistencies with enrollment and/or population data are more likely to skew the resulting ratios. As a result, some net enrollment ratios are greater than 100 percent. Difficulties also arise when a substantial proportion of students begin school earlier than the prescribed age, or when the reference date for entry into primary education does not coincide with the birthdays of all eligible students.

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Human Health

Sources: United Nations Population Division, World Health Organization, United Nations Children's Fund, Joint United Nations Programme on HIV/AIDS

	Life Expectancy at Birth (years)		Physicians Per 100,000 Population	Use of Improved Water Source (percent of population)		Use of Improved Sanitation (percent of population)		Malnutrition in Children Under Age Five (1995-2002)		HIV and AIDS			Tuber-culosis Incidence Rate Per 100,000 Population	Malaria		Health Care Expenditures Per Capita ($intl)	
										Adults Ages 15-49 Living With HIV or AIDS		ART Use Rate (b) (percent)		Reported Cases Per 100,000 Population	Percent of Children Under Age 5 Using Treated Bed Nets	Total Spending (c)	Govern-ment Spending
	1980-1985	2000-2005	1995-2003	2002		2002		Under-weight Prev-alence	Stunting Prev-alence	Percent in 2003	Change Since 2001 (a)	2002-2003	2002	1998-2001	1999-2004	2001	2001
				Urban	Rural	Urban	Rural										
World	**61.3**	**65.4**	**157** d	**95**	**72**	**81**	**37**	**27**	**31**	**1.1**	**8.5**		**142**		**..**	**629**	**349**
Asia (excl. Middle East)	**61.5**	**67.7**	**107**	**93**	**75**	**72**	**31**	**31**	**33**	**0.4**	**..**	**..**	**152**	**..**	**..**	**230**	**115**
Armenia	72.5	72.4	353	99	80	96	61	3	13	0.1	25.0	0.0	77	2	..	273	112
Azerbaijan	68.4	72.2	354	95	59	73	36	7	13	0.1	..	0.0	82	13	1.4	48	32
Bangladesh	50.0	61.4	23	82	72	75	39	48	45	..	..	0.0	221	40	..	58	26
Bhutan	47.7	63.2	5	86	60	65	70	19	40	..	..	..	118	279	..	64	58
Cambodia	52.1	57.4	16	58	29	53	8	45	45	2.6	6.3	3.0	549	399	..	184	27
China	66.6	71.0	164	92	68	69	29	11	16	0.1	27.7	5.0	113	2	..	224	83
Georgia	70.7	73.6	391	90	61	96	69	3	12	0.1	100.0	8.0	85	8	..	108	41
India	54.9	63.9	51	96	82	58	18	47	46	0.9	31.6	2.0	168	192	..	80	14
Indonesia	56.2	66.8	16	89	69	71	38	26	..	0.1	93.0	2.7	256	93	0.1	77	19
Japan	76.9	81.6	201	100	100	100	100	..	..	0.1	0.0	..	33	..	..	2,131	1,660
Kazakhstan	67.0	66.3	330	96	72	87	52	4	10	0.2	59.2	1.0	146	..	..	204	123
Korea, Dem People's Rep	69.1	63.1	297	100	100	58	60	21	42	..	..	..	160	516	..	44	32
Korea, Rep	67.2	75.5	181	97	71	..	..	..	..	0.1	48.2	..	91	5	..	948	421
Kyrgyzstan	65.6	68.6	268	98	66	75	51	11	25	0.1	160.0	0.0	142	1	..	108	53
Lao People's Dem Rep	45.8	54.5	59	66	38	61	14	40	41	0.1	112.5	..	170	498	..	51	28
Malaysia	68.0	73.1	70	96	94	..	98	12	..	0.4	24.4	..	95	56	..	345	185
Mongolia	57.5	63.9	267	87	30	75	37	13	25	0.1	150.0	..	209	..	..	122	88
Myanmar	51.8	57.3	30	95	74	96	63	35	34	1.2	18.5	1.0	154	252	..	26	5
Nepal	49.1	59.9	5	93	82	68	20	48	51	0.5	36.4	..	190	29	..	63	19
Pakistan	53.0	61.0	66	95	87	92	35	38	37	0.1	17.7	2.2	181	55	..	85	21
Philippines	62.1	70.0	116	90	77	81	61	28	30	0.1	107.0	3.5	320	45	..	169	76
Singapore	71.8	78.1	140	100	..	100	..	14	11	0.2	20.6	0.0	43	..	..	993	333
Sri Lanka	67.9	72.6	43	99	72	98	89	29	14	0.1	59.1	2.0	54	348	..	122	60
Tajikistan	65.9	68.8	218	93	47	71	47	..	..	0.1	..	0.0	109	186	1.9	43	12
Thailand	65.0	69.3	30	95	80	97	100	19	16	1.5	(9.7)	4.0	128	100	..	254	145
Turkmenistan	63.2	67.1	317	93	54	77	50	12	22	0.1	..	..	94	0	..	245	180
Uzbekistan	66.6	69.7	289	97	84	73	48	19	31	0.1	266.7	0.0	102	0	..	91	68
Viet Nam	58.7	69.2	53	93	67	84	26	33	36	0.4	33.3	1.0	193	86	15.8	134	38
Europe	**72.0**	**74.5**	**348**	**100**	**..**	**..**	**..**	**..**	**..**	**0.5**	**..**	**..**	**51**	**..**	**..**	**1,461**	**1,089**
Albania	70.4	73.7	139	99	95	99	81	14	32	..	..	0.0	28	..	..	150	97
Austria	73.1	78.5	324	100	100	100	100	..	..	0.3	1.0	92.6	15	..	..	2,259	1,565
Belarus	70.7	70.1	450	100	100	..	..	..	..	..	..	< 1.0	83	..	..	464	402
Belgium	73.7	78.8	418	100	..	..	..	..	..	0.2	23.5	93.8	14	..	..	2,481	1,779
Bosnia and Herzegovina	70.7	74.0	134	100	96	99	88	4	10	0.1	..	10.0	60	..	..	268	99
Bulgaria	71.2	70.9	338	100	100	100	100	..	..	0.1	..	44.5	48	..	..	303	249
Croatia	70.5	74.2	237	..	..	..	..	1	1	0.1	..	98.7	47	..	..	726	594
Czech Rep	70.7	75.4	343	..	..	..	..	1	2	0.1	19.0	..	13	..	..	1,129	1,032
Denmark	74.6	76.6	366	100	100	..	..	..	..	0.2	8.7	90.9	13	..	..	2,503	2,062
Estonia	69.6	71.7	316	..	..	93	..	..	..	1.1	54.0	32.0	55	..	..	562	437
Finland	73.9	78.0	311	100	100	100	100	..	..	0.1	25.0	94.6	10	..	..	1,845	1,395
France	74.7	79.0	329	100	..	..	..	..	..	0.4	9.1	..	14	..	..	2,567	1,951
Germany	73.8	78.3	362	100	100	..	..	..	..	0.1	4.9	94.7	10	..	..	2,820	2,112
Greece	75.2	78.3	440	..	..	..	..	..	..	0.2	2.3	..	20	..	..	1,522	852
Hungary	69.1	71.9	316	100	98	100	85	2	3	0.1	..	97.0	32	..	..	914	686
Iceland	76.8	79.8	347	100	100	..	..	..	..	0.2	0.0	87.5	3	..	..	2,643	2,191
Ireland	73.1	77.0	237	100	..	..	..	..	..	0.1	18.2	..	13	..	..	1,935	1,471
Italy	74.5	78.7	606	100	..	..	..	..	..	0.5	7.7	72.7	8	..	..	2,204	1,660
Latvia	69.3	71.0	291	..	..	..	..	..	..	0.6	27.1	51.0	78	..	..	509	267
Lithuania	70.8	72.7	403	..	..	..	..	..	..	0.1	18.2	55.0	66	..	..	478	337
Macedonia, FYR	69.6	73.6	219	..	..	..	..	6	7	0.1	0.0	20.0	42	..	..	331	281
Moldova, Rep	64.8	68.9	269	97	88	86	52	3	10	0.2	..	8.3	155	..	..	112	56
Netherlands	76.0	78.3	329	100	99	100	100	..	..	0.2	11.8	96.0	9	..	..	2,612	1,653
Norway	76.0	78.9	356	100	100	..	..	..	..	0.1	11.1	89.6	6	..	..	2,920	2,497
Poland	70.9	73.9	220	100	..	..	..	..	..	0.1	..	92.9	32	..	..	629	452
Portugal	72.2	76.2	324	..	..	..	..	..	..	0.4	4.8	..	47	..	..	1,618	1,116
Romania	69.7	70.5	189	91	16	86	10	6	8	0.1	..	64.4	148	..	..	460	364
Russian Federation	68.3	66.8	417	99	88	93	70	3	13	1.1	62.3	83.3	126	..	..	454	310
Serbia and Montenegro	70.2	73.2	..	99	86	97	77	2	5	0.2	0.0	26.4	38	..	..	616	488
Slovakia	70.6	73.7	325	100	100	100	100	..	..	0.1	..	95.0	24	..	..	681	608
Slovenia	71.2	76.3	219	..	..	..	..	..	..	0.1	0.0	96.3	21	..	..	1,545	1,157
Spain	75.8	79.3	320	..	..	..	..	..	..	0.7	0.0	92.3	30	..	..	1,607	1,147
Sweden	76.3	80.1	305	100	100	100	100	..	..	0.1	6.1	95.0	5	..	..	2,270	1,934
Switzerland	76.2	79.1	352	100	100	100	100	..	..	0.4	8.3	95.0	8	..	..	3,322	1,897
Ukraine	69.1	69.7	297	100	94	100	97	3	15	1.4	20.0	< 1.0	95	..	..	176	119
United Kingdom	74.0	78.2	166 e	100	..	..	..	..	..	0.2	20.5	92.1	12	..	..	1,989	1,635
Middle East & N. Africa	**59.2**	**67.9**	**121**	**94**	**73**	**90**	**51**	**15**	**23**	**0.2**	**43.8** f	**..**	**65**	**..**	**..**	**302**	**174**
Afghanistan	40.0	43.1	19	19	11	16	5	48	52	..	..	0.0	333	1,621	..	34	18
Algeria	60.5	69.7	85	92	80	99	82	6	18	0.1	32.4	..	52	1	..	169	127
Egypt	56.5	68.8	212	100	97	84	56	11	21	0.1	9.1	..	29	0	..	153	75
Iran, Islamic Rep	59.7	70.3	105	98	83	86	78	11	15	0.1	72.2	100.0	29	32	..	422	184
Iraq	62.3	60.7	54	97	50	95	48	16	22	0.1	..	..	167	5	..	97	31
Israel	74.5	79.2	391	100	100	100	..	..	..	0.1	..	..	10	..	..	1,839	1,273
Jordan	63.7	71.0	205	91	91	94	85	5	8	0.1	0.0	21.3	5	..	..	412	194
Kuwait	71.3	76.6	153	..	..	..	..	10	24	..	..	..	26	..	..	612	482
Lebanon	65.9	73.5	325	100	100	100	87	3	12	0.1	40.0	100.0	14	..	..	673	189
Libyan Arab Jamahiriya	62.2	72.8	129	72	68	97	96	5	15	0.3	..	..	21	..	..	239	134
Morocco	58.3	68.7	48	99	56	83	31	9	24	0.1	..	20.7	114	0	..	199	78
Oman	62.7	72.4	126	81	72	97	61	24	23	0.1	30.0	..	12	24	..	343	277
Saudi Arabia	62.6	72.3	140	97	..	100	..	14	20	..	..	..	42	15	..	591	441
Syrian Arab Rep	62.5	71.9	140	94	64	97	56	7	18	0.1	..	..	44	0	..	427	187
Tunisia	64.9	72.8	70	94	60	90	62	4	12	0.1	100.0	..	23	..	..	463	350
Turkey	62.3	70.5	124	96	87	94	62	8	16	..	..	..	32	16	..	294	209
United Arab Emirates	68.6	74.7	202	..	..	100	100	14	17	..	..	..	18	..	..	921	698
Yemen	49.1	60.0	22	74	68	76	14	46	52	0.1	..	..	92	7,600	..	69	24

For more information, please visit http://earthtrends.wri.org/datatables/population

	Life Expectancy at Birth (years)		Physicians Per 100,000 Population	Use of Improved Water Source (percent of population) 2002		Use of Improved Sanitation (percent of population) 2002		Malnutrition in Children Under Age Five (1995-2002)		HIV and AIDS			Tuber-culosis Incidence Rate Per 100,000 Population	Malaria		Health Care Expenditures Per Capita ($intl)	
										Adults Ages 15-49 Living With HIV or AIDS		ART Use Rate (b)		Reported Cases Per 100,000 Population	Percent of Children Under Age 5 Using Treated Bed Nets	Total Spending (c)	Govern-ment Spending
	1980-1985	2000-2005	1995-2003	Urban	Rural	Urban	Rural	Under-weight Prev-alence	Stunting Prev-alence	Percent in 2003	Change Since 2001 (a)	(percent) 2002-2003	Population 2002	1998-2001	1999-2004	2001	2001
Sub-Saharan Africa	**48.5**	**46.6**	**15**	**82**	**46**	**55**	**26**	**30**	**39**	**7.5**	**5.0** f	**..**	**359**	**..**	**3.2** g	**85**	**36**
Angola	40.0	40.1	8	70	40	56	16	31	45	3.9	10.0	< 1.0	336	6,594	2.3	70	44
Benin	49.2	50.6	6	79	60	58	12	23	31	1.9	5.1	2.5	86	11,545	7.4	39	18
Botswana	62.8	39.7	29	100	90	57	25	13	23	37.3	0.0	7.9	657	2,836	..	381	252
Burkina Faso	46.1	45.7	4	82	44	45	5	34	37	4.2	8.0	1.4	157	619	6.5	27	16
Burundi	46.6	40.9	5	90	78	47	35	45	57	6.0	0.0	1.9	359	43,505	1.3	19	11
Cameroon	50.7	46.2	7	84	41	63	33	21	35	6.9	4.0	1.5	188	2,900	1.3	42	16
Central African Rep	46.5	39.5	4	93	61	47	12	24	39	13.5	4.3	< 1.0	338	..	1.5	58	30
Chad	42.3	44.7	3	40	32	30	..	28	29	4.8	5.9	..	222	4,683	0.6	17	13
Congo	56.8	48.2	25	72	17	14	2	14	19	4.9	0.0	..	395	5,880	..	22	14
Congo, Dem Rep	47.1	41.8	7	83	..	43	23	31	38	4.2	5.3	0.0	384	1,414	0.7	12	5
Côte d'Ivoire	50.0	41.0	9	..	..	61	23	21	25	7.0	10.4	2.7	412	2,449	1.1	127	20
Equatorial Guinea	43.8	49.1	25	45	42	60	46	19	39	..	..	6.8	191	..	0.7	106	64
Eritrea	43.3	52.7	3	72	54	34	3	44	38	2.7	0.0	< 1.0	268	5,648	4.2	36	23
Ethiopia	42.7	45.5	3	81	11	19	4	47	52	4.4	16.7	< 1.0	370	621	..	14	6
Gabon	56.3	56.6	29	95	47	37	30	12	21	8.1	21.6	..	248	2,148	..	197	94
Gambia	44.1	54.1	4	95	77	72	46	17	19	1.2	0.0	6.3	230	10,096	14.7	78	39
Ghana	53.6	57.9	9	93	68	74	46	25	26	3.1	3.2	1.8	211	17,143	4.5	60	36
Guinea	40.2	49.1	9	78	38	25	6	23	26	3.2	30.0	..	215	75,386	..	61	33
Guinea-Bissau	39.1	45.3	17	79	49	57	23	25	30	..	..	..	196	2,421	7.4	37	20
Kenya	55.7	44.6	13	89	46	56	43	21	35	6.7	(8.3)	3.0	540	545	4.6	114	24
Lesotho	52.0	35.1	5	88	74	61	32	18	46	28.9	0.0	< 1.0	726	..	..	101	80
Liberia	44.9	41.4	2	72	52	49	7	26	39	5.9	20.0	..	247	26,699	..	127	96
Madagascar	48.0	53.6	9	75	34	49	27	33	49	1.7	32.7	..	234	..	0.2	20	13
Malawi	45.7	37.5	5	96	62	66	42	25	49	14.2	5.2	1.8	431	20,080	35.5	39	14
Mali	44.4	48.6	4	76	35	59	38	33	38	1.9	0.0	2.5	334	741	8.4	30	12
Mauritania	47.4	52.5	14	63	45	64	9	32	35	0.6	50.8	..	188	9,724	4.1	45	33
Mozambique	42.8	38.1	2	76	24	51	14	26	44	12.2	9.1	0.0	436	19,842	..	47	32
Namibia	55.2	44.3	30	98	72	66	14	24	24	21.3	5.3	0.0	751	1,502	3.4	342	232
Niger	40.7	46.2	3	80	36	43	4	40	40	1.2	25.5	..	193	1,693	5.8	22	9
Nigeria	48.1	51.5	27	72	49	48	30	36	43	5.4	6.5	1.5	304	30	1.2	31	7
Rwanda	46.1	39.3	2	92	69	56	38	27	41	5.1	4.5	< 1.0	389	6,510	5	44	24
Senegal	46.3	52.9	8	90	54	70	34	23	25	0.8	7.9	< 1.0	242	11,925	1.7	63	37
Sierra Leone	35.3	34.2	7	75	46	53	30	27	34	..	..	0.0	405	8,943	1.5	26	16
Somalia	43.0	47.9	4	32	27	47	14	26	23	..	..	..	405	118	0.3	15	7
South Africa	57.7	47.7	69	98	73	86	44	12	25	21.5	6.3	0.0	558	61	..	652	270
Sudan	49.1	55.6	16	78	64	50	24	17	..	2.3	26.7	< 1.0	217	12,530	0.4	39	7
Tanzania, United Rep	51.0	43.3	2	92	62	54	41	29	44	8.8	7.1	< 1.0	363	1,207	2.1	26	12
Togo	50.2	49.7	6	80	36	71	15	25	22	4.1	2.1	..	361	9,273	2	45	22
Uganda	47.2	46.2	5	87	52	53	39	23	39	4.1	(13.5)	6.3	377	46	0.2	57	33
Zambia	52.0	32.4	7	90	36	68	32	28	47	16.5	3.8	0.0	668	18,877	6.5	52	28
Zimbabwe	59.6	33.1	6	100	74	69	51	13	27	24.6	0.0	0.0	683	5,410	..	142	64
North America	**74.2**	**77.3**	**516**	**100**	**100**	**100**	**100**	**1**	**2**	**0.6**	**5.3** f	**..**	**5**	**..**	**..**	**4,683**	**2,151**
Canada	75.9	79.3	209	100	99	100	99	..	..	0.3	14.6	..	6	..	..	2,792	1,977
United States	74.0	77.1	549	100	100	100	100	1	2	0.6	5.6	..	5	..	..	4,887	2,170
C. America & Caribbean	**66.1**	**71.5**	**181**	**97**	**76**	**87**	**47**	**10**	**20**	**0.8**	**9.8**	**..**	**54**	**..**	**..**	**428**	**202**
Belize	71.2	71.4	105	100	82	71	25	6	..	2.4	25.0	7.7	55	475	..	278	125
Costa Rica	73.5	78.1	173	100	92	89	97	5	6	0.6	9.1	..	15	33	..	562	385
Cuba	73.4	76.7	591	95	78	99	95	4	5	0.1	3.1	..	12	..	..	229	197
Dominican Rep	62.8	66.7	188	98	85	67	43	5	6	1.7	(2.3)	0.0	95	12	..	353	127
El Salvador	56.6	70.7	124	91	68	78	40	12	23	0.7	16.7	..	60	6	..	376	176
Guatemala	58.0	65.8	90	99	92	72	52	24	46	1.1	13.8	46.0	77	307	1.2	199	96
Haiti	51.8	49.5	25	91	59	52	23	17	23	5.6	8.3	..	319	119	..	56	30
Honduras	60.8	68.9	83	99	82	89	52	17	29	1.8	22.9	< 1.0	86	365	..	153	81
Jamaica	71.2	75.7	85	98	87	90	68	6	6	1.2	50.0	< 1.0	8	..	..	253	107
Mexico	67.5	73.4	171	97	72	90	39	8	18	0.3	6.7	92.0	33	5	..	544	241
Nicaragua	59.3	69.5	164	93	65	78	51	10	20	0.2	12.7	0.0	64	201	..	158	77
Panama	70.5	74.7	168	99	79	89	51	7	14	0.9	36.4	..	47	32	..	458	316
Trinidad and Tobago	70.2	71.3	79	92	88	100	100	7	5	3.2	7.7	< 1.0	13	..	..	388	168
South America	**64.8**	**70.2**	**190**	**95**	**64**	**83**	**42**	**6**	**14**	**0.6**	**14.8**	**..**	**72**	**..**	**..**	**551**	**264**
Argentina	70.0	74.2	301	97	..	..	..	5	12	0.7	0.0	91.2	46	1	..	1,130	603
Bolivia	53.9	63.9	73	95	68	58	23	10	26	0.1	20.0	< 1.0	234	185	..	125	83
Brazil	63.0	68.1	206	96	58	83	35	6	11	0.7	4.8	100.0	62	225	..	573	238
Chile	70.6	76.1	109	100	59	96	64	1	2	0.3	4.0	..	18	..	..	792	348
Colombia	66.6	72.2	135	99	71	96	54	7	14	0.7	50.0	..	45	482	0.7	356	234
Ecuador	64.3	70.8	148	92	77	80	59	15	27	0.3	5.3	..	137	846	..	177	89
Guyana	61.0	63.2	48	83	83	86	60	14	11	2.5	0.0	0.0	115	3,554	5.5	215	172
Paraguay	67.1	70.9	117	100	62	94	58	5	11	0.5	50.0	50.0	70	48	..	332	127
Peru	61.4	69.8	117	87	66	72	33	7	25	0.5	56.9	19.2	202	305	..	231	127
Suriname	67.1	71.1	45	98	73	99	76	13	10	1.7	25.0	..	68	4,075	2.7	398	240
Uruguay	70.8	75.3	365	98	93	95	85	5	8	0.3	5.5	50.5	29	..	..	971	450
Venezuela	68.6	73.7	194	85	70	71	48	5	13	0.7	40.8	..	42	81	..	386	240
Oceania	**70.4**	**74.6**	**189**	**99**	**52**		**57**	**..**	**..**	**0.2**	**29.2** f	**..**	**55**	**..**	**..**	**1,851**	**1,283**
Australia	75.2	79.2	249	100	100	100	100	..	..	0.1	16.7	53.2	6	..	..	2,532	1,719
Fiji	64.7	69.8	34	..	..	99	98	8	3	0.1	20.0	..	30	..	..	224	150
New Zealand	73.7	78.3	223	100	..	..	..	..	..	0.1	16.7	..	11	..	..	1,724	1,324
Papua New Guinea	49.7	57.6	5	88	32	67	41	35	..	0.6	60.0	0.0	254	1,793	..	144	128
Solomon Islands	60.6	69.2	13	94	65	98	18	21	27	..	..	..	91	16,512	..	133	124
Developed	**72.4**	**74.8**	**361**	**100**	**94**	**100**	**92** h	**..**	**..**	**..**	**..**	**..**	**57**	**..**	**..**	**2,221**	**1,328**
Developing	**59.6**	**64.9**	**99**	**92**	**70**	**73**	**31**	**28**	**32**	**..**	**..**	**..**	**164**	**..**	**..**	**192**	**80**

a. Measures the percent change in the total number of adults with HIV/AIDS between 2001 and 2003. **b**. The percent of adults with advanced HIV infection receiving antiretroviral therapy (ART).
c. Includes both personal (private) and government (public) spending on health care. **d**. Calculated by WRI. **e**. Data are from 1993. **f**. Regional totals were calculated by UNAIDS.
g. Calculated by UNICEF. **h.** Developed country estimates for urban and rural water and sanitation coverage were calculated by WHO.

Human Health: Technical Notes

DEFINITIONS AND METHODOLOGY

Life Expectancy at Birth is the average number of years that a newborn baby is expected to live if the age-specific mortality rates effective at the year of birth apply throughout his or her lifetime.

Physicians per 100,000 Population indicates the density of doctors in a country. "Physician" includes graduates of a faculty or school of medicine who are working in any medical field (including teaching, research, and practice).

Improved Water Source includes any of the following types of drinking water sources: household connections, public standpipes, boreholes, protected dug wells, protected springs, and rainwater collection. To be counted, at least 20 liters per person per day of improved water must be available within one kilometer of a user's dwelling. Examples of unimproved water sources include unprotected wells and springs, vendor-provided water, tanker-provided water, and bottled water. These last examples are considered "unimproved" because they are not consistently available in sufficient quantities. **Improved Sanitation** includes any of the following excreta disposal facilities: connection to a public sewer, connection to a septic tank, pour-flush latrine, simple pit latrine, and ventilated improved pit latrine. Examples of an unimproved sanitation system include open pit latrines, public or shared latrines, and service or bucket latrines.

Data were collected from assessment questionnaires and household surveys and plotted on a graph for each country to show coverage in available years (not necessarily 2002). A trend line was drawn and reviewed by a panel of experts from WHO and UNICEF to determine the level of sanitation and water available in 2002.

Underweight Prevalence, an indicator of malnutrition, refers to the proportion of children under five years of age whose weight-for-age is more than two standard deviations (for moderate underweight) or more than three standard deviations (for severe underweight) below the median weight-for-age of a reference population. **Stunting prevalence,** an indicator of chronic malnutrition, refers to the percentage of children under five whose height-for-age is more than two (moderate stunting) and three (severe stunting) standard deviations from the median of the reference population.

Malnutrition data were obtained from Multiple Indicator Cluster Surveys (MICS), Demographic and Health Surveys (DHS), and other national-level surveys. Where possible, only comprehensive or representative national data have been used.

Adults Ages 15-49 Living With HIV or AIDS is the estimated percentage of people aged 15-49 living with HIV/AIDS. **Change Since 2001** measures the percent change in the total population infected with AIDS or HIV between 2001 and 2003. These estimates include all people with HIV infection, whether or not they have developed symptoms of AIDS, who are alive at the end of the year specified. Data for this age group capture those in their most sexually active years. Measuring infection within this age range also allows greater comparability for populations with different age structures. Estimates for a single point in time and the starting date of the epidemic were used to plot an epidemic curve charting the spread of HIV in a particular country.

Antiretroviral Therapy (ART) Use Rate is the estimated percentage of adults with advanced HIV infection receiving antiretroviral therapy. This therapy can dramatically reduce HIV-related mortality and improve the quality of life of those infected. The estimated number of people receiving treatment is determined by national program-monitoring reports or estimates from local WHO offices. The number of adults with advanced HIV infection is estimated by the Joint United Nations Programme on HIV/AIDS (UNAIDS) to be 15 percent of the total number of infected adults.

Tuberculosis Incidence Rate is the estimated number of new tuberculosis (TB) cases per 100,000 people in the year specified. The estimates include all cases (pulmonary, smear positive, and extrapulmonary). If left untreated, each person with an infectious case of TB will infect 10-15 people every year. It is estimated that TB caused 2 million deaths in 2002 and is now the leading cause of death in people infected with HIV. Data are collected by country using a standard collection form. Initial estimates are derived using surveys of the prevalence of infection and are then refined using a consultative and analytical process involving a panel of epidemiological experts at WHO.

Reported Malaria Cases is the total number of malaria cases reported to the WHO by countries in which malaria is endemic. Most countries report only laboratory confirmed cases, but some countries in Sub-Saharan Africa report clinically diagnosed cases as well. Transmitted to humans by the bite of an infected mosquito, malaria is one of the world's prevalent health crises, killing more than one million people annually. Data on malaria are collected from a variety of surveys, including Routine Health Information Systems (HIS), MICS, DHS, Demographic Surveillance Sites (DSS), and Rolling Back Malaria (RBM) baseline surveys.

Percent of Children Under Age Five Using Treated Bed Nets is the percent of children under age five in each country that sleep under a net treated with an insecticide to ward off mosquitoes, a powerful method of preventing malaria infections. According to UNICEF, the majority of deaths from malaria occur in children under age 5. Data are obtained by UNICEF from DHS, MICS, and other national surveys.

Health Care Spending per Capita is defined as the sum of government and private expenditures on health, expressed on a per-person basis. The estimates are provided in international dollars, which minimizes the consequences of differing price levels among countries. **Government Health Spending** includes all public outlays reserved for the enhancement of the health status of the population and/or the distribution of medical care. Expenditures by all levels of government (national, regional, and local), extrabudgetary agencies, and external resources such as grants are included. The estimates for extrabudgetary expenditure on health include purchase of health goods and services by schemes that are compulsory and government-controlled. **Private Health Spending** is the sum of expenditures by prepaid plans and risk-pooling arrangements, public and private enterprises for medical care and health-enhancing benefits (outside of payment to social security), nonprofit institutions that primarily serve households, and household out-of-pocket spending.

Per capita totals were calculated by WHO using population estimates from the Organization for Economic Co-operation and Development (OECD) and the United Nations Population Division.

Information on government health expenditures are obtained from the OECD, the International Monetary Fund (IMF), national health-accounts reports, government finance data, statistical yearbooks, and public-finance reports. Information for private health expenditures are obtained from national health-accounts reports, statistical yearbooks and other periodicals, official web sites, reports from non-governmental organizations, household surveys, academic studies, government ministries, and professional and trade associations.

FREQUENCY OF UPDATE BY DATA PROVIDERS

Both the UN Population Division and the Joint United Nations Program on HIV/AIDS (UNAIDS) publish country-level statistics every two years with annual revisions of key estimates. UNICEF publishes the most recent available data each year. WHO publishes country-level statistics annually and updates the *Global Atlas of Infectious Diseases* database as new information becomes available.

DATA RELIABILITY AND CAUTIONARY NOTES

Life Expectancy: The United Nations Population Division (UNPD) estimates demographic parameters on a country-by-country basis, so data reliability varies among countries. In some developing countries, census data are not available or are incomplete, and estimates concerning population trends are derived from surveys. Although estimates are based on incomplete mortality data and projections cannot factor in unforeseen events (e.g., famine, wars), UN demographic models are widely accepted and use well-understood qualities, making these data fairly reliable.

Physicians per 100,000 Population: Data reliability varies by country. Due to out-of-date health personnel records, some countries mistakenly include retired physicians or physicians no longer working in the health sector, resulting in overestimates. Also, this indicator speaks solely of the quantity of physicians, not the quality or accessibility of the personnel. It does not show the difference in urban and rural concentrations. The exact definition of "physician" may vary among countries. Some countries may include interns, physicians that are retraining, and those working in the private sector.

Improved Water Sources and Sanitation: These data have become more reliable as WHO and UNICEF shift from provider-based information (national census estimates) to consumer-based information (survey data). Nonetheless, estimates were calculated based on a wide variety of sources of disparate quality, and comparisons among countries should be made with care. Definitions of urban and rural are not consistent across countries. The assessment does not account for intermittent or poor quality of water supplies. WHO emphasizes that these data measure use of an improved water supply and excreta disposal system, but access to sanitary and safe systems cannot be adequately measured on a global scale.

Malnutrition in Children under Five: The data included for these variables cover a wide range of years and sources. Some data refer to periods other than 1995-2002, measure stunting or percentage underweight in a different age range than 0-5, or were collected for only part of a country. Since data are not available for more affluent countries, the regional totals reported here may be larger than the actual averages.

Adults Ages 15-49 Living with HIV or AIDS: While HIV surveillance systems are generally more extensive than those for other diseases, data reliability still varies on a country-by-country basis. The extent of uncertainty depends primarily on the type of epidemic—infection rates for generalized (high-level) epidemics are calculated differently from rates for concentrated (low-level) epidemics—and on the quality, coverage, and consistency of a country's surveillance system. A detailed description of the methods, software, quality of data, and development of ranges for these data was published in the journal Sexually Transmitted Infections in July 2004.

Antiretroviral Therapy Use Rate: The data have been reviewed by UNAIDS and compared with other sources to consolidate validity. The reliability of the national data presented in national reports is dependent on the quality of information provided by the countries themselves. Some countries have very small or highly localized epidemics, so the rates presented here do not necessarily reflect national commitment and action. This indicator does not distinguish between the different types of therapy available nor does it measure the cost, quality, or effectiveness of the treatment. In certain settings, a system may not yet be in place to collect data from community-based organizations, private prescribers, and pharmacies. The estimated proportion of the total infected population with advanced HIV infection (currently 15 percent) may require revision, as the proportion varies according to the stage of the HIV epidemic and the coverage and effectiveness of ART.

Tuberculosis Incidence Rate: Data are reviewed at all levels of WHO, and WHO headquarters attempts to complete any missing responses and resolve any inconsistencies. The quality of the information provided by a particular country is dependent on the quality of its national surveillance system.

Reported Malaria Cases: Malaria infection-rate data are less accurate than estimates of HIV/AIDS or tuberculosis. Data may reflect only a fraction of the true number of malaria cases in a country because of incomplete reporting systems or incomplete coverage by health services, or both. Also, many malaria patients may seek treatment outside of the formal health sector. Case detection and reporting systems vary widely.

Health Care Spending: The estimates provided here should be considered the best estimates of WHO and not the official estimates of its member states. WHO has compared the data to a variety of sources, including inpatient care expenditure and pharmaceutical care expenditure, in an effort to ensure the plausibility of the estimates that have been collected. For further information on data collection and reliability, refer to the World Health Report methodology available at http://www.who.int/whr/2004/en/09_annexes_en.pdf.

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Gender and Development

Sources: United Nations Development Programme, United Nations Human Settlements Programme, United Nations Population Division, United Nations Children's Fund, United Nations Educational, Scientific, and Cultural Organization, Inter-Parliamentary Union

	Gender Empowerment Measure (0-1 scale, 1 = complete equality) 2003	Woman Headed Households as a Percent of Total 1990-99 {a}	Maternity and Family Planning: Contra-ceptive Prevalence (percent) 1990-2002 {a}	Maternity and Family Planning: Women With Unmet Family Planning Needs (percent) 1990-2002 {a}	Maternity and Family Planning: Maternal Mortality Ratio (deaths per 100,000 live births) 2000	Maternity and Family Planning: Skilled Attendants at Delivery (percent of births) 1995-00	Education and Literacy: Ratio of Women to Men Enrolled in Secondary Education 2001-02	Education and Literacy: Literacy Rate (percent) 2000-04 Women	Education and Literacy: Literacy Rate (percent) 2000-04 Men	Income and Labor: Annual Earned Income (international dollars) 1991-00 {a,b} Women	Income and Labor: Annual Earned Income (international dollars) 1991-00 {a,b} Men	Income and Labor: Female Professional and Technical Workers (percent of total) 1992-01 {a}	Parliamentary Seats Held by Women (percent of total) 2004
World	..	..	**60.9**	..	**400**	**58**	..	**76.6**	**87.0**	..	..	..	**15.6**
Asia (excl. Middle East)	..	..	**64.6**	..	..	..	..	**78.3**	**88.3**	..	..	..	**14.2**
Armenia	..	..	60.5	11.8	55	97	106	99.2	99.7	2,564	3,700	..	4.6
Azerbaijan	..	..	55.4	11.5	94	84	98	..	..	2,322	4,044	..	10.5
Bangladesh	0.22	..	53.8	15.3	380	12	109	31.4	50.3	1,150	2,035	25	2.0
Bhutan	..	..	18.8	..	420	24	..	..	..	..	..	..	9.3
Cambodia	0.36	..	23.8	32.6	450	32	59	59.3	80.8	1,622	2,117	33	10.9
China	..	..	83.8	..	56	76	..	86.5	95.1	3,571	5,435	..	20.2
Georgia	0.39	..	40.5	23.8	32	96	108	..	..	1,325	3,283	64	..
India	..	..	48.2	15.8	540	43	74	..	..	1,442	3,820	..	9.3
Indonesia	..	..	57.4	9.2	230	64	100	83.4	92.5	2,138	4,161	..	8.0
Japan	0.53	20.0	55.9	..	10	100	101	..	..	16,977	37,208	46	9.9
Kazakhstan	..	..	66.1	8.7	210	99	98	99.2	99.7	4,247	7,156	..	8.6
Korea, Dem People's Rep	..	..	61.8	..	67	97	..	..	..	..	..	..	..
Korea, Rep	0.38	..	80.5	..	20	100	100	..	..	10,747	23,226	34	5.5
Kyrgyzstan	..	..	59.5	11.6	110	98	101	..	..	1,269	1,944	..	6.7
Lao People's Dem Rep	..	..	32.2	..	650	19	72	55.5	77.4	1,358	2,082	..	22.9
Malaysia	0.52	18.5	54.5	..	41	97	111	85.4	92.0	5,219	13,157	45	16.3
Mongolia	0.43	..	67.4	9.9	110	97	120	97.5	98.0	1,316	1,955	66	10.5
Myanmar	..	..	32.7	..	360	56	93	81.4	89.2	..	..	..	..
Nepal	..	..	39.3	27.8	740	11	74	26.4	61.6	891	1,776	..	6.4
Pakistan	0.42	..	27.6	32.0	500	20	..	28.5 j	53.4 j	915	2,789	26	20.8
Philippines	0.54	..	46.5	19.8	200	58	110	92.7	92.5	3,144	5,326	62	17.2
Singapore	0.65	..	62.0	..	30	100	..	88.6	96.6	15,822	31,927	43	16.0
Sri Lanka	0.28	..	66.1	..	92	97	..	89.6	94.7	2,570	4,523	49	4.4
Tajikistan	..	..	33.9	..	100	71	82	99.3	99.7	759	1,225	..	12.4
Thailand	0.46	..	72.2	..	44	99	..	90.5	94.9	5,284	8,664	55	9.6
Turkmenistan	..	..	61.8	10.1	31	97	..	98.3 j	99.3 j	3,274	5,212	..	26.0
Uzbekistan	..	..	67.2	13.7	24	96	97	98.9	99.6	1,305	1,983	..	7.2
Viet Nam	..	..	78.5	4.8	130	70	93	86.9 j	93.9 j	1,888	2,723	..	27.3
Europe	..	..	**69.1**	..	..	..	..	**99.0**	**99.5**	..	..	..	**19.1**
Albania	..	..	57.5	..	55	99	..	98.3	99.2	3,442	6,185	..	5.7
Austria	0.77	33.1	50.8	..	4	100 j	96	..	..	15,410	43,169	48	30.6
Belarus	..	..	50.4	..	35	100	105	99.6	99.8	4,405	6,765	..	18.4
Belgium	0.81	26.2	78.4 c	2.1 d	10	100 j	112	..	..	18,528	37,180	48	33.9
Bosnia and Herzegovina	..	..	47.5	..	31	100	..	91.1	98.4	..	..	..	12.3
Bulgaria	..	..	41.5	..	32	..	98	98.1	99.1	5,719	8,627	..	26.3
Croatia	0.56	..	..	..	8	100	101	97.1	99.3	7,453	13,374	51	17.8
Czech Rep	0.59	..	72.0	8.0 d	9	99	102	..	..	11,322	20,370	52	15.7
Denmark	0.85	..	78.0 d,j	..	5	100 j	105	..	..	26,074	36,161	51	38.0
Estonia	0.59	54.2	70.3	..	63	..	102	99.8	99.8	9,777	15,571	68	18.8
Finland	0.82	..	77.4 j	..	6	100 j	111	..	..	21,645	30,970	52	37.5
France	..	..	74.6	5.7 d	17	99 j	101	..	..	19,923	33,950	..	11.7
Germany	0.80	30.6	74.7	..	8	100 j	99	..	..	18,763	35,885	49	31.4
Greece	0.52	..	..	..	9	..	..	..	..	10,892	25,601	48	..
Hungary	0.53	..	77.4	4.2 d	16	..	101	..	..	10,307	17,465	62	9.8
Iceland	0.82	..	..	..	0	..	106	..	..	22,716	36,043	55	30.2
Ireland	0.71	26.3	..	..	5	100	110	..	..	21,056	52,008	52	14.2
Italy	0.58	..	60.2 c	7.4 d	5	..	96	..	..	16,702	36,959	45	10.3
Latvia	0.59	..	48.0	10.6 d	42	100	101	99.7	99.8	7,685	11,085	66	21.0
Lithuania	0.51	..	46.6	12.1 d	13	..	99	99.6	99.6	8,419	12,518	70	10.6
Macedonia, FYR	0.52	..	..	..	23	97	98	..	..	4,599	8,293	51	18.3
Moldova, Rep	0.47	..	62.4	6.7 d	36	99	103	98.6	99.6	1,168	1,788	64	12.9
Netherlands	0.82	42.8	78.5	..	16	100	97	..	..	20,358	38,266	48	35.1
Norway	0.91	34.3	73.8 e, j	..	16	100 j	103	..	..	31,356	42,340	49	36.4
Poland	0.61	35.2	49.4	..	13	99 j	..	..	..	8,120	13,149	60	20.7
Portugal	0.64	19.8	66.3 j	..	5	100	..	..	..	13,084	24,373	51	19.1
Romania	0.47	..	63.8	4.5 d	49	98	101	96.3	98.4	4,837	8,311	56	9.3
Russian Federation	0.47	..	..	..	67	99	100	99.5	99.7	6,508	10,189	64	8.0
Serbia and Montenegro	..	21.8	58.3 f	..	11	99	..	..	..	..	..	..	7.9
Slovakia	0.61	23.1	74.0 d	..	3	..	101	99.7	99.7	10,127	15,617	61	19.3
Slovenia	0.58	..	73.8	..	17	100 j	101	99.6	99.7	14,084	22,832	55	12.2
Spain	0.72	..	80.9	3.0 d	4	..	106	..	..	13,209	29,971	46	30.5
Sweden	0.85	37.0	78.0 d, j	..	2	100 j	121	..	..	23,781	28,700	50	45.3
Switzerland	0.77	..	82.0 c	..	7	..	94	..	..	20,459	40,769	45	24.8
Ukraine	0.41	..	67.5	14.9	35	100	100	99.5	99.8	3,429	6,493	64	5.3
United Kingdom	0.70	25.3	84.0 g	..	13	99	125	..	..	19,807	32,984	44	17.3
Middle East & N. Africa	..	..	**51.8**	..	**220 i**	**70 i**	..	**61.6**	**80.5**	..	..	..	..
Afghanistan	..	..	4.8	..	1900	12	..	..	..	..	..	..	..
Algeria	..	..	64.0	..	140	92	107	59.6	78.0	2,684	8,794	..	..
Egypt	0.27	..	56.1	11.2	84	61	93	43.6 j	67.2 j	1,963	5,216	30	3.6
Iran, Islamic Rep	0.31	..	72.9	..	76	90	95	70.4 j	83.5 j	2,835	9,946	33	..
Iraq	..	..	13.7 j	..	250	72	..	..	..	..	..	..	..
Israel	0.61	29.5	68.0 h	..	17	99 j	99	93.4	97.3	14,201	26,636	54	15.0
Jordan	..	..	55.8	11.0	41	97	101	85.9	95.5	1,896	6,118	..	7.9
Kuwait	..	..	50.2	..	5	98	106	81.0	84.7	7,116	20,979	..	0.0
Lebanon	..	..	61.0	..	150	89	109	..	..	2,552	8,336	..	2.3
Libyan Arab Jamahiriya	..	..	39.7	..	97	94	106	70.7	91.8	..	..	..	..
Morocco	..	..	50.3	16.1	220	40	..	38.3	63.3	2,153	5,354	..	..
Oman	..	..	23.7	..	87	95	99	65.4	82.0	4,056	18,239	..	..
Saudi Arabia	0.21	..	31.8	..	23	91 j	89	69.5	84.1	3,825	18,616	31	0.0
Syrian Arab Rep	..	..	36.1	..	160	76	89	74.2	91.0	1,549	5,496	..	12.0
Tunisia	..	..	60.0	..	120	90	104	63.1	83.1	3,615	9,933	..	11.5
Turkey	0.29	..	63.9	10.1	70	81	77	78.5	94.4	4,757	7,873	31	4.4
United Arab Emirates	..	..	27.5	..	54	96	106	80.7	75.6	..	..	25	0.0
Yemen	0.12	..	20.8	38.6	570	22	..	28.5	69.5	387	1,274	15	0.3

For more information, please visit http://earthtrends.wri.org/datatables/population

	Gender Empowerment Measure (0-1 scale, 1 = complete equality) 2003	Woman Headed Households as a Percent of Total 1990-99 [a]	Maternity and Family Planning: Contraceptive Prevalence (percent) 1990-2002 [a]	Maternity and Family Planning: Women With Unmet Family Planning Needs (percent) 1990-2002 [a]	Maternity and Family Planning: Maternal Mortality Ratio (deaths per 100,000 live births) 2000	Maternity and Family Planning: Skilled Attendants at Delivery (percent of births) 1995-00	Education and Literacy: Ratio of Women to Men Enrolled in Secondary Education 2001-02	Education and Literacy: Literacy Rate (percent) 2000-04 Women	Education and Literacy: Literacy Rate (percent) 2000-04 Men	Income and Labor: Annual Earned Income (international dollars) 1991-00 [a,b] Women	Income and Labor: Annual Earned Income (international dollars) 1991-00 [a,b] Men	Income and Labor: Female Professional and Technical Workers (percent of total) 1992-01 [a]	Parliamentary Seats Held by Women (percent of total) 2004
Sub-Saharan Africa	**..**	**..**	**20.2**	**22.4**	**940 i**	**42 i**	**..**	**54.4**	**69.8**	**..**	**..**	**..**	**13.5**
Angola	..	..	6.2	..	1700	45	81	..	..	1,627	2,626	..	15.5
Benin	..	..	18.6	27.2	850	66	46	25.5	54.8	876	1,268	..	7.2
Botswana	0.56	..	40.4	..	100	94	107	81.5	76.1	5,353	10,550	52	17.0
Burkina Faso	..	5.2	11.9	4.4	1000	31	67	8.1 j	18.5 j	855	1,215	..	11.7
Burundi	..	..	15.7	..	1000	25	75	43.6	57.7	561	794	..	18.5
Cameroon	..	..	19.3	13.0	730	60	81	59.8	77.0	1,235	2,787	..	8.9
Central African Rep	..	..	27.9	16.2	1100	44	..	33.5	64.7	889	1,469	..	..
Chad	..	..	7.9	9.4	1100	16	..	37.5	54.5	760	1,284	..	5.8
Congo	..	..	..	..	510	..	73	77.1	88.9	707	1,273	..	10.6
Congo, Dem Rep	..	..	31.4	..	990	61	..	..	..	467	846	..	10.2
Côte d'Ivoire	..	..	15.0	43.4	690	63	..	..	..	818	2,222	..	8.5
Equatorial Guinea	..	..	..	..	880	65	58	..	..	16,852	42,304	..	5.0
Eritrea	..	..	8.0	27.0	630	21	67	..	..	654	1,266	..	22.0
Ethiopia	..	..	8.1	35.8	850	6	65	33.8	49.2	516	1,008	..	7.8
Gabon	..	..	32.7	28.0	420	86	..	..	..	4,937	8,351	..	11.0
Gambia	..	15.9	9.6	..	540	55	70	..	..	1,263	2,127	..	13.2
Ghana	..	..	22.0	23.0	540	44	83	65.9	81.9	1,802	2,419	..	9.0
Guinea	..	..	6.2	24.2	740	35	..	..	..	1,569	2,317	..	19.3
Guinea-Bissau	..	..	7.6	..	1100	35	..	..	..	465	959	..	..
Kenya	..	..	39.0	23.9	1000	44	88	78.5	90.0	962	1,067	..	7.1
Lesotho	..	29.4	30.4	..	550	60	127	90.3	73.7	1,357	3,578	..	17.0
Liberia	..	..	6.4 j	..	760	51	..	39.3	72.3	..	..	..	..
Madagascar	..	..	18.8	25.6	550	46	..	..	..	534	906	..	6.4
Malawi	..	..	30.6	29.7	1800	56	74	48.7	75.5	427	626	..	9.3
Mali	..	..	8.1	28.5	1200	41	..	11.9 j	26.7 j	635	1,044	..	10.2
Mauritania	..	..	8.0	31.6	1000	57	76	31.3	51.5	1,581	2,840	..	4.4
Mozambique	..	..	5.6	6.7	1000	44	63	31.4	62.3	840	1,265	..	30.0
Namibia	0.57	..	28.9	22.0	300	78	114	82.8	83.8	4,262	8,402	55	21.4
Niger	..	..	14.0	16.6	1600	16	63	9.3	25.1	575	1,005	..	1.2
Nigeria	..	..	15.3	17.5	800	42	..	59.4	74.4	562	1,322	..	5.8
Rwanda	..	..	13.2	37.0	1400	31	93	63.4	75.3	968	1,570	..	45.0
Senegal	..	19.6	12.9	32.6	690	58	68	29.7	49.0	1,140	2,074	..	19.2
Sierra Leone	..	..	4.3	..	2000	42	..	..	..	337	815	..	14.5
Somalia	..	..	..	..	1100	34	..	..	..	..	..	..	..
South Africa	..	37.8	56.3	15.0	230	84	108	85.3	86.7	6,371	14,202	..	27.8
Sudan	..	..	8.3	26.0	590	86 j	..	49.1	70.8	867	2,752	..	9.7
Tanzania, United Rep	..	..	25.4	21.8	1500	36	..	69.2	85.2	467	660	..	21.4
Togo	..	..	25.7	32.3	570	49	..	45.4	74.3	941	2,004	..	7.4
Uganda	..	..	22.8	24.4	880	39	79	59.2	78.8	1,088	1,651	..	24.7
Zambia	..	..	34.2	18.3	750	43	78	73.8	86.3	571	1,041	..	12.0
Zimbabwe	..	32.8	53.5	12.9	1100	73	89	86.3	93.8	1,757	3,059	..	10.0
North America	**..**	**..**	**76.2**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**18.1**
Canada	0.79	46.6	74.7	..	6	98	99	..	..	22,964	36,299	54	23.6
United States	0.77	29.0	76.4	..	17	99	98	..	..	27,338	43,797	55	14.0
C. America & Caribbean	**..**	**..**	**64.4**	**..**	**190 i**	**82 i**	**..**	**84.8**	**88.3**	**..**	**..**	**..**	**21.4**
Belize	0.46	..	46.7	..	140	83	..	77.1	76.7	2,376	9,799	52	9.3
Costa Rica	0.66	..	75.0	..	43	98	103	95.9	95.7	4,698	12,197	28	35.1
Cuba	..	..	73.3	..	33	100	99	96.8	97.0	..	..	..	36.0
Dominican Rep	0.53	32.8	64.7	12.5	150	98	125	84.4	84.3	3,491	9,694	49	15.4
El Salvador	0.45	..	59.7	8.2	150	90	100	77.1	82.4	2,602	7,269	46	10.7
Guatemala	..	..	38.2	23.1	240	41	93	62.5	77.3	2,007	6,092	..	8.2
Haiti	..	..	27.4	39.8	680	24	..	50.0	53.8	1,170	2,089	..	9.1
Honduras	0.36	..	61.8	7.0	110	56	..	80.2	79.8	1,402	3,792	36	5.5
Jamaica	..	..	65.9	..	87	95	104	91.4	83.8	3,169	4,783	..	13.6
Mexico	0.56	16.3	68.4	..	83	86	107	88.7	92.6	4,915	12,967	40	21.2
Nicaragua	..	29.4	68.6	14.7	230	67	117	76.6	76.8	1,520	3,436	..	20.7
Panama	0.49	22.3	58.2 j	..	160	90	107	91.7	92.9	3,958	7,847	49	9.9
Trinidad and Tobago	0.64	..	38.2	..	160	96	109	97.9	99.0	5,916	13,095	51	25.4
South America	**..**	**..**	**74.4**	**8.1**	**190 i**	**82 i**	**..**	**88.8**	**90.0**	**..**	**..**	**..**	**14.7**
Argentina	0.65	22.4	..	..	82	98	106	97.0	97.0	5,662	15,431	53	31.3
Bolivia	0.52	18.1	53.4	26.1	420	69	97	80.7	93.1	1,559	3,463	40	17.8
Brazil	..	23.1	76.7	7.3	260	88	111	86.5	86.2	4,594	10,879	62	9.1
Chile	0.46	..	..	..	31	100	..	95.6	95.8	5,442	14,256	52	10.1
Colombia	0.50	24.4	76.9	6.2	130	86	111	92.2	92.1	4,429	8,420	50	10.8
Ecuador	0.49	..	65.8	10.0	130	69	100	89.7	92.3	1,656	5,491	44	16.0
Guyana	..	..	37.3	..	170	86	..	..	..	2,439	6,217	..	20.0
Paraguay	0.42	..	57.4	11.3	170	71	102	90.2	93.1	2,175	6,641	54	9.6
Peru	0.52	..	68.9	10.2	410	59	93	80.3	91.3	2,105	7,875	44	18.3
Suriname	..	..	42.1	..	110	85	139	..	..	..	..	51	17.6
Uruguay	0.51	29.2	..	..	27	100	114	98.1	97.3	5,367	10,304	52	11.5
Venezuela	0.44	..	..	..	96	94	116	92.7	93.5	3,125	7,550	61	9.7
Oceania	**..**	**..**	**64.1**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**12.4**
Australia	0.81	..	76.1 j	..	8	100	99	..	..	23,643	33,259	55	26.5
Fiji	0.34	..	..	..	75	100	106	91.4 j	94.5 j	2,838	7,855	9	5.9
New Zealand	0.77	..	74.9	..	7	100	..	..	..	18,168	26,481	52	28.3
Papua New Guinea	..	..	25.9	..	300	53	78	..	..	1,586	2,748	..	0.9
Solomon Islands	..	..	..	..	130	85	..	..	..	1,239	1,786	..	0.0
Developed	**..**	**..**	**68.7**	**..**	**..**	**..**	**..**	**98.6 k**	**99.1 k**	**..**	**..**	**..**	**18.5**
Developing	**..**	**..**	**59.4**	**..**	**440**	**55 i**	**..**	**69.4 k**	**83.4 k**	**..**	**..**	**..**	**13.6**

a. Data are for the most recent year available within the range of dates shown. **b**. Excludes agricultural wages. **c**. Including some cases of sterilization for non-contraceptive reasons. **d**. Data pertain to all sexually active women. **e**. Data pertain to women born in 1945, 1950, 1955, 1960, 1965, or 1968. **f**. Data pertain to former Yugoslavia, excluding the province of Kosovo and Metohija. **g.** Data exclude Northern Ireland**. h**. Data pertain only to the Jewish population. **i**. Regional totals are calculated by UNICEF and combine South America, Central America, and the Caribbean. **j**. Data refer to years or periods other than those specified in the column heading. **k.** Regional totals were calculated by UNESCO.

Gender and Development: Technical Notes

DEFINITIONS AND METHODOLOGY

Gender Empowerment Measure is a composite index that quantifies women's opportunities. The measure is calculated from three components. *Political participation and decision-making power* is measured by the proportional share, by gender, of parliamentary seats. *Economic participation and decision-making power* is measured by (a) the proportional share, by gender, of positions as legislators, senior officials, and managers; and (b) the proportional share, by gender, of professional and technical positions. *Power over economic resources* is measured by the estimated earned income for women and men, in US dollars adjusted for purchasing power parity (PPP). Variables in these three areas are weighted equally and indexed by their relationship to the ideal scenario (i.e., 50-50 distribution between genders is considered the ideal for representation in parliaments). The gender empowerment measure for a particular country is presented on a scale of 0-1, with higher numbers representing greater levels of equality.

Woman-Headed Households is the percent of occupied housing units whose members acknowledge a woman as the head of the household. In many countries, female-headed households suffer from a lower and more precarious tenure status than male-headed households, which leads to greater insecurity for themselves and their dependents. Data were collected primarily through census data and household surveys. In other cases, data may come from specific housing studies carried out by different UN groups. Public housing boards, housing financial institutions, real-estate agencies, and nongovernmental organizations have also supplied data when census or household data were unavailable.

Contraceptive Prevalence Rate is the percentage of women of reproductive age (15-49 years) in a marital or consensual union who are currently using contraception.

Women with Unmet Family Planning Needs is the percentage of fertile women who are not using contraception and report that they do not want children or want their next child with a delay of two years or more. Contraception includes both modern (sterilization, the pill, condoms, vaginal barrier methods, etc.) and traditional (periodic or prolonged abstinence, withdrawal, etc.) methods. Data were compiled primarily from surveys based on nationally representative samples of women aged 15-49. The surveys used for data compilation include Demographic and Health Surveys (DHS), UNICEF's Multiple Indicator Cluster Surveys (MICS), and Family Health Surveys (FHS).

Maternal Mortality Ratio is the annual number of deaths of women from pregnancy-related causes, either when pregnant or within 42 days of birth or termination of pregnancy. Measured per 100,000 live births, it quantifies the risk of death once a woman has become pregnant. Women in countries with both high fertility and high maternal mortality run the highest lifetime risks of death as a result of childbearing. (Reduction of maternal mortality is one the United Nations' MILLENNIUM Development Goals.) Estimates of maternal mortality were obtained by UNICEF from a variety of sources, including government reporting, household surveys, and DHS.

Skilled Attendants At Delivery is the percentage of births attended by physicians, nurses, midwives, or primary health care workers trained in midwifery skills. Women are most in need of skilled care during delivery and the immediate postpartum period, when roughly three-quarters of all maternal deaths occur. Multiple Indicator Cluster Surveys (MICS), developed by UNICEF with partners in 1997, were used by governments in 66 countries to collect the data presented here. Demographic and Health Surveys (DHS) provided relevant data to UNICEF for more than 35 additional countries. For the majority of remaining countries, national governments provided non-MICS data. Where no reliable official figures exist, estimates have been made by UNICEF. Where possible, only comprehensive or representative national data have been used.

Ratio of Women to Men Enrolled in Secondary Education represents the ratio of female to male gross enrollment in secondary schooling. A ratio of 100 indicates equality in representation. Lower numbers represent a higher percentage of male than female enrollment. The data are for the 2001-2002 school year. The ratio is calculated by WRI by dividing the gross enrollment of males by that of females for secondary education. The result is multiplied by 100 to produce the final ratio. UNICEF calculates gross enrollment data by dividing the number of pupils enrolled in a given level of education, regardless of age, by population in the relevant official age group, and then multiplying by 100 to produce a ratio.

Literacy Rate, shown here for both men and women, is generally defined as the percentage of the population aged 15 years and over who can both read and write, with understanding, a short, simple statement on their everyday life. This indicator can be used to measure the achievement of literacy programs and the effectiveness of primary education. According to UNESCO, "literacy represents a potential for further intellectual growth and contribution to economic-socio-cultural development of society." Adult literacy correlates with GNP per capita, life expectancy, fertility rates, infant mortality, and urbanization. Most literacy data are collected during national population censuses. Typically, censuses are held only once in a decade, so UNESCO supplements these data with household surveys, labor force surveys, employment surveys, industry surveys, and agricultural surveys when they are available.

Annual Earned Income, shown here for both men and women, is an estimate of the annual earning power available to workers in the nonagricultural sector. Data are reported in 2002 international dollars adjusted for purchasing power parity (PPP). Direct measures of income disaggregated by gender are unavailable for most countries. In order to calculate this indicator, UNDP uses a ratio of female nonagricultural wage to the male non-agricultural wage, male and female shares of the economically active population, total male and female population, and GDP per capita (PPP). These data are obtained from the World Bank's World Development Indicators and the United Nations Population Division.

Female Professional and Technical Workers is women's share of total positions defined according to the International Standard Classification of Occupations (ISCO-88) Major Group 2. This classification includes physical, mathematical and engineering science professionals, life science and health professionals, teaching professionals and other (business, social science, legal, religious) professionals. Values were calculated by UNDP on the basis of occupational data from the International Labor Organization (ILO) LABORSTA database. The ILO receives these data from country labor surveys.

Parliamentary Seats Held by Women is calculated based on the total number of seats in parliament and the number of seats occupied by women. When there is both an upper house and a lower house of parliament, the total number of women in both houses is divided by the total number of seats in both houses. Data are current as of April 1, 2004. The Inter-Parliamentary Union compiles these data based on information provided by national parliaments.

FREQUENCY OF UPDATE BY DATA PROVIDERS

The Gender Empowerment Index and labor data are published annually by UNDP in the *Human Development Report.* Literacy and education data are compiled annually by UNESCO. UNICEF publishes maternal health indicators in its annual *State of the World's Children.* Household data are released by UN-Habitat in its Human Settlement Statistics database approximately every five years. Data on world contraceptive use are updated every two years. The Inter-Parliamentary Union updates its Women in Parliament data set monthly to reflect elections.

DATA RELIABILITY AND CAUTIONARY NOTES

Gender Empowerment Measure: This index is calculated for the purposes of comparing across countries, so data must be obtained from international datasets, limiting the variables that can be used for the calculation. Without these constraints, other variables that are more detailed could have been used to measure more accurately the political, professional, and economic empowerment of women.

Women-Headed Households: Data reliability varies on a country-by-country basis. Data for women-headed households are limited and were collected over a 15-year period. The reader should use caution when comparing across countries.

Contraceptive Prevalence Rate and Women with Unmet Family Planning Needs: The data refer only to women ages 15-49 who are married or in a consensual union. Information on single men or women is not as widely available, although it constitutes a significant proportion of contraceptive use (or lack thereof).

Maternal Mortality Ratio: The purpose of these estimates is to draw attention to the existence and likely dimensions of the problem of maternal mortality. The data are not intended to serve as precise estimates. The margins of uncertainty associated with these values are large and the estimates cannot be used to monitor trends.

Skilled Attendants at Delivery: The data included for this variable cover a wide range of years and sources. Some data refer to periods other than 1995-2002. Comparisons between countries should be made with caution due to the resulting potential for variability in data quality and timing for individual countries.

Ratio of Women to Men Enrolled in Secondary Education: While UNESCO keeps the most complete global data set on enrollment levels, problems do remain. The availability and quality of national school enrollment statistics vary widely, particularly for developing countries. Even though UNESCO has applied the same methodology to analyze all of the country data, definitions of "schooling" and "enrollment" are not strictly comparable among countries.

Literacy Rate: The availability and quality of national statistics on literacy varies widely, particularly for developing countries. When census and survey data are not available for a particular country, estimates need to be made based on neighboring countries. Even when census and survey data are available, they are typically collected only once every decade. In addition, many industrialized countries have stopped collecting literacy data in recent years, based on the assumption, sometimes incorrect, that universal primary education means universal literacy. Even though UNESCO has applied the same methodology to analyze all of the country data, actual definitions of adult literacy are not strictly comparable among countries. Some countries assume that persons with no schooling are illiterate, or change definitions between censuses. In addition, UNESCO's definition of literacy does not include people who, though familiar with the basics of reading and writing, do not have the skills to function at a reasonable level in their own society. Practices for identifying literates and illiterates during actual census enumeration may also vary, and errors in literacy self-declaration can affect data reliability. Therefore, users should exercise caution when making cross-country comparisons.

Annual Earned Income: Since direct measures of income disaggregated by gender are unavailable for most countries, this indicator is calculated by UNDP from wage figures including both men and women, estimates of the size of the labor force by gender, and ratios of male-to-female income.

Female Professional and Technical Workers: The collection and reporting of labor statistics is governed by a well-defined set of standards developed through a number of international agreements. The ILO applies rigorous quality standards to the data it receives. However, as is the case with all large datasets that rely on government reporting, there are likely to be some irregularities.

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Income and Poverty

Sources: World Bank, United Nations Development Programme

	GDP Per Capita PPP (int'l $) 2002	National Poverty Rates (percent) Survey Year	Total	Urban	Rural	International Poverty Rates (international dollars) Survey Year	Percent of Population Living on Less Than {a} $1/day	$2/day	Poverty Gap {b} (percent) $1/day	$2/day	Income Inequality Survey Year	Gini Index {c} (0 = perfect equality)	Unemployment Rate 2000-2002 {d}	Human Development Index {e} (1 = most developed) 2002	Human Poverty Index (100 = highest poverty) 2002
World	**7,880**	..	..	..	..	..	..	..	..	..	..	..	..	**0.73**	..
Asia (excl. Middle East)	**4,684**	..	..	..	..	..	..	..	..	..	..	..	**4.6**	..	..
Armenia	3,117	1998-99	53.7	60.4	44.8	1998 f	12.8	49.0	3.3	17.3	1998 f	37.9	..	0.75	..
Azerbaijan	3,207	2001	49.6	..	..	2001 f	3.7	9.1	< 1.0	3.5	2001 f	36.5	1.3	0.75	..
Bangladesh	1,695	2000	49.8	36.6	53.0	2000 f	36.0	82.8	8.1	36.3	2000 f	31.8	3.3	0.51	42.2
Bhutan	..	..	..	..	..	..	..	..	..	..	..	..	..	0.54	..
Cambodia	2,001	1997	36.1	21.1	40.1	1997 f	34.1	77.7	9.7	34.5	1997 f	40.4	1.8	0.57	42.6
China	4,577	1998	4.6	< 2.0	4.6	2001 f	16.6	46.7	3.9	18.4	2001 f	44.7	3.1	0.75	13.2
Georgia	2,307	1997	11.1	12.1	9.9	2001 f	2.7	15.7	0.9	4.6	2001 f	36.9	11.0	0.74	..
India	2,681	1999-00	28.6	24.7	30.2	1999-00 f	34.7	79.9	8.2	35.3	1999-00 f	32.5	..	0.60	31.4
Indonesia	3,228	1999	27.1	..	..	2002 f	7.5	52.4	0.9	15.7	2002 f	34.3	6.1	0.69	17.8
Japan	26,937	..	..	..	..	..	..	..	..	..	1993 g	24.9	5.4	0.94	11.1
Kazakhstan	5,814	1996	34.6	30.0	39.0	2001 f	< 2.0	8.5	< 0.5	1.4	2001 f	31.3	..	0.77	..
Korea, Dem People's Rep	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Korea, Rep	17,161	..	..	..	..	1998 g	< 2.0	< 2.0	< 0.5	< 0.5	1998 f	31.6	3.1	0.89	..
Kyrgyzstan	1,622	1999	64.1	49.0	69.7	2001 f	< 2.0	27.2	< 0.5	5.9	2001 f	29.0	8.6	0.70	..
Lao People's Dem Rep	1,765	1997-98	38.6	26.9	41.0	1997-98 f	26.3	73.2	6.3	29.6	1997 f	37.0	..	0.53	40.3
Malaysia	9,130	1989	15.5	..	..	1997 g	< 2.0	9.3	< 0.5	2.0	1997 g	49.2	3.9	0.79	..
Mongolia	1,709	1995	36.3	38.5	33.1	1995 f	13.9	50.0	3.1	17.5	1998 f	44.0	..	0.67	19.1
Myanmar	..	..	..	..	..	..	..	..	..	..	..	..	..	0.55	25.4
Nepal	1,382	1995-96	42.0	23.0	44.0	1995 f	37.7	82.5	9.7	37.5	1995-96 f	36.7	..	0.50	41.2
Pakistan	1,941	1998-99	32.6	24.2	35.9	1998 f	13.4	65.6	2.4	22.0	1998-99 f	33.0	7.8	0.50	41.9
Philippines	4,171	1997	36.8	21.5	50.7	2000 f	14.6	46.4	2.7	17.2	2000 f	46.1	9.8	0.75	15.0
Singapore	24,006	..	..	..	..	..	..	..	..	..	1998 g	42.5	3.4	0.90	6.3
Sri Lanka	3,560	1995-96	25.0	15.0	27.0	1995-96 f	6.6	45.4	1.0	13.5	1995 f	34.4	8.2	0.74	18.2
Tajikistan	981	..	..	..	..	1998 f	10.3	50.8	2.6	16.3	1998 f	34.7	..	0.67	..
Thailand	7,009	1992	13.1	10.2	15.5	2000 f	< 2.0	32.5	< 0.5	9.0	2000 f	43.2	1.8	0.77	13.1
Turkmenistan	5,049	..	..	..	..	1998 f	12.1	44.0	2.6	15.4	1998 f	40.8	..	0.75	..
Uzbekistan	1,661	2000	27.5	22.5	30.5	2000 f	21.8	77.5	5.4	28.9	2000 f	26.8	..	0.71	..
Viet Nam	2,305	1993	50.9	25.9	57.2	1998 f	17.7	63.7	3.3	22.9	1998 f	36.1	..	0.69	20.0
Europe	**18,097**	..	..	..	..	..	..	..	..	..	..	..	**7.8**	..	..
Albania	4,270	2002	25.4	..	29.6	2002 f	< 2.0	11.8	< 0.5	2.0	2002 f	28.2	22.7	0.78	..
Austria	29,220	..	..	..	..	..	..	..	..	..	1997 g	30.0	3.6	0.93	..
Belarus	5,518	2000	41.9	..	..	2000 f	< 2.0	< 2.0	< 0.5	0.1	2000 f	30.4	2.3	0.79	..
Belgium	27,569	..	..	..	..	..	..	..	..	..	1996 g	25.0	6.9	0.94	12.4 h
Bosnia and Herzegovina	5,777	2001-02	19.5	13.8	19.9	..	..	..	..	..	2001 f	26.2	..	0.78	..
Bulgaria	7,253	2001	12.8	..	..	2001 f	4.7	16.2	1.4	5.7	2001 g	31.9	19.4	0.80	..
Croatia	10,286	..	..	..	..	2000 f	< 2.0	< 2.0	< 0.5	< 0.5	2001 f	29.0	15.2	0.83	..
Czech Rep	15,794	..	..	..	..	1996 g	< 2.0	< 2.0	< 0.5	< 0.5	1996 g	25.4	7.3	0.87	..
Denmark	30,943	..	..	..	..	..	..	..	..	..	1997 g	24.7	4.3	0.93	9.1 h
Estonia	12,255	1995	8.9	6.8	14.7	1998 f	< 2.0	5.2	< 0.5	0.8	2000 g	37.2	12.6	0.85	..
Finland	26,186	..	..	..	..	..	..	..	..	..	2000 g	26.9	9.0	0.94	8.4 h
France	26,921	..	..	..	..	..	..	..	..	..	1995 g	32.7	8.9	0.93	10.8 h
Germany	27,102	..	..	..	..	..	..	..	..	..	2000 g	28.3	8.6	0.93	10.3 h
Greece	18,718	..	..	..	..	..	..	..	..	..	1998 g	35.4	9.6	0.90	..
Hungary	13,869	1997	17.3	..	..	1998 g	< 2.0	7.3	< 0.5	1.7	1999 f	24.4	5.8	0.85	..
Iceland	29,749	..	..	..	..	..	..	..	..	..	..	..	3.2	0.94	..
Ireland	36,360	..	..	..	..	..	..	..	..	..	1996 g	35.9	4.2	0.94	15.3 h
Italy	26,429	..	..	..	..	..	..	..	..	..	2000 g	36.0	9.0	0.92	11.6 h
Latvia	9,202	..	..	..	..	1998 f	< 2.0	8.3	< 0.5	2.0	1998 g	32.4	12.8	0.82	..
Lithuania	10,313	..	..	..	..	2000 f	< 2.0	13.7	< 0.5	4.2	2000 f	31.9	13.8	0.84	..
Macedonia, FYR	6,483	..	..	..	..	1998 f	< 2.0	4.0	< 0.5	0.6	1998 f	28.2	31.9	0.79	..
Moldova, Rep	1,478	1997	23.3	..	26.7	2001 f	22.0	63.7	5.8	25.1	2001 f	36.2	7.3	0.68	..
Netherlands	29,105	..	..	..	..	..	..	..	..	..	1994 g	32.6	3.1	0.94	8.2 h
Norway	36,596	..	..	..	..	..	..	..	..	..	2000 g	25.8	3.9	0.96	7.1 h
Poland	10,934	1993	23.8	..	..	1999 g	< 2.0	< 2.0	< 0.5	< 0.5	1999 f	31.6	19.9	0.85	..
Portugal	18,282	..	..	..	..	1994 g	< 2.0	< 0.5	< 0.5	< 0.5	1997 g	38.5	5.1	0.90	..
Romania	6,556	1994	21.5	20.4	27.9	2000 f	2.1	20.5	0.6	5.2	2000 f	30.3	6.6	0.78	..
Russian Federation	8,269	1994	30.9	..	..	2000 f	6.1	23.8	1.2	8.0	2000 f	45.6	8.9	0.80	..
Serbia and Montenegro	..	..	..	..	..	..	..	..	..	..	..	..	22.3	..	..
Slovakia	12,892	..	..	..	..	1996 g	< 2.0	2.4	< 0.5	0.7	1996 g	25.8	18.6	0.84	..
Slovenia	18,615	..	..	..	..	1998 f	< 2.0	< 2.0	< 0.5	< 0.5	1998-99 g	28.4	5.9	0.90	..
Spain	21,457	..	..	..	..	..	..	..	..	..	1990 g	32.5	11.4	0.92	11.0 h
Sweden	26,048	..	..	..	..	..	..	..	..	..	2000 g	25.0	5.2	0.95	6.5 h
Switzerland	30,008	..	..	..	..	..	..	..	..	..	1992 g	33.1	2.9	0.94	..
Ukraine	4,887	1995	31.7	..	..	1999 g	2.9	45.7	0.6	16.3	1999 f	29.0	11.1	0.78	..
United Kingdom	26,155	..	..	..	..	..	..	..	..	..	1999 g	36.0	5.1	0.94	14.8 h
Middle East & North Africa	**5,994**	..	..	..	..	..	**2.4**	**29.9**	..	..	..	..	..	..	..
Afghanistan	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Algeria	5,783	1998	12.2	7.3	16.6	1995 f	< 2.0	15.1	< 0.5	3.8	1995 f	35.3	29.8	0.70	21.9
Egypt	3,813	1999-00	16.7	..	..	2000 f	3.1	43.9	0.5	11.3	1999 f	34.4	9.0	0.65	30.9
Iran, Islamic Rep	6,701	..	..	..	..	1998 f	< 2.0	7.3	< 0.5	1.5	1998 f	43.0	..	0.73	16.4
Iraq	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Israel	19,532	..	..	..	..	..	..	..	..	..	1997 g	35.5	10.3	0.91	..
Jordan	4,223	1997	11.7	..	..	1997 f	< 2.0	7.4	< 0.5	1.4	1997 f	36.4	13.2	0.75	7.2
Kuwait	16,320	..	..	..	..	..	..	..	..	..	..	..	0.8	0.84	..
Lebanon	4,755	..	..	..	..	..	..	..	..	..	..	..	..	0.76	9.5
Libyan Arab Jamahiriya	..	..	..	..	..	..	..	..	..	..	..	..	..	0.79	15.3
Morocco	3,810	1998-99	19.0	12.0	27.2	1999 f	< 2.0	14.3	< 0.5	3.1	1998-99 f	39.5	..	0.62	34.5
Oman	13,337	..	..	..	..	..	..	..	..	..	..	..	..	0.77	31.5
Saudi Arabia	12,845	..	..	..	..	..	..	..	..	..	..	..	..	0.77	15.8
Syrian Arab Rep	3,527	..	..	..	..	..	..	..	..	..	..	..	11.2	0.71	13.7
Tunisia	6,763	1995	7.6	3.6	13.9	2000 f	< 2.0	6.6	< 0.5	1.3	2000 f	39.8	..	0.75	19.2
Turkey	6,365	..	..	..	..	2000 f	< 2.0	10.3	< 0.5	2.5	2000 f	40.0	10.6	0.75	12.0
United Arab Emirates	..	..	..	..	..	..	..	..	..	..	..	..	2.3	0.82	..
Yemen	870	1998	41.8	30.8	45.0	1998 f	15.7	45.2	4.5	15.0	1998 f	33.4	..	0.48	40.3

For more information, please visit http://earthtrends.wri.org/datatables/economics

	GDP Per Capita PPP (int'l $) 2002	National Poverty Rates (percent) Survey Year	Total	Urban	Rural	International Poverty Rates (international dollars) Survey Year	Percent of Population Living on Less Than {a} $1/day	$2/day	Poverty Gap {b} (percent) $1/day	$2/day	Income Inequality Survey Year	Gini Index {c} (0 = perfect equality)	Unemployment Rate 2000-2002 {d}	Human Development Index {e} (1 = most developed) 2002	Human Poverty Index (100 = highest poverty) 2002
Sub-Saharan Africa	**1,779**	..	..	..	..	..	**46.5**	**78.0**	..	..	..	..	..	..	..
Angola	2,208	..	..	..	..	..	..	..	..	..	..	..	..	0.38	..
Benin	1,073	1995	33.0	..	..	..	..	..	..	..	..	..	..	0.42	45.7
Botswana	7,928	..	..	..	..	1993 f	23.5	50.1	7.7	22.8	1993 f	63.0	15.8	0.59	43.5
Burkina Faso	1,112	1998	45.3	16.5	51.0	1998 f	44.9	81.0	14.4	40.6	1998 f	48.2	..	0.30	65.5
Burundi	635	1990	..	43.0	36.0	1998 f	58.4	89.2	24.9	51.3	1998 f	33.3	..	0.34	45.8
Cameroon	2,037	2001	40.2	22.1	49.9	2001 f	17.1	50.6	4.1	19.3	2001 f	44.6	..	0.50	36.9
Central African Rep	1,171	..	..	..	..	1993 f	66.6	84.0	38.1	58.4	1993 f	61.3	..	0.36	47.7
Chad	1,029	1995-96	64.0	63.0	67.0	..	..	..	..	..	..	..	..	0.38	49.6
Congo	979	..	..	..	..	..	..	..	..	..	..	..	..	0.49	31.9
Congo, Dem Rep	621	..	..	..	..	..	..	..	..	..	..	..	..	0.37	42.9
Côte d'Ivoire	1,520	..	..	..	..	1998 f	15.5	50.4	3.8	18.9	1998 f	45.2	..	0.40	45.0
Equatorial Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..	0.70	32.7
Eritrea	909	1993-94	53.0	..	..	..	..	..	..	..	..	..	..	0.44	41.8
Ethiopia	745	1999-00	44.2	37.0	45.0	1999-00 f	26.3	80.7	5.7	31.8	2000 f	30.0	..	0.36	55.5
Gabon	6,595	..	..	..	..	..	..	..	..	..	..	..	..	0.65	..
Gambia	1,571	1998	..	48.0	61.0	1998 f	59.3	82.9	28.8	51.1	1998 f	38.0	..	0.45	45.8
Ghana	2,141	1998	39.5	18.6	49.9	1999 f	44.8	78.5	17.3	40.8	1999 f	30.0	..	0.57	26.0
Guinea	2,098	1994	40.0	..	..	..	..	..	..	..	1994 f	40.3	..	0.43	..
Guinea-Bissau	705	..	..	..	..	..	..	..	..	..	1993 f	47.0	..	0.35	48.0
Kenya	1,018	1997	52.0	49.0	53.0	1997 f	23.0	58.6	6.0	24.1	1997 f	44.5	..	0.49	37.5
Lesotho	2,423	..	..	..	..	1995 f	36.4	56.1	19.0	33.1	1995 f	63.2	..	0.49	47.9
Liberia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Madagascar	744	1999	71.3	52.1	76.7	1999 f	49.1	83.3	18.3	44.0	2001 f	47.5	..	0.47	35.9
Malawi	581	1997-98	65.3	54.9	66.5	1997-98 f	41.7	76.1	14.8	38.3	1997 f	50.3	..	0.39	46.8
Mali	976	1998	63.8	30.1	75.9	1994 f	72.8	90.6	37.4	60.5	1994 f	50.5	..	0.33	58.9
Mauritania	1,683	2000	46.3	25.4	61.2	2000 f	25.9	63.1	7.6	26.8	2000 f	39.0	..	0.47	48.3
Mozambique	1,061	1996-97	69.4	62.0	71.3	1996 f	37.9	78.4	12.0	36.8	1996-97 f	39.6	..	0.35	49.8
Namibia	6,128	..	..	..	..	1993 g	34.9	55.8	14.0	30.4	1993 g	70.7	33.8	0.61	37.7
Niger	806	1989-93	63.0	52.0	66.0	1995 f	61.4	85.3	33.9	54.8	1995 f	50.5	..	0.29	61.4
Nigeria	919	1992-93	34.1	30.4	36.4	1997 f	70.2	90.8	34.9	59.0	1996-97 f	50.6	..	0.47	35.1
Rwanda	1,224	1993	51.2	..	..	1983-85 f	35.7	84.6	7.7	36.7	1983-85 f	28.9	..	0.43	44.7
Senegal	1,594	1992	33.4	..	40.4	1995 f	26.3	67.8	7.0	28.2	1995 f	41.3	..	0.44	44.1
Sierra Leone	523	1989	68.0	53.0	76.0	1989 f	57.0	74.5	39.5	51.8	1989 f	62.9	..	0.27	..
Somalia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	10,152	..	..	..	..	1995 f	7.1	23.8	1.1	8.6	1995 f	59.3	29.5	0.67	31.7
Sudan	1,936	..	..	..	..	..	..	..	..	..	..	..	..	0.51	31.6
Tanzania, United Rep	579	2000-01	35.7	..	38.7	1993 f	19.9	59.7	4.8	23.0	1993 f	38.2	..	0.41	36.0
Togo	1,486	1987-89	32.3	..	..	..	..	..	..	..	..	..	..	0.50	38.0
Uganda	1,413	1997	44.0	..	..	..	..	..	..	..	1999 f	43.0	..	0.49	36.4
Zambia	839	1998	72.9	56.0	83.1	1998 f	63.7	87.4	32.7	55.4	1998 f	52.6	..	0.39	50.4
Zimbabwe	..	1995-96	34.9	7.9	48.0	1990-91 f	36.0	64.2	9.6	29.4	1995 f	56.8	..	0.49	52.0
North America	**35,138**	..	..	..	..	..	..	..	..	..	..	..	**5.9**	..	..
Canada	29,484	..	..	..	..	..	..	..	..	..	1998 g	33.1	7.7	0.94	12.2 h
United States	35,746	..	..	..	..	..	..	..	..	..	2000 g	40.8	5.8	0.94	15.8 h
C. America & Caribbean	**7,347**	..	..	..	..	..	..	..	..	..	..	..	**3.0**	..	..
Belize	6,538	..	..	..	..	..	..	..	..	..	..	..	..	0.74	16.7
Costa Rica	8,817	1992	22.0	19.2	25.5	2000 g	2.0	9.5	0.7	3.0	2000 g	46.5	6.4	0.83	4.4
Cuba	..	..	..	..	..	..	..	..	..	..	..	..	3.3	0.81	5.0
Dominican Rep	6,644	1998	28.6	20.5	42.1	1998 g	< 2.0	< 2.0	< 0.5	< 0.5	1998 g	47.4	15.6	0.74	13.7
El Salvador	4,887	1992	48.3	43.1	55.7	2000 g	31.1	58.0	14.1	29.7	2000 g	53.2	6.2	0.72	17.0
Guatemala	4,058	2000	56.2	27.1	74.5	2000 g	16.0	37.4	4.6	16.0	2000 g	48.3	3.1	0.65	22.5
Haiti	1,623	1995	..	..	66.0	..	..	..	..	..	..	..	..	0.46	41.1
Honduras	2,597	1993	53.0	57.0	51.0	1998 g	23.8	44.4	11.6	23.1	1999 g	55.0	3.8	0.67	16.6
Jamaica	3,982	2000	18.7	..	25.1	2000 f	< 2.0	13.3	< 0.5	2.7	2000 f	37.9	..	0.76	9.2
Mexico	8,972	1988	10.1	..	..	2000 g	9.9	26.3	3.7	10.9	2000 g	54.6	2.4	0.80	9.1
Nicaragua	2,486	1998	47.9	30.5	68.5	2001 f	45.1	79.9	16.7	41.2	2001 g	55.1	11.2	0.67	18.3
Panama	6,166	1997	37.3	15.3	64.9	2000 g	7.2	17.6	2.3	7.4	2000 g	56.4	13.2	0.79	7.7
Trinidad and Tobago	9,446	1992	21.0	24.0	20.0	1992 g	12.4	39.0	3.5	14.6	1992 g	40.3	..	0.80	7.7
South America	**7,333**	..	..	..	..	..	..	..	..	..	..	..	**11.5**	..	..
Argentina	11,083	1998	..	29.9	..	2001 g	3.3	14.3	0.5	4.7	2001 g	52.2	17.8	0.85	..
Bolivia	2,459	1999	62.7	..	81.7	1999 f	14.4	34.3	5.4	14.9	1999 f	44.7	5.2	0.68	14.4
Brazil	7,752	1990	17.4	13.1	32.6	2001 g	8.2	22.4	2.1	8.8	2001 g	58.5	9.4	0.78	11.8
Chile	9,796	1998	17.0	..	..	2000 g	< 2.0	9.6	< 0.5	2.5	2000 g	57.1	7.8	0.84	4.1
Colombia	6,493	1999	64.0	55.0	79.0	1999 g	8.2	22.6	2.2	8.8	1999 g	57.6	17.9	0.77	8.1
Ecuador	3,583	1994	35.0	25.0	47.0	1998 g	17.7	40.8	7.1	17.7	1998 f	43.7	11.0	0.74	12.0
Guyana	4,224	1998	35.0	..	..	1998 g	< 2.0	6.1	< 0.5	1.7	1999 f	43.2	..	0.72	12.9
Paraguay	4,657	1991	21.8	19.7	28.5	1999 g	14.9	30.3	6.8	14.7	1999 g	56.8	..	0.75	10.6
Peru	5,012	1997	49.0	40.4	64.7	2000 g	18.1	37.7	9.1	18.5	2000 g	49.8	8.7	0.75	13.2
Suriname	..	..	..	..	..	..	..	..	..	..	..	..	..	0.78	..
Uruguay	7,767	..	..	..	..	2000 g	< 2.0	3.9	< 0.5	0.8	2000 g	44.6	17.2	0.83	3.6
Venezuela	5,368	1989	31.3	..	..	1998 g	15.0	32.0	6.9	15.2	1998 g	49.1	12.8	0.78	8.5
Oceania	**21,348**	..	..	..	..	..	..	..	..	..	..	..	**5.9**	..	..
Australia	28,262	..	..	..	..	..	..	..	..	..	1994 g	35.2	6.0	0.95	12.9 h
Fiji	5,242	..	..	..	..	..	..	..	..	..	..	..	..	0.76	21.3
New Zealand	21,742	..	..	..	..	..	..	..	..	..	1997 g	36.2	5.2	0.93	..
Papua New Guinea	2,366	1996	37.5	16.1	41.3	..	..	..	..	..	1996 f	50.9	..	0.54	37.0
Solomon Islands	1,654	..	..	..	..	..	..	..	..	..	..	..	..	0.62	..
High Income {i}	**28,480**	..	..	..	..	..	..	..	..	..	..	..	**6.2**	**0.93**	..
Middle Income {i}	**5,800**												**4.9**	**0.76**	
Low Income {i}	**2,110**	..	..	..	..	..	..	..	..	..	..	..	..	**0.56**	..

a. Measures the percent of the population living below $1.08 a day and $2.15 a day at 1993 international prices. **b**. The Poverty Gap measures both the breadth and severity of poverty below thresholds of $1.08 a day and $2.15 a day at 1993 international prices. **c**. The Gini Index measures the equality of income distribution within the population (0 = perfect equality; 100 = perfect inequality). **d**. Data are for the most recent year in the listed range. **e**. According to the UNDP, the Human Development Index measures "average achievement in three basic dimensions of human development—a long and healthy life, knowledge, and a decent standard of living." **f.** Ranked by per capita consumption or expenditures. **g.** Ranked by per capita income. **h**. For OECD countries, a separate Human Poverty Index is used (see notes). **i**. Regional totals for high-, middle-, and low- income countries are calculated by the original data providers.

Income and Poverty: Technical Notes

DEFINITIONS AND METHODOLOGY

Gross Domestic Product (GDP) Per Capita is the total annual output of a country's economy divided by the population of the country for that year. GDP is the final market value of all goods and services produced in a country in a given year, equal to total consumer, investment, and government spending. Dollar figures for GDP are converted to international dollars using purchasing power parity (PPP) rates and are not adjusted for inflation. An international dollar buys roughly the same amount of goods and services in each country.

PPP rates account for the local prices of goods and services, allowing GDP estimates to be adjusted for cost of living and more accurately compared across countries. PPP rates are estimated through extrapolation and regression analysis using data from the International Comparison Programme (ICP). Computation of the PPP involves deriving implicit quantities from national accounts expenditure data and specially collected price data and then revaluing the implicit quantities in each country at a single set of average prices. GDP data for most developing countries are collected from national statistical organizations and central banks by visiting and resident World Bank missions. The data for high-income economies are from the OECD.

The **Survey Year** shows the years in which the surveys used to collect national poverty data, international poverty data, and income inequality data were administered.

National Poverty Rates show the percent of a country's population living below a nationally established poverty line. Estimates include total poverty rates and rates in both urban and rural areas. Values are calculated on a country-by-country basis according to the needs of the poor in a given country. Data for the National Poverty Rates are derived from surveys prepared for the World Bank and conducted between 1985 and 2002. Surveys asked households to report either their income, or, preferably, their consumption levels. These nationally representative household surveys were conducted by national statistical offices, private agencies under the supervision of government, or international agencies. The level of income that is used to determine national poverty lines varies among countries. As the cost of living is frequently higher in urban areas, the urban poverty line is higher than the rural poverty line in the same country.

International Poverty Rates data are based on nationally representative primary household surveys conducted by national statistical offices, or by private agencies under the supervision of government or international agencies and obtained from government statistical offices and World Bank country departments. Surveys were conducted between 1985 and 2002. PPP exchange rates, such as those from the Penn World Tables or the World Bank, are used because they take into account local prices and goods and services not traded internationally. In past years, the World Bank has calculated poverty estimates using PPPs from the Penn World Tables. Beginning in 2002 the World Bank used 1993 consumption PPP estimates produced at the Bank.

Population Living Below $1/day is the percentage of the population of a country living on less than $1.08 a day at 1993 international prices, equivalent to $1 in 1985 prices when adjusted for purchasing power parity. This amount is calculated as the consumption level necessary to basic life maintenance, and income below this level is referred to as "extreme poverty." **Population Living Below $2/day i**s the percentage of the population of a country living on less than $2.15 a day at 1993 international prices, equivalent to $2 in 1985 prices when adjusted for purchasing power parity.

Poverty Gap measures both the breadth and severity of poverty below thresholds (poverty lines) of $1.08/day and $2.15/day at 1993 international prices (equivalent to $1 and $2 respectively in 1985 prices, adjusted for purchasing power parity). Measured as a percentage, the indicator shows the "poverty deficit" of the country's population, where the poverty deficit is the per capita amount of resources that would be needed to bring all poor people to the poverty line through perfectly targeted cash transfers.

For example, a greater proportion of the population in Laos is living on less than $2/day than in El Salvador—73 percent vs. 58 percent. While Laos has a greater breadth (incidence) of poverty, the poverty in El Salvador is more severe, so the two countries both have poverty gaps that approach 30 percent. It would require the same investment in both countries relative to the total population in each to bring the entire population to the poverty line: 30% x $2/day = $0.60/day per capita.

In technical terms, the poverty gap is defined as the mean distance from the poverty line expressed as a percentage of the poverty line, counting the distance of the non-poor as zero. It is calculated by dividing the average income shortfall by the poverty line. For example, in a country with a poverty line of $1/day and three average daily incomes—$1.60, $0.90, and $0.50—the poverty gap would be 20 percent. (Three shortfalls—$0.00, $0.10, and $0.50—are averaged to yield a mean shortfall of $0.20, and the resulting poverty gap is $0.20/$1.00 = 20 percent)

The **Gini Index** measures income inequality by quantifying the deviation of income or consumption distribution from perfect equality. A score of zero implies perfect equality while a score of 100 implies perfect inequality. If every person in a country earned the same income, the Gini Index would be zero; if all income was earned by one person, the Gini Index would be 100. The Gini Index is calculated by compiling income (or expenditure) distribution data. For developing countries, the Gini Index is compiled from household survey data; for high-income countries the index is calculated directly from the Luxemburg Income Study database, using an estimation method consistent with that applied for developing countries. Once compiled, income or expenditure distribution data are plotted on a Lorenz curve, which illustrates the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini Index is calculated as the area between the Lorenz curve and a hypothetical (45-degree) line of absolute equality, expressed as a percentage of the maximum area under the line.

Unemployment Rate is defined as the percentage of the total labor force which is simultaneously without work, available to work, and actively seeking work. Definitions may vary among countries. The World Bank receives its data on national unemployment rates from the International Labour Organization's (ILO) Bureau of Statistics. The ILO compiles this information from a combination of sources, including labor force surveys, national estimates, social insurance statistics, and employment office statistics. The information presented here is the annual average of the monthly, quarterly, or biannual unemployment estimates.

The **Human Development Index** is comprised of three sub-indices that measure health and lifespan, education and knowledge, and standard of living. It attempts to describe achievement of development goals related to quality of life using data that can be compared across countries and time. It is aggregated from 4 indicators: *life expectancy, adult literacy, the gross school enrollment index,* and *GDP per capita. Life expectancy* is the average number of years that a newborn baby is expected to live using current age-specific mortality rates. *Adult literacy* is defined as the percentage of the population aged 15 years and over which can both read and write, with understanding, a short, simple statement on their everyday life. The *gross enrollment index* measures school enrollment, regardless of age, as a percentage of the official school-age population. *Gross Domestic Product (GDP)* per capita measures the total annual output of a country's economy per person. These four indicators are classified in three separate categories—life expectancy, education, and GDP—which are indexed independently and then weighted equally to calculate the final index. More information is available at http://hdr.undp.org.

The **Human Poverty Index** is a composite indicator that describes a population's deprivation from three development goals related to quality of life: health, literacy, and sufficient standard of living. The index is scaled from 0-100, with 100 representing the highest possible level of poverty.

Data presented here are from two separate surveys. Non-OECD countries are evaluated using the "HP-1" index based on four indicators: probability at birth of not surviving to age 40 (1/3 total index value), adult illiteracy rate (1/3 total index value), children underweight for age (1/6 total index value), and population without access to an improved water source (1/6 total index value). OECD countries are evaluated using the "HP-2" index with four different indicators: probability at birth of not surviving to age 60, adults lacking functional literacy skills, population below income poverty line, and long-term unemployment. The four OECD indicators are weighted equally in calculating the final index. For more information, see http://hdr.undp.org.

FREQUENCY OF UPDATE BY DATA PROVIDERS

Human Development Index and **Human Poverty Index** data are published annually by the United Nations Development Programme (UNDP) in the *Human Development Report*. **Poverty Rates** and **Income Inequality** data are updated irregularly as surveys are conducted in individual countries; new survey results are compiled and released annually in the World Bank's World Development Indicators. **GDP Per Capita** and **Unemployment Rates** are updated annually in World Development Indicators.

DATA RELIABILITY AND CAUTIONARY NOTES

GDP per capita (PPP): While the World Bank produces the most reliable global GDP estimates available, many obstacles inhibit data collection and compilation of accurate information. Informal economic activities sometimes pose a measurement problem, especially in developing countries, where much economic activity may go unrecorded. Obtaining a complete picture of the economy requires estimating household outputs produced for local sale and home use, barter exchanges, and illicit or deliberately unreported activity. Technical improvements and growth in the services sector are both particularly difficult to measure. Purchasing power parity (PPP) rates are based on price surveys that do not include a full selection of goods and services, and not all countries participate in the International Comparison Program. The World Bank is in the process of developing updated PPP estimates from new price surveys

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National Poverty Rates: National poverty lines are based on the calculation of the minimum income necessary to purchase a fixed amount of essential food and non-food items. Since these needs vary by nation, the poverty rates in this category are not comparable among countries, and, unlike international poverty rates, should not be used for comparison. However, national poverty rates can provide a more complete sense of poverty in a nation by describing poverty levels unique to each country and showing the differences between urban and rural areas.

International Poverty Rates: The quality of surveys underlying these estimates varies, and even similar surveys may not be strictly comparable. For example, surveys can be based on either household consumption or household income. Consumption data are considered to be more accurate and accord better with the standard of living, but when consumption data are not available, surveys based on household income are used. Household consumption can also differ widely, for example, based on the number of distinct categories of consumer goods they identify. Comparisons across countries at different levels of development pose a potential problem because of differences in the relative importance of consumption of nonmarket goods. The local market value of all in-kind consumption (including consumption from own production, particularly important in underdeveloped rural economies) should be included in the measure of total consumption expenditure. Similarly, the imputed profit from production of nonmarket goods should be included in income. This is not always done, though such omissions were a far bigger problem in surveys before the 1980s. Most survey data now include valuations for consumption or income from own production. Nonetheless, valuation methods vary. For example, some surveys use the price in the nearest market, while others use the average farm gate selling price.

Although the $1/day and $2/day poverty lines are commonly used, there exists an ongoing debate as to how well they capture poverty across nations. Values should be treated as rough statistical approximations of the number of people earning or consuming at a given level rather than a certain prognosis of how many people are poor. International poverty rates do not capture other elements of poverty, including lack of access to health care, education, safe water, or sanitation.

Income Inequality: Values are derived in part from household surveys that measure expenditure in different countries. Despite recent improvements in survey methodology and consistency in the type of data collection, income distribution indicators are still not strictly comparable across countries. Surveys can differ in the type of information requested—for example, whether income or consumption is used. The distribution of income is typically more unequal than the distribution of consumption. Even where two surveys request income information, definitions of income may vary. Consumption is usually a much better welfare indicator, particularly in developing countries. The households that are surveyed can differ in size and in the extent of income sharing among members, and individuals within a household may differ in age and consumption needs. Differences among countries in these respects may bias comparisons of distribution.

Unemployment Rate: Though the quality of the underlying data compiled by the ILO varies and differences in national reporting standards do exist, the final estimates should be considered generally accurate. The ILO has developed a rigorous accounting procedure, and balances government reports with employment office statistics as well as its own surveys and the knowledge of in-country experts.

Human Development Index and Human Poverty Index: These two indices have been constructed specifically to use data from respected sources and calculated in a fashion as to allow for time-series analysis and cross-country comparisons. Ultimately, there is some degree of subjectivity in the creation of any index of this sort, but the data underlying the index can be considered reliable. For a discussion of the collection of international statistics and their limitations, see the "Note on Statistics in the Human Development Report" in the Technical Notes and Definitions appendix of the Human Development Report 2004.

SOURCES

GDP, National Poverty Rates, International Poverty Rates, Income Inequality, and Unemployment Rates: World Bank. 2004. World Development Indicators Online. Washington, DC: The World Bank. Available at http://www.worldbank.org/data/onlinedbs/onlinedbases.htm.

Human Development and Human Poverty Indices: United Nations Development Programme. 2004. *Human Development Report 2004*. New York: United Nations. Available at http://hdr.undp.org/reports/global/2004/.

Economics and Financial Flows

Sources: World Bank, United Nations Conference on Trade and Development

	Gross Domestic Product (GDP), Constant 1995 $US						Financial Flows (million current $US)			Workers'	
	Total (million dollars) 2002	Average Annual Growth Rate (percent) 1992-2002	Per Capita (dollars) 2002	Distribution by Sector (percent) Agriculture 2002	Industry 2002	Services 2002	Cross-Border Mergers and Acquisitions (net inflows) (a) 2003	Foreign Direct Investment (net inflows) 2002	Official Development Assistance and Aid 2002	Remittances as a Percent of Gross National Income (GNI) 2002	Average Annual Inflation (b) (percent) 1998-2003
World	**35,065,010**	**2.8**	**5,708**	**4**	**28**	**68 c**	**..**	**630,827**	**69,815**	**..**	**..**
Asia (excl. Middle East)	**9,182,585**	**2.6**	**2,738**	**6**	**33**	**61 c**	**..**	**91,267**	**13,009**	**0.28**	**..**
Armenia	4,591	5.4	777	26	37	37	25	111	293	0.42	1.6
Azerbaijan	4,132	1.2	638	16	52	32	1,387	1,392	349	2.78	(0.3) d
Bangladesh	53,751	5.0	396	23	26	51	437	47	913	5.57	3.5
Bhutan	494	7.0	580	34	37	29	..	0	73	..	3.5
Cambodia	4,062	4.8	395	36	28	36	0.3	54	487	3.19	1.1
China	1,206,605	9.0	944	15	51	34	2,174	49,308	1,476	0.14	(0.0)
Georgia	2,783	2.1	861	21	23	56	1 e	165	313	1.41	7.4 d
India	517,843	6.0	493	23	27	51	(414)	3,030	1,463	1.68	4.1
Indonesia	224,386	2.5	1,060	17	44	39	2,029	(1,513)	1,308	0.84	10.3
Japan	5,608,145	1.1	45,029	1	31	68 c	2,506	9,087	..	0.02	(0.6)
Kazakhstan	28,009	0.4	1,933	9	39	53	337	2,583	188	0.47	8.6
Korea, Dem People's Rep	..	..	..	..	..	..	..	..	267	..	..
Korea, Rep	680,293	5.3	14,937	4	34	63	3,095	..	(82)	..	2.8
Kyrgyzstan	2,055	0.7	459	38	23	39	5 e	5	186	2.77	11.6
Lao People's Dem Rep	2,640	6.3	477	51	23	26 c	..	25	278	..	26.1
Malaysia	116,937	5.3	4,811	9	47	44	(3,601)	3,203	86	..	1.7
Mongolia	1,077	2.8	442	30	16	54	7 e	78	208	5.29	6.2
Myanmar	..	..	..	..	..	..	417 e	129	121	..	24.7
Nepal	5,803	4.6	242	41	21	38	..	10	365	3.06	3.8
Pakistan	76,385	3.4	521	23	23	53	..	823	2,144	5.81	3.6
Philippines	95,570	3.7	1,209	15	33	53	229	1,111	..	0.23	4.6
Singapore	113,486	6.1	27,533	0	35	65	(3,252)	6,097	7	..	0.6
Sri Lanka	16,909	4.6	899	20	26	54	76	242	344	8.01	8.8
Tajikistan	2,863	(3.0)	271	29	25	46	..	9	168	7.10	..
Thailand	183,981	2.5	3,000	9	43	48	(121)	900	296	..	1.2
Turkmenistan	9,909	1.5	911	25	44	30 c	..	100	41	..	..
Uzbekistan	13,341	2.3	693	35	22	44	21 e	65	189	..	..
Viet Nam	33,203	7.4	413	23	39	38	14	1,400	1,277	..	1.4
Europe	**11,451,996**	**2.1**	**16,010**	**2**	**28**	**69**	**..**	**402,391**	**9,024**	**..**	**..**
Albania	3,420	5.8	1,114	25	19	56	2	135	317	14.19	2.7
Austria	272,562	2.2	34,044	2	32	66	371	886	..	0.18	1.9
Belarus	15,684	2.0	2,118	11	37	52	2 e	247	39	..	93.7
Belgium	323,356	2.4	31,094	1	27	72	15	..	..	..	2.0
Bosnia and Herzegovina	6,886	..	1,671	18	37	45	0.1 e	293	587	13.70	..
Bulgaria	13,634	0.3	1,742	13	28	59	383	600	381	..	6.2
Croatia	24,288	3.6	5,500	8	29	62	581	981	166	3.24	3.3
Czech Rep	58,107	2.0	5,695	4	40	57	1,615	9,323	393	..	2.8
Denmark	210,690	2.6	39,661	3	27	71	(1,340)	6,410	..	..	2.5
Estonia	6,790	3.7	4,315	5	30	65	3	285	69	0.10	3.9
Finland	169,358	4.0	32,284	3	33	64	2,957	8,156	..	..	2.1
France	1,822,901	2.2	30,790	3	25	72	8,718	52,020	..	0.06	1.6
Germany	2,706,380	1.5	32,826	1	30	69	5,489	37,296	..	..	1.4
Greece	150,494	3.0	14,162	7	22	70	572	53	..	0.95	3.3
Hungary	58,300	3.4	5,903	4	31	65	160	854	471	0.08	7.9
Iceland	9,041	3.7	31,385	..	..	..	(147)	125	..	..	4.7
Ireland	116,935	8.6	30,551	3	42	54 c	(1,516)	24,697	..	0.06	4.3
Italy	1,229,818	1.8	21,396	3	29	69	10,597	14,699	..	0.03	2.5
Latvia	7,238	3.4	3,033	5	25	71	12	382	86	0.03	2.4
Lithuania	9,244	2.5	2,999	7	31	62	135	713	147	0.27	0.6
Macedonia, FYR	4,928	0.8	2,432	12	30	57	0.2	77	277	2.65	3.3
Moldova, Rep	3,103	(4.0)	488	24	23	53	19 e	111	142	0.09	18.3
Netherlands	503,046	3.0	31,287	3	26	71	674	28,534	..	..	3.1
Norway	176,295	3.2	40,043	2	38	60	5,276	1,008	..	..	2.5
Poland	145,305	4.8	4,557	3	30	66	273	4,131	1,160	0.62	5.3
Portugal	131,930	3.0	13,034	4	30	66 c	1,625	4,235	..	2.47	3.4
Romania	36,010	0.6	1,652	13	38	49	492	1,144	701	0.02	32.7
Russian Federation	393,851	(0.8)	3,273	6	34	60	(884)	3,009	1,301	0.08	26.3
Serbia and Montenegro	14,932	0.1 f	1,798	..	..	..	863 e	475	1,931	17.97	..
Slovakia	24,852	3.9	4,655	4	29	67	160	4,012	189	..	8.1
Slovenia	24,553	4.1	12,326	3	36	61	(14)	1,865	171	0.08	7.6
Spain	736,495	3.2	18,050	3	30	66	(428)	21,284	..	0.66	3.2
Sweden	286,614	2.7	33,665	2	28	70	(107)	11,828	..	0.08	1.7
Switzerland	339,642	1.3	46,554	..	..	..	2,977	3,599	..	0.06	1.0
Ukraine	50,566	(4.7)	1,028	15	38	47	191	693	484	0.35	13.2
United Kingdom	1,354,618	2.9	22,974	1	26	73	(25,556)	28,180	..	..	2.1
Middle East & N. Africa	**744,095 i**	**1.7 g**	**2,666**	**13**	**32**	**55**	**..**	**..**	**9,145**	**1.42**	**..**
Afghanistan	..	..	..	52	24	24	..	..	1,285	..	..
Algeria	51,888	2.6	1,665	10	53	37	3	1,065	361	..	2.2
Egypt	82,939	4.7	1,253	17	33	50	2,198	647	1,286	2.96	2.9
Iran, Islamic Rep	117,104	3.5	1,819	12	39	49	..	37	116	..	14.7
Iraq	..	..	..	..	..	..	..	..	116	..	..
Israel	106,383 j	4.6 h	16,676	..	..	..	(549)	1,649	754	..	2.7
Jordan	8,589	3.7	1,662	2	26	72	990	56	534	21.05	1.4
Kuwait	27,282 i	3.4 g	11,598	..	..	..	(441)	7	5	..	1.7
Lebanon	12,736	3.3	2,922	12	21	67	98	257	456	5.50	..
Libyan Arab Jamahiriya	..	..	..	..	..	..	(430)	..	10	..	(5.1) d
Morocco	43,761	3.0	1,455	16	30	54	1,624	428	636	8.29	1.5
Oman	15,940	3.9	6,147	..	..	..	(125)	40	41	..	(0.7)
Saudi Arabia	141,592 i	1.3 g	7,562	5	51	44	(473)	..	27	..	(0.6)
Syrian Arab Rep	13,618	3.5	805	24	29	47	..	225	81	..	(0.8) d
Tunisia	25,253	4.7	2,573	10	29	60	..	795	475	5.49	2.6
Turkey	204,869	2.8	2,947	13	24	63	275	1,037	636	1.11	49.2
United Arab Emirates	..	..	17,520	..	..	..	(36)	..	4	..	..
Yemen	5,838	5.4	330	15	40	44	..	114	584	14.10	9.7

For more information, please visit http://earthtrends.wri.org/datatables/economics

	Gross Domestic Product (GDP), Constant 1995 $US						Financial Flows (million current $US)			Workers'	
	Total (million dollars) 2002	Average Annual Growth Rate (percent) 1992-2002	Per Capita (dollars) 2002	Distribution by Sector (percent) Agriculture 2002	Industry 2002	Services 2002	Cross-Border Mergers and Acquisitions (net inflows) {a} 2003	Foreign Direct Investment (net inflows) 2002	Official Development Assistance and Aid 2002	Remittances as a Percent of Gross National Income (GNI) 2002	Average Annual Inflation {b} (percent) 1998-2003
Sub-Saharan Africa	**393,001**	**3.1**	**593**	**17**	**29**	**53**	**..**	**7,826**	**17,507**	**..**	**..**
Angola	8,305	5.2	623	8	68	24	..	1,312	421	..	175.5
Benin	2,872	5.0	443	36	14	50	..	41	220	2.70	2.8
Botswana	7,245	5.7	3,983	2	47	50	..	37	38	..	7.9
Burkina Faso	3,051	4.5	284	31	18	51	..	8	473	1.52	1.8
Burundi	1,012	(1.6)	143	49	19	31	..	0	172	..	8.8
Cameroon	11,038	3.6	710	44	19	37	..	86	632	..	1.6 d
Central African Rep	1,331	3.0	332	57	22	21	..	4	60	..	2.6
Chad	2,017	3.3	238	38	17	45	..	901	233	..	3.8
Congo	2,560	1.9	700	6	63	30	..	331	420	0.05	1.5
Congo, Dem Rep	4,660	(3.4)	90	58	19	23	..	32	807	..	276.8 d
Côte d'Ivoire	11,941	3.4	776	26	20	53	..	230	1,069	..	3.0
Equatorial Guinea	742	24.2	2,444	9	86	5	..	323	20	..	..
Eritrea	716	5.0	160	12	25	63	..	21	230	..	..
Ethiopia	8,334	5.5	122	42	11	47	..	75	1,307	0.51	1.8
Gabon	5,685	2.6	4,323	8	46	46	..	123	72	..	..
Gambia	509	3.7	356	26	14	60	..	43	61	..	3.9 d
Ghana	8,671	4.2	437	36	24	40	55	50	653	0.79	22.9
Guinea	4,861	4.3	633	24	37	39	1	0	250	0.48	..
Guinea-Bissau	241	0.1	187	62	13	25	..	1	59	..	2.7
Kenya	10,172	2.1	323	16	19	65	(2)	50	393	..	6.4
Lesotho	1,205	3.7	552	16	43	41	..	81	76	0.19	..
Liberia	657	17.2	197	..	..	..	(37)	(65)	52	..	..
Madagascar	3,562	2.6	215	32	13	55	5 e	8	373	..	9.3
Malawi	1,744	3.8	157	37	15	49	..	6	377	0.05	23.3
Mali	3,548	4.6	327	34	30	36	..	102	472	3.30	1.9
Mauritania	1,451	4.4	533	21	29	50	..	12	355	..	4.2
Mozambique	4,229	8.3	223	23	34	43	88 e	406	2,058	..	11.3
Namibia	4,398	3.9	2,411	11	31	58	67	..	135	0.10	9.4
Niger	2,387	3.3	209	40	17	43	..	8	298	..	1.7
Nigeria	32,953	2.3	254	37	29	34	..	1,281	314	..	12.2
Rwanda	2,405	4.2	295	42	22	37	..	3	356	0.38	2.9
Senegal	6,287	4.7	618	15	22	63	..	93	449	..	1.6
Sierra Leone	862	(2.9)	165	53	32	16	..	5	353	..	4.9
Somalia	..	..	..	..	..	..	..	(0)	194	..	..
South Africa	182,280	2.7	4,201	4	32	64	995	739	657	..	6.3
Sudan	11,507	6.0	335	39	18	43	768 e	633	351	7.36	8.7 k
Tanzania, United Rep	7,179	3.9	213	44	16	39	2	240	1,233	..	..
Togo	1,545	3.1	320	40	22	38	..	75	51	4.13	2.0
Uganda	8,597	6.7	363	32	22	46	..	150	638	6.15	3.1
Zambia	4,292	1.5	422	22	26	52	..	197	641	..	24.0 d
Zimbabwe	6,771	1.2	521	17	24	59	..	26	201	..	77.0 d
North America	**9,962,239**	**3.5**	**31,089**	**2**	**23**	**75 c**	**..**	**60,134**	**..**	**..**	**..**
Canada	741,060	3.6	23,621	..	..	..	(10,884)	20,501	..	..	2.4
United States	9,221,179	3.5	31,891	2	23	75 c	(12,726)	39,633	..	..	2.5
C. America & Caribbean	**473,654**	**2.7**	**3,009**	**6**	**27**	**68**	**..**	**18,609**	**2,254**	**2.48**	**..**
Belize	817	4.2	3,568	15	20	65	..	25	22	1.71	1.1
Costa Rica	15,479	4.6	3,938	8	29	62	11	662	5	1.32	10.3
Cuba	..	..	..	..	..	..	..	..	61	..	..
Dominican Rep	18,388	6.2	2,128	12	33	55	..	961	157	9.71	9.9
El Salvador	11,501	3.8	1,758	9	30	61	417	208	233	14.31	2.3
Guatemala	18,532	3.8	1,552	22	19	58	..	110	249	7.51	6.6
Haiti	2,851	0.8	338	27	16	57	..	6	156	..	15.5
Honduras	4,806	2.8	716	13	31	56	..	143	435	11.35	9.5
Jamaica	5,682	0.1	2,107	6	31	63	..	481	24	16.03	7.6
Mexico	374,729	3.2	3,721	4	26	70	(4,127)	14,622	136	1.64	7.9
Nicaragua	..	..	497	18	25	57	..	174	517	9.88	7.7
Panama	11,288	3.8	3,418	6	14	80	(120)	57	35	0.72	1.0
Trinidad and Tobago	7,206	4.2	5,526	2	41	58	87	737	(7)	..	4.2
South America	**1,643,751**	**2.3**	**4,093**	**8**	**26**	**66**	**..**	**26,319**	**2,386**	**0.65**	**..**
Argentina	249,537	1.3	6,842	11	32	57	1,788	785	0	..	6.6
Bolivia	8,240	3.5	952	15	33	52	..	677	681	1.05	2.4
Brazil	810,244	2.7	4,642	6	21	73	2,206	16,566	376	0.34	8.1
Chile	84,689	5.0	5,441	9	34	57	56	1,713	(23)	..	3.2
Colombia	99,472	2.0	2,276	14	30	56	35	2,023	441	3.03	8.2
Ecuador	223,511	1.8	1,796	9	28	63	273	1,275	216	7.49	39.7
Guyana	724	3.5	950	31	29	41	0.3 e	44	65	7.75	5.2 d
Paraguay	9,382	1.5	1,701	22	28	50	..	(22)	57	1.52	9.3
Peru	64,305	4.0	2,380	8	28	64	156	2,391	491	1.30	2.2
Suriname	447	2.9	1,905	11	20	69	..	..	12	1.53	42.1
Uruguay	18,469	1.2	5,447	9	27	64	9	177	13	0.24	8.8
Venezuela	74,732	0.4	2,978	3	43	54	164	690	57	..	19.7
Oceania	**567,617**	**3.7**	**18,031**	**4**	**26**	**70 c**	**..**	**17,585**	**1,319**	**..**	**..**
Australia	485,640	4.0	24,455	4	26	71 c	(4,836)	16,622	..	..	3.4
Fiji	2,396	2.7	2,736	16	27	57	1	77	34	..	2.4
New Zealand	73,613	3.2	18,947	..	..	..	1,199	823	..	0.41	2.1
Papua New Guinea	4,600	1.1	879	27	39	33	82	50	203	..	12.9
Solomon Islands	234	(1.3)	534	..	..	..	..	(7)	26	..	8.3
High Income {l}	**28,547,160**	**2.6**	**29,541**	**2**	**27**	**71 c**	**..**	**483,001**	**1,852**	**..**	**..**
Middle Income {l}	**5,864,176**	**3.4**	**1,979**	**9**	**34**	**56**	**..**	**133,443**	**27,370**	**..**	**..**
Low Income {l}	**979,032**	**5.0**	**431**	**26**	**26**	**48**	**..**	**14,640**	**27,652**	**..**	**..**

a. Equal to the value of sales minus purchases for all cross-border mergers & acquisitions (M&As). **b.** Based on the Consumer Price Index (CPI). **c**. Sectoral GDP data for these countries and regions are from 2001. **d.** Average annual growth from 1998-2002. **e**. Data are for cross-border sales only; purchases are either equal to zero or data are unavailable. **f**. For the time period 1995-2002. **g**. For the time period 1992-2001. **h**. For the time period 1992-2000. **i**. Values are from 2001. **j**. Values are from 2000. **k.** Average annual growth from 1998-2001. **l**. With the exception of FDI inflows regional aggregates for low-, middle-, and high-income countries are obtained directly from the World Bank, not calculated from a list of countries by WRI.

Economics and Financial Flows: Technical Notes

DEFINITIONS AND METHODOLOGY

Gross Domestic Product (GDP), Constant 1995 Dollars is the sum of the value added by all producers in an economy. Data are expressed in millions of U.S. dollars. Currencies are converted to dollars using the International Monetary Fund's (IMF) average official exchange rate for 2002. Gross domestic product estimates at purchaser values (market prices) include the value added in the agriculture, industry, and service sectors, plus taxes and minus subsidies not included in the final value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion of natural resources. To obtain series of constant price data that one can compare over time, the World Bank rescales GDP and value added by industrial origin to a common reference year, currently 1995.

National accounts indicators for most developing countries are collected from national statistical organizations and central banks by visiting and resident World Bank missions. The data for high-income economies are obtained from the Organisation for Economic Cooperation and Development (OECD) data files (see the OECD's monthly *Main Economic Indicators*). Additional data are obtained from the United Nations Statistics Division's *National Accounts Statistics: Main Aggregates and Detailed Tables* and *Monthly Bulletin of Statistics.*

Average Annual Growth Rate of GDP is the average percentage growth of a country or region's economy for each year between (and including) 1992 and 2002. WRI assumes compound growth and uses the least-squares method to calculate average annual percent growth. The least squares method works by fitting a trend line to the natural logarithm of annual GDP values. The slope (m) of this trend line is used to calculate the annual growth rate (r) using the equation $r = e^m - 1$. The growth rate is an average rate that is representative of the available observations over the entire period. It does not necessarily match the actual growth rate between any two periods.

Gross Domestic Product Per Capita is the total annual output of a country's economy divided by the mid-year population. GDP per capita values are obtained directly from the World Bank.

Distribution of GDP by Sector is the percent of total output of goods and services that are a result of value added by a given sector. These goods and services are for final use occurring within the domestic territory of a given country, regardless of the allocation to domestic and foreign claims. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC) revision 3. The ISIC is a classification system for economic activity developed and maintained by the United Nations.

Agriculture corresponds to ISIC divisions 1-5 and includes forestry and fishing. **Industry** corresponds to ISIC divisions 10-45 and comprises the mining, manufacturing, construction, electricity, water, and gas sectors. **Services** correspond to ISIC divisions 50-99 and include value added in wholesale and retail trade (including hotels and restaurants); transport; and government, financial, professional, and personal services such as education, health care, and real estate services. Value added from services is calculated as total GDP less the portion from agriculture and industry, so any discrepancies that may occur in the GDP distribution by sector calculation will appear here.

Cross-Border Mergers and Acquisitions (M&As) are defined as the joining of two firms or the takeover of one by another when the parties involved are based in different national economies. Data are presented here as the net inflows of M&A capital (sales less purchases) and are in millions of U.S. dollars.

The United Nations Conference on Trade and Development (UNCTAD) obtains these data from Thomson Financial Securities Data Company. Data are reported at the time of transaction and recorded by the governments of both the target firm and the purchasing firm. WRI calculates net inflows by subtracting the total value of purchases of firms within a country from total value of acquisitions made by firms within that country. Transaction amounts are recorded at the time of transfer, rather than contract.

Foreign Direct Investment (FDI) is private investment in a foreign economy to obtain a lasting management interest (10 percent or more of voting stock) in an enterprise. The IMF defines FDI in its *Balance of Payments Manual* as the sum of equity investment, reinvestment of earnings, and inter-company loans between parent corporations and foreign affiliates. Data are in million current U.S. dollars. FDI became the dominant means for funds transfer from rich to poor countries after the liberalization of global financial markets in the 1970s and accounts for more than one-half of financial flows to developing countries. Data are based on balance of payments information reported by the IMF, supplemented by data from the OECD and official national sources.

Official Development Assistance (ODA) and Aid includes concessions by governments and international institutions to developing countries to promote economic development and welfare. The data shown here record the actual receipts of financial resources or of goods or services valued at the cost to the donor, less any repayments of loan principal during the same period. Values are reported in million current US dollars. Grants by official agencies of the members of the Development Assistance Committee (DAC) of the OECD are included, as are loans with a grant element of at least 25 percent, and technical cooperation and assistance. The data on development assistance are compiled by the DAC and published in its annual statistical report, *Geographical Distribution of Financial Flows to Aid Recipients,* and the DAC annual *Development Co-operation Report.*

WRI calculates **Remittances as a Percent of GNI** by dividing workers' remittances by Gross National Income. Both values are originally in current U.S. dollars, and the quotient is expressed as a percentage.

Workers' remittances include the transfer of earned wages by migrant workers to their home country. It includes all transfers by migrants who are employed or intend to remain employed for more than a year in another economy in which they are considered residents. Transfers made by self-employed workers are not considered remittances, as this indicator attempts to describe money raised through labor rather than entrepreneurial activity. Since 1980, recorded remittance receipts to low- and middle-income countries have increased six-fold.

Average Annual Inflation Rate is the average annual percentage change in consumer prices between (and including) 1998 and 2003. The inflation rates shown here are based on the Consumer Price Index (CPI), which measures the change in cost to the average consumer of acquiring a basket of goods and services, using the Laspeyres formula. WRI assumes compound growth and uses the least-squares method to calculate average annual percent growth. The least squares method works by fitting a trend line to the natural logarithm of annual consumer price values. The slope (m) of this trend line is used to calculate the annual growth rate (r) using the equation $r = e^m - 1$. The growth rate is an average rate that is representative of the available observations over the entire period. It does not necessarily match the actual growth rate between any two periods.

FREQUENCY OF UPDATE BY DATA PROVIDERS

The World Bank publishes *World Development Indicators* each year in April. Data for this table were taken from the 2004 on-line edition, which typically include values through 2002 or 2003. UNCTAD updates the *World Investment Report* annually.

DATA RELIABILITY AND CAUTIONARY NOTES

Gross Domestic Product: The World Bank produces the most reliable global GDP estimates available. Informal economic activities sometimes pose a measurement problem, however, especially in developing countries, where much economic activity may go unrecorded. Obtaining a complete picture of the economy requires estimating household outputs produced for local sale and home use, barter exchanges, and illicit or deliberately unreported activity. Technical improvements and growth in the services sector are both particularly difficult to measure. How consistent and complete such estimates will be depends on the skill and methods of the compiling statisticians and the resources available to them. Because values are measured in U.S. dollars, these data do not account for differences in purchasing power among countries.

Mergers and Acquisitions: Values are calculated based on the year that a deal closes, not at the time a deal is announced. M&A values may be paid out over more than one year. Data are accepted "as is" from national surveys. Some underreporting of data may occur, though as all transactions are registered in both the country of the purchasing firm and the targeting firm, this is likely to be uncommon.

Foreign Direct Investment: Because of the multiplicity of sources, definitions, and reporting methods, data may not be comparable across countries. (Data do not include capital raised locally, which has become an important source of financing in some developing countries.) In addition, data only capture cross-border investment flows when equity participation is involved and thus omit non-equity cross-border transactions. For a more detailed discussion, please refer to the World Bank's *World Debt Tables 1993-1994,* volume 1, chapter 3.

Official Development Assistance: Data are not directly comparable, since the ODA figures do not distinguish among different types of aid, which can affect individual economies in different ways. Because data are based on donor-country reports, they may not match aid receipts recorded in developing and transition economies. According to the World Bank, "the nominal values used here may overstate the real value of aid to the recipient." The purchasing power of foreign aid can decrease when price and exchange rates fluctuate, grants are tied to specific policy restrictions, or technical assistance pays for the work of firms in other countries.

Worker Remittances: Data on worker remittances are reported by the countries receiving the transfers. Variations in reporting standards do exist, particularly in determining the residency status of a worker.

Inflation Rate: Data are based on CPIs, which are updated frequently and based on the prices of explicit goods and services. However, the weights used in calculating CPIs are derived from household expenditure surveys, which can vary in quality and frequency across countries. The definition of a household, the specific "basket" of goods chosen, and the geographic location of a survey can vary across countries and within a specific country over time. According to the World Bank, these data are "useful for measuring consumer prices within a country, [but] consumer price indexes are of less value in making comparisons across countries."

SOURCES

GDP, Financial Flows (excluding M&A data), Remittances, and Inflation data: The World Bank, Development Data Group. 2004. World Development Indicators 2004 online. Washington, D.C.: The World Bank. Available at http://www.worldbank.org/data/onlinedbs/onlinebases.htm.

Mergers and Acquisitions: United Nations Conference on Trade and Development (UNCTAD). 2004. *World Investment Report 2004: The Shift Towards Services.* Annex tables B.7 "Cross-border M&A sales by region/economy of seller" and B.8 "Cross-border M&A purchases by region/economy of purchaser." New York and Geneva: United Nations. Available at http://www.unctad.org/Templates/Page.asp?intItemID=1465&lang=1.

Institutions and Governance

Sources: Polity IV Project, Transparency International, World Bank, International Telecommunications Union, Privacy International, Freedom House

	Governance Indices			Regulatory Barriers to Starting a Business, 2004		Government Expenditures (as a percent of Gross Domestic Product)			Access to Information		
	Level of Democracy (-10 - 10, 10 = most democratic) 2002	Political Competition (0 - 5, 5 = most competitive) 2002	Corruption Perceptions Index (0 - 10, 10= least corrupt) 2003	Average Number of Days to Incorporate	Percent of GNI Per Capita [a] Required to Incorporate	Public Health 2000	Public Education [b] 2000	Military 2000	Digital Access Index (1 - 100, 100= most access) 2002	Status of Freedom of Information (FOI) Legislation 2005	Press Freedom Index (0 - 100, 0= most free) 2004
World	..	..	..	**50**	**79**	**5.4**	**4.1**	**2.3**	..	..	..
Asia (excl. Middle East)	..	..	..	..	..	**4.5**	..	**1.4**	..	..	..
Armenia	5	4	3.0	25	7	3.2	2.9	3.6	30	Law Enacted	64
Azerbaijan	-7	2	1.8	123	15	0.7	3.9	2.6	24	Pending Effort	71
Bangladesh	6	3	1.3	35	91	1.6	2.5	1.4	18	Pending Effort	68
Bhutan	-8	2	..	62	11	3.5	5.2	..	13	..	68
Cambodia	2	4	..	94	480	1.7	1.8	3.5	17	..	63
China	-7	1	3.4	41	15	2.0	..	2.1	43	..	80
Georgia	5	3	1.8	25	14	1.1	2.2	0.6	37	Law Enacted	54
India	9	4	2.8	89	50	0.9	4.1	2.3	32	Law Enacted [c]	41
Indonesia	7	4	1.9	151	131	0.6	1.5	1.1	34	Pending Effort	55
Japan	10	5	7.0	31	11	6.0	3.6	1.0	75	Law Enacted	18
Kazakhstan	-6	2	2.4	25	11	2.1	..	0.8	41	..	74
Korea, Dem People's Rep	-9	1	..	..	..	1.8	..	..	..	..	98
Korea, Rep	8	4	4.3	22	18	2.6	3.8	2.8	82	Law Enacted	29
Kyrgyzstan	-3	2	2.1	21	12	2.0	2.9	1.8	32	..	71
Lao People's Dem Rep	-7	1	..	198	19	1.5	2.3	2.0	15	..	82
Malaysia	3	3	5.2	30	25	1.8	6.2	1.7	57	..	69
Mongolia	10	5	..	20	8	4.4	..	2.5	35	..	36
Myanmar	-7	1	1.6	..	..	0.3	1.3	2.3	17	..	95
Nepal	-4	3	..	21	74	1.6	3.7	0.9	19	..	65
Pakistan	-5	2	2.5	24	36	1.0	1.8	4.4	24	Law Enacted [c]	59
Philippines	8	4	2.5	50	20	1.7	3.5	1.1	43	Pending Effort [d]	34
Singapore	-2	2	9.4	8	1	1.3	..	4.7	75	..	64
Sri Lanka	6	3	3.4	50	11	1.8	..	4.5	38	Pending Effort	53
Tajikistan	-1	3	1.8	..	..	0.9	..	1.2	21	Law Enacted [e]	73
Thailand	9	4	3.3	33	7	2.1	5.4	1.5	48	Law Enacted	39
Turkmenistan	-9	1	..	..	..	3.0	..	3.8	37	..	95
Uzbekistan	-9	1	2.4	35	17	2.8	..	..	31	Law Enacted [e]	84
Viet Nam	-7	1	2.4	56	29	1.5	..	..	31	..	82
Europe	..	..	..	..	..	**6.5**	..	**2.0**	..	..	..
Albania	7	4	2.5	47	32	2.4	..	1.2	39	Law Enacted	49
Austria	10	5	8.0	29	6	5.6	5.8	0.8	75	Law Enacted	23
Belarus	-7	2	4.2	79	25	4.6	..	1.3	49	..	84
Belgium	10	5	7.6	34	11	6.2	..	1.4	74	Law Enacted	9
Bosnia and Herzegovina	..	..	3.3	54	46	3.1	..	9.5	46	Law Enacted	48
Bulgaria	9	4	3.9	32	10	4.0	..	2.7	53	Law Enacted	35
Croatia	7	4	3.7	49	14	7.8	..	2.9	59	Law Enacted	37
Czech Rep	10	5	3.9	40	11	6.5	4.4	2.0	66	Law Enacted	23
Denmark	10	5	9.5	4	0	6.8	8.3	1.5	83	Law Enacted	8
Estonia	6	3	5.5	72	8	4.5	..	1.6	67	Law Enacted	17
Finland	10	5	9.7	14	1	5.0	5.9	1.3	79	Law Enacted	9
France	9	5	6.9	8	1	7.1	5.8	2.6	72	Law Enacted	19
Germany	10	5	7.7	45	6	8.0	4.5	1.5	74	Pending Effort	16
Greece	10	5	4.3	38	35	5.3	3.8	4.9	66	Law Enacted	28
Hungary	10	5	4.8	52	23	5.1	4.9	1.7	63	Law Enacted	20
Iceland	..	..	9.6	..	..	7.8	6.0	..	82	Law Enacted	8
Ireland	10	5	7.5	24	10	4.7	4.3	0.7	69	Law Enacted	16
Italy	10	5	5.3	13	16	6.0	4.6	2.1	72	Law Enacted	33
Latvia	8	4	3.8	18	18	3.5	5.9	1.0	54	Law Enacted	17
Lithuania	10	5	4.7	26	4	4.4	..	1.8	56	Law Enacted	18
Macedonia, FYR	9	4	2.3	48	12	5.1	..	2.1	48	Pending Effort	53
Moldova, Rep	8	3	2.4	30	19	2.9	4.0	0.4	37	Law Enacted	63
Netherlands	10	5	8.9	11	13	5.5	..	1.6	79	Law Enacted	12
Norway	10	5	8.8	23	3	6.5	6.8	1.8	79	Law Enacted	9
Poland	9	4	3.6	31	21	4.2	5.0	1.9	59	Law Enacted	19
Portugal	10	5	6.6	78	14	6.2	5.8	2.1	65	Law Enacted	14
Romania	8	4	2.8	28	7	5.2	..	2.5	48	Law Enacted	47
Russian Federation	7	4	2.7	36	7	3.7	2.9	3.6	50	Pending Effort [f]	67
Serbia and Montenegro	7	4	2.3	51	10	5.9	..	5.9	45	Law Enacted [g]	40
Slovakia	9	4	3.7	52	6	5.1	4.1	1.7	59	Law Enacted	21
Slovenia	10	5	5.9	61	12	6.1	..	1.2	72	Law Enacted	19
Spain	10	5	6.9	108	17	5.3	..	1.2	67	Law Enacted	19
Sweden	10	5	9.3	16	1	7.1	..	2.1	85	Law Enacted	8
Switzerland	10	5	8.8	20	9	5.9	..	1.1	76	Law Enacted [c]	9
Ukraine	7	4	2.3	34	18	2.9	4.2	3.6	43	Law Enacted	68
United Kingdom	10	5	8.7	18	1	5.9	..	2.5	77	Law Enacted	19
Middle East & N. Africa	..	..	..	..	..	**3.5**	..	**5.9**	..	..	..
Afghanistan	-66	-66	..	..	..	2.7	..	..	..	..	72
Algeria	-3	3	2.6	26	27	2.7	..	3.5	37	..	63
Egypt	-6	2	3.3	43	63	1.8	..	2.5	40	..	76
Iran, Islamic Rep	3	3	3.0	48	7	2.7	4.4	3.9	43	..	79
Iraq	-9	1	2.2	..	..	1.0	..	..	..	..	66
Israel	10	5	7.0	34	6	5.7	7.3	8.2	70	Law Enacted	28
Jordan	-2	4	4.6	36	52	3.8	..	9.0	45	..	63
Kuwait	-7	2	5.3	35	2	2.7	..	8.0	51	..	57
Lebanon	-66	-66	3.0	46	132	..	3.0	5.4	48	..	66
Libyan Arab Jamahiriya	-7	1	2.1	..	..	1.5	..	..	42	..	94
Morocco	-6	2	3.3	11	12	1.6	5.0	4.1	33	..	61
Oman	-8	2	6.3	34	5	2.4	..	10.6	43	..	74
Saudi Arabia	-10	1	4.5	64	70	3.3	..	10.6	44	..	80
Syrian Arab Rep	-7	1	3.4	47	34	2.2	..	5.5	28	..	80
Tunisia	-4	3	4.9	14	11	4.6	6.8	1.7	41	..	80
Turkey	7	3	3.1	9	26	4.4	3.5	5.0	48	Law Enacted	52
United Arab Emirates	..	1	5.2	54	27	2.7	..	2.5	64	..	75
Yemen	-2	3	2.6	63	269	1.4	10.0	5.4	18	..	67

For more information, please visit http://earthtrends.wri.org/datatables/governance

	Governance Indices			Regulatory Barriers to Starting a Business, 2004		Government Expenditures (as a percent of Gross Domestic Product)			Access to Information		
	Level of Democracy (-10 - 10, 10 = most democratic) 2002	Political Competition (0 - 5, 5 = most competitive) 2002	Corruption Perceptions Index (0 - 10, 10= least corrupt) 2003	Average Number of Days to Incorporate	Percent of GNI Per Capita {a} Required to Incorporate	Public Health 2000	Public Education {b} 2000	Military 2000	Digital Access Index (1 - 100, 100= most access) 2002	Status of Freedom of Information (FOI) Legislation 2005	Press Freedom Index (0 - 100, 0= most free) 2004
Sub-Saharan Africa	..	..	..	**63**	**225**	**2.7**	..	**1.9**	..	..	..
Angola	-3	3	1.8	146	885	1.9	2.7	4.9	11	Law Enacted e	66
Benin	6	4	..	32	197	1.8	3.1	..	12	..	30
Botswana	9	4	5.7	108	11	3.7	..	3.7	43	Pending Effort	30
Burkina Faso	0	4	..	135	153	1.8	..	1.7	8	..	39
Burundi	0	3	..	43	192	2.0	3.4	6.0	10	..	75
Cameroon	-4	3	1.8	37	183	1.1	3.2	1.4	16	..	67
Central African Rep	5	3	..	14	205	2.1	..	..	10	..	64
Chad	-2	3	..	75	344	2.4	..	1.5	10	..	74
Congo	-4	2	2.2	67	318	1.4	..	..	17	..	54
Congo, Dem Rep	-77	-77	..	155	603	1.4	..	..	12	..	80
Côte d'Ivoire	4	3	2.1	58	134	1.0	4.6	..	13	..	65
Equatorial Guinea	-5	2	..	..	..	1.3	0.6	..	20	..	89
Eritrea	-7	2	..	..	..	3.7	..	..	13	..	89
Ethiopia	1	3	2.5	32	77	1.1	4.8	9.8	10	Pending Effort	66
Gabon	-4	2	..	..	..	1.6	3.9	..	34	..	62
Gambia	-5	2	2.5	..	..	2.9	2.7	1.1	13	..	63
Ghana	6	4	3.3	85	88	2.4	..	1.0	16	Pending Effort	28
Guinea	-1	3	..	49	208	1.8	1.9	1.5	10	..	71
Guinea-Bissau	5	3	..	..	..	3.4	..	4.4	10	..	63
Kenya	8	4	1.9	47	53	2.1	6.3	1.6	19	Pending Effort	60
Lesotho	8	3	..	92	58	4.9	10.0	3.1	19	Pending Effort	40
Liberia	0	3	..	..	..	3.2	..	..	..	..	75
Madagascar	7	4	2.6	44	65	1.6	3.2	1.2	15	..	41
Malawi	5	4	2.8	35	141	3.0	..	0.9	15	Pending Effort	52
Mali	6	3	3.0	42	187	1.8	..	2.5	9	..	27
Mauritania	-6	2	..	82	141	2.7	..	..	14	..	64
Mozambique	6	4	2.7	153	96	3.8	..	2.4	12	Pending Effort	45
Namibia	6	4	4.7	85	19	4.8	..	3.4	39	Pending Effort	34
Niger	4	0	..	27	396	1.5	2.8	1.1	4	..	56
Nigeria	4	0	1.4	44	95	0.4	..	0.8	15	Pending Effort	53
Rwanda	-4	2	..	21	317	3.0	2.8	3.8	15	..	82
Senegal	8	4	3.2	57	113	2.6	3.2	1.4	14	..	37
Sierra Leone	5	3	2.2	26	..	2.6	..	3.6	10	..	58
Somalia	-77	-77	..	..	..	1.2	..	..	..	..	80
South Africa	9	4	4.4	38	9	3.6	..	1.5	45	Law Enacted	24
Sudan	-6	2	2.3	..	..	1.1	..	3.0	13	..	85
Tanzania, United Rep	2	3	2.5	35	187	2.1	..	..	15	Pending Effort	50
Togo	-2	3	..	53	229	1.5	4.8	..	18	..	78
Uganda	-4	2	2.2	36	131	3.1	..	2.2	17	Pending Effort	44
Zambia	1	3	2.5	35	23	2.9	..	0.6	17	Pending Effort	63
Zimbabwe	-7	2	2.3	96	305	3.8	..	4.9	29	Law Enacted h	89
North America	..	..	..	..	..	**5.8**	**4.9**	**3.0**	..	..	..
Canada	10	5	8.7	3	1	6.4	5.2	1.2	78	Law Enacted	15
United States	10	5	7.5	5	1	5.8	4.9	3.1	78	Law Enacted	13
C. America & Caribbean	..	..	..	..	..	**2.7**	..	..	..	..	..
Belize	..	..	4.5	..	..	2.4	6.2	..	47	Law Enacted	22
Costa Rica	10	5	4.3	77	26	4.7	4.4	..	52	..	19
Cuba	-7	1	4.6	..	..	6.1	8.5	..	38	..	96
Dominican Rep	8	4	3.3	78	25	2.2	..	..	42	Law Enacted	39
El Salvador	7	4	3.7	115	128	3.6	2.5	0.7	38	Pending Effort	42
Guatemala	8	4	2.4	39	63	2.2	1.7	0.8	38	Pending Effort	62
Haiti	-2	3	1.5	203	176	2.5	..	..	15	..	79
Honduras	7	4	2.3	62	73	3.2	..	..	29	Pending Effort	52
Jamaica	9	4	3.8	31	15	2.9	6.3	..	53	Law Enacted	17
Mexico	8	4	3.6	58	17	2.6	..	0.5	50	Law Enacted	36
Nicaragua	8	3	2.6	45	170	3.7	..	1.3	19	Pending Effort	37
Panama	9	5	3.4	19	25	5.3	5.0	..	47	Law Enacted	45
Trinidad and Tobago	..	..	4.6	..	..	1.8	3.8	..	53	Law Enacted	25
South America	..	..	..	..	..	**3.4**	..	**1.5**	..	..	..
Argentina	8	4	2.5	32	16	4.9	4.6	1.3	53	Pending Effort f	35
Bolivia	9	4	2.3	59	174	3.5	5.5	1.5	38	Pending Effort f	37
Brazil	8	4	3.9	155	12	3.1	3.8	1.3	50	Pending Effort	36
Chile	9	4	7.4	27	10	2.9	3.9	2.8	58	Pending Effort	23
Colombia	7	3	3.7	43	27	3.7	4.8	3.4	45	Law Enacted	63
Ecuador	6	3	2.2	92	47	2.2	..	..	41	Law Enacted	42
Guyana	6	3	..	..	..	4.2	..	..	43	..	20
Paraguay	7	3	1.6	74	158	3.0	4.9	1.0	39	Pending Effort	54
Peru	9	4	3.7	98	36	2.6	..	2.0	44	Law Enacted	34
Suriname	..	..	..	..	..	6.3	..	..	46	..	18
Uruguay	10	5	5.5	45	48	5.1	2.8	1.1	54	Pending Effort	26
Venezuela	6	3	2.4	116	15	3.4	..	1.1	47	..	68
Oceania	..	..	..	..	..	**6.2**	**4.9**	**1.6**	..	..	..
Australia	10	5	8.8	2	2	6.2	4.7	1.7	74	Law Enacted	14
Fiji	5	3	..	64	25	2.6	6.0	2.1	43	Pending Effort	29
New Zealand	10	5	9.5	12	0	6.2	6.0	1.3	72	Law Enacted	10
Papua New Guinea	10	5	2.1	56	31	3.8	2.3	0.8	26	Pending Effort	25
Solomon Islands	..	..	..	35	44	4.6	3.5	..	17	..	30

a. Gross national income. **b**. May include subsidies for private or religious schools. **c**. Law is not yet implemented. **d**. Extensive access is available through the national constitution. **e**. Limited implementation. **f**. Executive order implementing FOI adopted. **g**. Laws in Montenegro still pending. **h**. This law is primarily used to supress media, while its FOIA provisions are unused.

Key to Indices:

Level of Democracy (Polity IV): Scaled from -10 to 10, -10 represents a fully autocratic regime, 10 a fully democratic regime. -66 represents an interruption in government due to foreign occupation. -77 signifies a period of interregnum after a collapse of centralized political authority.
Political Competition (Polity IV): Assigned a value from 0 to 5: 0 = unregulated, 1 = most repressed (least competitive), and 5 = most competitive (least repressed).
Corruption Perceptions Index (Transparency International): Scaled from 0 (most corrupt) to 10 (least corrupt).
Digital Access Index (International Telecommunications Union): Scaled from 0 to 100, 100 represents highest access.
Press Freedom Index (Freedom House): Scaled from 1 to 100. 1-30 = Free, 31-60 = Partly Free, 61-100 = Not Free.

Institutions and Governance: Technical Notes

DEFINITIONS AND METHODOLOGY

The **Level of Democracy** is a scale measuring the degree to which a nation is either autocratic or democratic. A score of plus 10 indicates a strongly democratic state; a score of minus 10 a strongly autocratic state. A democratic government possesses fully competitive political participation, institutionalized constraints on executive power, and guarantee of civil liberties to all citizens. An autocratic system sharply restricts or suppresses competitive political participation, and its chief executives are chosen by an elite group and exercise power with few institutionalized constraints.

The **Level of Political Competition** measures the extent to which alternate preferences for policy and leadership can be pursued in the political arena. On a scale of 0-5, one of the following categories is assigned to a country: (0) "Not Applicable" is used for a political system without stable groups. (1) "Repressed" is assigned to totalitarian party systems, authoritarian military dictatorships, and despotic monarchies—any regime where oppositional activity is not permitted outside of the ruling party. Repressed regimes also have the power and ability to carry out systematic repression. (2) "Suppressed" political systems contain some limited political competition outside of government; however, peaceful political competition and large classes of people are excluded from the political process. (3) "Factional" polities contain parochial or ethnic-based political factions that compete for influence in order to promote agendas that favor the interests of group members over common interests. (4) "Transitional" arrangements accommodate competing interests, but some factionalism associated with parochial interests may still be present. (5) "Competitive" systems are characterized by relatively stable and enduring political groups with regular competition and voluntary transfer of power. Small parties or political groups may, however, be restricted.

The Level of Democracy and Political Competition indices are reported by the Polity IV Project of the Center for International Development & Conflict Management. The Polity IV indices are compiled by a panel of experts using multiple historical sources for each country, combined with reference to a variety of standard sources.

The **Corruption Perceptions Index (CPI)** measures the degree to which corruption—the abuse of public office for private gain—is perceived to exist among public officials and politicians. Ratings range in value from 10 (least corrupt) to 0 (most corrupt). CPI is a composite index compiled by Transparency International from the results of 17 surveys reported by 13 different independent institutions.

Regulatory Barriers to Starting a Business measure the average amount of time and money necessary to register and incorporate a new business venture in the largest city of a given country. These two indicators are measured in days and as a percent of the per capita gross national income (GNI). Governments differ significantly in the requirements they set for these processes. Broadly speaking, higher values represent regulatory environments that stifle the creation of new enterprises.

Data are obtained from the World Bank's Doing Business Database. World Bank staff collect this information in an extensive investigative process involving surveys and the input of local experts. Surveys are sent to lawyers working as business retainers in the country of interest. Respondents are asked to list the steps required to begin a business and to estimate both the cost and amount of time required to perform each. Respondents' answers are compared and normalized in order to present a clear picture of the regulations surrounding the start of a business as well as shortcuts and common methods used for compliance. Survey results are corroborated by other in-country experts in business law and practice.

Government Expenditures as a percent of gross domestic product (GDP) roughly indicate the economic importance of public health, public education, and military activities on national economies.

Public Health Expenditure consists of recurrent and capital spending from government (both central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. The estimates of health expenditure come mostly from the World Health Organization's (WHO) *World Health Report 2003* and its subsequent updates, and from the OECD for its member countries, supplemented by World Bank poverty assessments and country-sector studies. Data are also drawn from the World Bank and the International Monetary Fund.

Public Education Expenditure consists of public spending on public education plus subsidies to private education at the primary, secondary, and post-secondary levels. Foreign aid for education is excluded. Education expenditure estimates are provided to the World Bank by the Institute for Statistics of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). UNESCO compiles its data from annual financial reports of central or federal governments and state or regional administrations.

Military Expenditure is defined by the Stockholm International Peace Research Institute (SIPRI) as "all current and capital expenditure on: (a) the armed forces, including peacekeeping forces; (b) defense ministries and other government agencies engaged in defense projects; (c) paramilitary forces, when judged to be trained and equipped for military operations; and (d) military space activities." Expenditures include the cost of procurements, personnel, research and development, construction, operations, maintenance, and military aid to other countries. Civil defense, veteran's benefits, demobilization, and destruction of weapons are not included as military expenditures. SIPRI obtains military expenditure data from several sources. Primary sources include national budget documents, defense white papers, public finance statistics, and responses to surveys. Surveys are administered by either SIPRI, the United Nations, or the Organization for Security and Co-operation in Europe (OSCE). Secondary sources include data published by the North Atlantic Treaty Organization (NATO), the International Monetary Fund (IMF), the *Europa Yearbook,* and country reports of the Economist Intelligence Unit.

The Digital Access Index reflects the ability of each country's population to take advantage of internet communication technologies. It is a composite score of eight variables describing availability of infrastructure, affordability of access, educational level, quality of information and communication technology (ICT) services, and Internet usage. The index is calculated by the International Telecommunications Union (ITU). ITU receives data on information technology from governments and industry associations. Data on education and literacy rates are provided by UNESCO's Institute for Statistics.

Freedom of Information (FOI) Legislation requires disclosure of government records to the public. There are now 48 countries with comprehensive FOI laws, plus a dozen or so countries with FOI-related constitutional provisions that can be used to access information. Data are collected by Privacy International on a country-by-country basis and were last updated in February 2005. ".." in a data column signifies countries with no FOI legislation or no available data.

The **Press Freedom Index** is defined by Freedom House as "the degree to which each country permits the free flow of information," measured on a scale of 1 to 100. Countries with a score between 1 and 30 are considered to have a "free" media; 31 to 60, "partly free"; and 61 to 100, "not free." Freedom House emphasizes that this survey does not measure press responsibility; rather, it measures the degree of freedom in the flow of information. Data are collected from overseas correspondents, staff travel, international visitors, the findings of human rights organizations, specialists in geographic and geopolitical areas, the reports of governments, and a variety of domestic and international news media. The final index measures three separate categories of influence on the media: national laws and administrative decisions; censorship and intimidation; and quotas, licensing biases, or government funding.

FREQUENCY OF UPDATE BY DATA PROVIDERS

All variables are updated annually except for the Digital Access Index, which was most recently released by ITU in November, 2003.

DATA RELIABILITY AND CAUTIONARY NOTES

Many of the data in this table are index calculations and therefore contain an unavoidable amount of subjectivity. Indices typically measure ideas and behaviors rather than discrete physical quantities. While these data can illustrate rough comparisons and trends over time, rigid score comparisons and rankings are discouraged.

Level of Democracy and **Political Competition:** The Polity IV data are subject to substantial cross-checking and inter-coder reliability checks. The least reliable calculations are typically the most recent, due to "the fluidity of real-time political dynamics and the effects this immediacy may have on the assignment of Polity codes in a semi-annual research cycle."

Corruption Perceptions Index (CPI): CPI is based solely on the perceptions of local residents, expatriates, business people, academics, and risk analysts. Hard empirical data such as cross-country comparisons of prosecutions or media reporting are not used because they may measure the extent of anti-corruption efforts instead of the extent of actual corruption.

Regulatory Barriers to Starting a Business: The data have been subject to a rigorous series of quality-control measures in order to ensure accuracy and comparability across countries. However, problems do remain. Data only measure the time and expense of starting an enterprise in the largest city of each country. Only businesses who employ more than 50 people or have more than five local owners are included. Smaller enterprises that are not measured here may have the most difficulty navigating bureaucratic and legal requirements. These data also assume the ability of the business to hire a lawyer well-versed in the regulations regarding the starting of a business, a service not available to many smaller entrepreneurs.

Public Health Expenditure: The values reported here represent the product of an extensive effort by WHO, OECD, and the World Bank to produce a comprehensive data set on national health accounts. Nonetheless, there are some difficulties with the data. Few developing countries have health accounts that are methodologically consistent with national accounting procedures. Data on public spending at the sub-national level is not aggregated in all countries, making total public expenditure on health care difficult to measure. WHO cautions that these data should only be used for an "order of magnitude" estimate, and that specific cross-country comparisons should be avoided.

Public Education Expenditure: Recent data are preliminary. In some cases data refer only to a ministry of education's expenditures, excluding other ministries and local authorities that spend a part of their budget on educational activities. Spending on religious schools, which constitutes a large portion of educational spending in some developing countries, may be included. The World Bank cautions that these data do not measure the effectiveness or levels of attainment in a particular educational system.

Military Expenditure: The entire data set has been carefully compiled with extensive analysis by a single provider, SIPRI, which makes these data fairly reliable. When a time series is not available, or a country's definition of military expenditure differs from SIPRI's, estimates are made based on analysis of official government budget statistics. Estimates are always based on empirical evidence, not assumptions or extrapolations. SIPRI cautions that military expenditure does not relate directly to military capability or security.

Status of Freedom of Information Legislation: While the FOI data have been thoroughly researched, there are unavoidable difficulties in assigning each country to one of three categories. Some countries have laws guaranteeing access, but the laws are not enforced. Others guarantee access to government documents in specific categories, excluding access in other categories. A more thorough description of each country's policies is available at http://www.privacyinternational.org/issues/foia/foia-survey.html.

Press Freedom Index: Freedom House has been reviewing press freedom since 1979; the Press Freedom Survey emerged in its current form in 1994. The data are reproducible and the index components are clear. The data are considered to be reliable; nonetheless, there is an unavoidable amount of subjectivity in any index calculation.

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Energy

Sources: International Energy Agency, World Health Organization, BP plc

	Energy Consumption								Population Relying on Solid Fuels {b} (percent)	Electricity		Proven Fossil Fuel Reserves (million metric toe)			Net Fuel Imports {c} (1000 metric toe)
	Total From All Sources (1000 metric toe)		Per Capita (kgoe)	Consumption by Source (percent), 2001						Consumption Per Capita (kWh)	Percent of Population With Access				
	1991	2001	2001	Fossil Fuels	Solid Biomass	Nuclear	Hydro-electric	Other Renew-ables {a}	2000	2001	2000	Coal 2003	Oil 2003	Natural Gas 2003	2001
World	**8,706,507**	**10,029,096**	**1,631**	**79.5**	**10.4**	**6.9**	**2.2**	**0.7**	**56 d**	**2,326**	**73**	**501,172**	**156,700**	**158,198**	**..**
Asia (excl. Middle East)	**2,215,374**	**3,145,549**	**890**	**75.3**	**18.2**	**4.2**	**1.6**	**0.5**	**75**	**1,087**	**70**	**..**	**..**	**..**	**684,754**
Armenia	..	2,297	744	75.2	0.0	22.6	3.6	0.0	66	1,017	..	..	..	..	1,727
Azerbaijan	..	11,582	1,408	98.5	0.0	0.0	1.0	0.0	37	2,105	..	..	959	1,233	(7,955)
Bangladesh	12,572	20,410	145	61.7	37.9	0.0	0.4	0.0	> 95	99	20	..	..	306	4,276
Bhutan	..	..	..	..	..	..	..	..	< 5	..	..	..	..	..	..
Cambodia	..	..	..	..	..	..	..	..	> 95	..	16	..	..	..	..
China	873,087	1,139,369	887	78.6	18.8	0.4	2.1	0.1	80	1,069	99	58,900	3,238	1,641	3,583
Georgia	..	2,413	462	52.1	26.7	0.0	19.8	0.4	71	1,204	..	..	..	..	1,146
India	379,440	531,453	514	59.3	38.5	0.9	1.2	0.0	81	408	43	55,597	741	769	90,862
Indonesia	99,944	152,304	711	66.2	31.6	0.0	0.6	1.7	50	423	53	2,053	613	2,301	(80,835)
Japan	446,399	520,729	4,091	80.9	0.7	16.0	1.4	0.7	< 5	8,096	100	515	..	..	417,093
Kazakhstan	..	40,324	2,596	97.4	0.2	0.0	1.7	0.0	51	3,312	..	21,667	1,233	1,710	(43,679)
Korea, Dem People's Rep	31,299	20,440	912	90.6	4.9	0.0	4.5	0.0	68	760	20	300	..	..	1,291
Korea, Rep	100,390	194,780	4,132	83.6	0.1	15.0	0.2	0.0	< 5	5,607	100	52	..	..	164,442
Kyrgyzstan	..	2,235	447	59.1	0.2	0.0	47.8	0.0	> 95	1,439	..	..	..	..	983
Lao People's Dem Rep	..	..	..	..	..	..	..	..	95	..	..	..	..	..	..
Malaysia	26,222	51,608	2,197	94.2	4.7	0.0	1.2	0.0	29	2,824	97	..	524	2,165	(25,719)
Mongolia	..	..	..	..	..	..	..	..	67	..	90	..	..	..	..
Myanmar	10,505	12,159	252	21.3	77.4	0.0	1.3	0.0	> 95	94	5	..	..	328	(3,108)
Nepal	5,999	8,416	350	12.8	84.9	0.0	1.9	0.4	> 95	67	15	..	..	..	1,070
Pakistan	44,819	64,506	441	59.3	37.2	0.9	2.5	0.0	76	379	53	755	..	675	16,331
Philippines	28,268	42,151	546	54.1	23.1	0.0	1.4	21.3	85	517	87	..	..	..	21,935
Singapore	14,464	29,158	7,103	99.8	0.0	0.0	0.0	0.0	< 5	7,677	100	..	..	..	47,477
Sri Lanka	5,600	7,923	423	43.7	52.9	0.0	3.4	0.0	89	288	62	..	..	..	3,577
Tajikistan	..	3,036	494	56.4	0.0	0.0	39.8	0.0	> 95	2,172	..	..	..	..	1,655
Thailand	46,447	75,542	1,227	81.9	17.1	0.0	0.7	0.0	72	1,563	82	423	90	393	35,782
Turkmenistan	..	15,309	3,243	101.0	0.0	0.0	0.0	0.0	50	1,400	..	..	75	2,610	(34,979)
Uzbekistan	..	50,650	2,001	98.8	0.0	0.0	1.0	0.0	79	1,796	..	..	81	1,665	(5,068)
Viet Nam	24,824	39,356	497	37.8	58.3	0.0	4.0	0.0	> 95	332	76	100	338	207	(11,157)
Europe	**..**	**3,606,369**	**3,621**	**84.2**	**2.0**	**10.5**	**2.4**	**0.3**	**16**	**5,598**	**..**	**..**	**..**	**..**	**44,742**
Albania	1,862	1,715	549	65.8	7.5	0.0	17.8	0.1	76	1,123	..	..	..	..	808
Austria	26,701	30,721	3,790	77.5	9.0	0.0	11.7	0.6	< 5	7,419	100	..	..	..	20,034
Belarus	..	24,415	2,445	92.7	3.7	0.0	0.0	0.0	11	2,995	..	..	..	..	20,152
Belgium	51,651	59,001	5,743	76.5	0.6	20.5	0.1	0.1	< 5	8,272	100	..	..	..	51,174
Bosnia and Herzegovina	..	4,359	1,072	88.0	4.1	0.0	10.0	0.0	74	1,876	..	..	..	..	1,174
Bulgaria	22,631	19,476	2,424	73.3	2.8	26.2	0.8	0.0	31	3,854	..	908	..	..	9,666
Croatia	..	7,904	1,778	86.1	3.7	0.0	6.8	0.0	16	2,938	..	..	..	..	3,850
Czech Rep	42,916	41,396	4,036	90.6	0.9	9.3	0.4	0.2	< 5	5,891	100	2,597	..	..	11,485
Denmark	19,854	19,783	3,706	88.7	5.0	0.0	0.0	2.3	< 5	6,492	100	..	170	85	(6,111)
Estonia	..	4,697	3,472	89.7	11.4	0.0	0.0	0.0	34	4,766	..	..	..	..	1,763
Finland	29,582	33,815	6,518	56.9	18.7	17.6	3.4	0.1	< 5	15,687	100	..	..	..	18,319
France	239,982	265,570	4,459	53.9	3.6	41.3	2.4	0.3	< 5	7,401	100	19	..	..	139,392
Germany	349,219	351,092	4,263	84.1	1.3	12.7	0.5	0.6	< 5	6,852	100	29,667	..	186	216,864
Greece	22,286	28,704	2,622	94.5	3.3	0.0	0.6	0.7	< 5	4,686	100	958	..	..	21,866
Hungary	27,362	25,340	2,542	82.7	1.3	14.6	0.1	0.0	26	3,426	100	366	..	..	13,511
Iceland	2,123	3,363	11,800	27.1	0.0	0.0	16.8	56.0	< 5	26,947	100	..	..	..	956
Ireland	10,604	14,981	3,876	98.4	1.0	0.0	0.3	0.4	< 5	5,917	100	..	..	..	13,792
Italy	156,817	171,998	2,990	91.9	1.0	0.0	2.3	2.0	< 5	5,318	100	..	106	198	142,337
Latvia	..	4,297	1,828	61.3	29.3	0.0	5.7	0.0	19	2,193	..	..	..	..	2,607
Lithuania	..	8,023	2,303	58.3	8.2	37.2	0.3	0.0	42	2,687	..	..	..	..	4,113
Macedonia, FYR	..	2,608	1,282	89.9	5.7	0.0	2.1	0.9	58	2,799	..	..	..	..	979
Moldova, Rep	..	3,140	734	92.1	1.9	0.0	0.2	0.0	72	940	..	..	..	..	2,908
Netherlands	70,332	77,214	4,831	95.0	0.7	1.3	0.0	0.3	< 5	6,659	100	..	..	1,500	30,064
Norway	22,188	26,607	5,921	54.3	5.0	0.0	38.9	0.1	< 5	25,595	100	..	1,350	2,215	(201,565)
Poland	98,482	90,570	2,343	95.6	4.2	0.0	0.2	0.0	37	3,227	100	14,153	..	104	10,151
Portugal	17,301	24,732	2,465	86.2	7.6	0.0	4.9	0.5	< 5	4,145	100	..	..	..	22,013
Romania	51,476	36,841	1,642	86.6	5.8	3.9	3.5	0.0	45	2,041	..	486	123	280	9,246
Russian Federation	..	621,349	4,289	90.9	0.6	5.8	2.4	0.0	7	5,319	..	68,699	9,500	42,300	(365,972)
Serbia and Montenegro	..	16,061	1,523	86.6	5.0	0.0	6.2	0.0	70	2,869	..	..	..	..	5,033
Slovakia	19,147	18,717	3,470	73.3	1.4	24.1	2.3	0.2	24	5,005	100	..	..	..	11,856
Slovenia	..	6,838	3,440	70.8	5.9	20.0	4.8	0.1	< 5	6,007	..	..	..	..	3,623
Spain	94,662	127,381	3,116	80.3	2.9	13.0	2.8	0.7	< 5	5,501	100	287	..	..	100,320
Sweden	48,185	51,054	5,762	34.5	14.9	36.8	13.3	0.3	< 5	16,021	100	..	..	..	18,477
Switzerland	25,317	28,019	3,906	59.1	1.9	25.0	12.7	0.7	< 5	8,026	100	..	..	..	16,379
Ukraine	..	141,577	2,872	85.2	0.2	14.0	0.7	0.0	56	2,767	..	16,809	..	999	58,412
United Kingdom	218,742	235,158	3,994	88.5	0.4	10.0	0.1	0.4	< 5	6,171	100	833	595	567	(22,602)
Middle East & N. Africa	**378,681**	**577,251**	**1,487**	**96.9**	**1.8**	**0.0**	**0.8**	**0.3**	**17**	**1,848**	**87**	**..**	**..**	**..**	**(1,016,784)**
Afghanistan	..	..	..	..	..	..	..	..	> 95	..	2	..	..	..	..
Algeria	25,217	29,438	957	99.7	0.3	0.0	0.0	0.0	< 5	723	98	..	1,425	4,071	(115,502)
Egypt	32,425	48,012	695	94.7	2.8	0.0	2.5	0.0	23	1,114	94	..	508	1,580	(7,438)
Iran, Islamic Rep	75,352	120,000	1,785	99.0	0.7	0.0	0.4	0.0	< 5	1,689	98	..	17,952	24,021	(126,024)
Iraq	15,545	28,476	1,193	99.7	0.1	0.0	0.2	0.0	< 5	1,471	95	..	15,520	2,798	(94,820)
Israel	12,102	21,193	3,433	97.6	0.0	0.0	0.0	3.0	< 5	6,459	100	..	..	..	20,865
Jordan	3,538	5,116	987	98.1	0.1	0.0	0.1	1.3	10	1,373	95	..	..	..	4,922
Kuwait	4,784	16,368	6,956	100.0	0.0	0.0	0.0	0.0	< 5	15,818	100	..	13,292	1,401	(91,991)
Lebanon	2,883	5,435	1,537	95.0	2.3	0.0	0.5	0.1	< 5	1,824	95	..	..	..	5,141
Libyan Arab Jamahiriya	13,791	15,992	2,995	99.1	0.9	0.0	0.0	0.0	< 5	3,968	100	..	4,688	1,183	(58,285)
Morocco	7,053	11,006	372	93.9	4.0	0.0	0.7	0.2	11	570	71	..	..	..	10,648
Oman	5,956	9,984	3,714	100.0	0.0	0.0	0.0	0.0	< 5	3,247	94	..	756	851	(55,799)
Saudi Arabia	71,407	110,586	4,844	100.0	0.0	0.0	0.0	0.0	< 5	5,886	98	..	36,089	6,010	(364,198)
Syrian Arab Rep	13,037	13,955	822	93.8	0.0	0.0	6.1	0.0	19	1,539	86	..	311	270	(20,422)
Tunisia	5,447	8,243	857	84.6	15.2	0.0	0.1	0.0	29	1,046	95	..	65	..	1,641
Turkey	52,505	72,458	1,046	86.6	8.7	0.0	2.8	1.4	11	1,509	95	1,322	..	..	45,608
United Arab Emirates	20,833	32,624	11,332	100.0	0.0	0.0	0.0	0.0	< 5	12,279	96	..	12,954	5,454	(105,249)
Yemen	3,033	3,560	191	97.8	2.2	0.0	0.0	0.0	66	127	50	..	92	431	(19,029)

For more information, please visit http://earthtrends.wri.org/datatables/energy

	Energy Consumption								Population Relying on Solid Fuels {b} (percent)	Electricity		Proven Fossil Fuel Reserves (million metric toe)			Net Fuel Imports {c} (1000 metric toe)
	Total From All Sources (1000 metric toe)		Per Capita (kgoe)	Consumption by Source (percent), 2001						Consumption Per Capita (kWh)	Percent of Population With Access				
	1991	2001	2001	Fossil Fuels	Solid Biomass	Nuclear	Hydro-electric	Other Renew-ables {a}	2000	2001	2000	Coal 2003	Oil 2003	Natural Gas 2003	2001
Sub-Saharan Africa	..	..	..	..	..	..	..	..	**76**	..	**24**	..	..	..	..
Angola	6,361	8,454	662	30.3	68.7	0.0	1.0	0.0	> 95	101	12	..	1,201	..	(34,979)
Benin	1,703	2,028	318	..	71.2	0.0	0.0	0.0	89	65	22	..	..	..	511
Botswana	..	..	..	..	..	..	..	..	65	..	22	..	..	..	..
Burkina Faso	..	..	..	..	..	..	..	..	> 95	..	13	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	> 95	..	..	..	..	..	..
Cameroon	5,079	6,445	418	16.3	79.0	0.0	4.6	0.0	77	173	20	..	31	..	(6,046)
Central African Rep	..	..	..	..	..	..	..	..	> 95	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	95	..	..	..	..	..	..
Congo	1,082	931	263	29.2	64.9	0.0	3.1	0.0	67	134	21	..	214	..	(12,763)
Congo, Dem Rep	12,116	15,039	302	4.4	93.0	0.0	3.3	0.0	> 95	82	7	..	..	..	(562)
Côte d'Ivoire	4,543	6,497	404	32.5	66.6	0.0	..	0.0	93	194	50	..	..	..	509
Equatorial Guinea	..	..	..	..	..	..	..	..	83	..	..	..	..	..	..
Eritrea	..	771	200	..	68.9	0.0	0.0	0.0	> 95	46	17	..	..	..	244
Ethiopia	15,614	19,161	285	..	93.1	0.0	0.8	0.0	> 95	25	5	..	..	..	1,171
Gabon	1,359	1,702	1,327	39.9	55.7	0.0	4.5	0.0	34	907	31	..	324	..	(13,071)
Gambia	..	..	..	..	..	..	..	..	> 95	..	..	..	..	..	..
Ghana	5,512	8,180	408	26.5	66.3	0.0	6.9	0.0	95	348	45	..	..	..	2,172
Guinea	..	..	..	..	..	..	..	..	> 95	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	95	..	..	..	..	..	..
Kenya	12,535	15,377	495	17.7	78.2	0.0	1.3	2.7	85	118	8	..	..	..	2,801
Lesotho	..	..	..	..	..	..	..	..	85	..	5	..	..	..	..
Liberia	..	..	..	..	..	..	..	..	83	..	..	..	..	..	..
Madagascar	..	..	..	..	..	..	..	..	> 95	..	8	..	..	..	..
Malawi	..	..	..	..	..	..	..	..	> 95	..	5	..	..	..	..
Mali	..	..	..	..	..	..	..	..	> 95	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	69	..	..	..	..	..	..
Mozambique	7,167	7,687	422	6.0	88.3	0.0	9.8	0.0	87	272	7	..	..	..	473
Namibia	652	1,159	601	65.5	15.2	0.0	10.2	0.0	83	1,334	34	..	..	..	759
Niger	..	..	..	..	..	..	..	..	> 95	..	..	..	..	..	..
Nigeria	74,241	95,444	810	21.9	77.5	0.0	0.6	0.0	67	86	40	..	4,635	4,497	(110,304)
Rwanda	..	..	..	..	..	..	..	..	> 95	..	..	..	..	..	..
Senegal	2,235	3,179	330	44.5	55.5	0.0	0.0	0.0	79	137	30	..	..	..	1,446
Sierra Leone	..	..	..	..	..	..	..	..	92	..	..	..	..	..	..
Somalia	..	..	..	..	..	..	..	..	< 5	..	..	..	..	..	..
South Africa	95,393	107,738	2,426	85.5	11.9	2.6	0.2	0.0	28	4,546	66	33,013	..	..	(32,589)
Sudan	10,583	13,525	421	18.9	80.3	0.0	0.8	0.0	< 5	68	30	..	94	..	(8,025)
Tanzania, United Rep	10,007	13,917	391	6.9	91.5	0.0	1.6	0.0	> 95	61	11	..	..	..	938
Togo	1,005	1,422	303	..	74.3	0.0	0.0	0.0	> 95	109	9	..	..	..	323
Uganda	..	..	..	..	..	..	..	..	> 95	..	4	..	..	..	..
Zambia	5,597	6,423	608	10.2	81.5	0.0	10.9	0.0	87	591	12	..	..	..	575
Zimbabwe	9,768	9,882	775	36.3	57.4	0.0	2.6	0.0	67	813	40	335	..	..	886
North America	**2,152,179**	**2,529,598**	**7,929**	**85.3**	**2.5**	**9.1**	**1.8**	**0.8**	**< 5**	**13,416**	**100**	..	..	..	**510,372**
Canada	208,832	248,184	7,999	77.0	4.2	8.1	11.5	0.0	< 5	16,787	100	3,350	2,308 e	1,498	(129,563)
United States	1,943,347	2,281,414	7,921	86.2	2.3	9.2	0.8	0.9	< 5	13,053	100	121,962	4,184	4,711	639,935
C. America & Caribbean	**175,649**	**214,218**	**1,265**	**82.7**	**11.1**	**1.1**	**1.7**	**3.2**	**37**	**1,409**	**85**	..	..	..	**(53,415)**
Belize	..	..	..	..	..	..	..	..	< 5	..	..	..	..	..	..
Costa Rica	2,097	3,481	867	50.8	11.0	0.0	14.0	24.8	58	1,598	96	..	..	..	1,783
Cuba	13,530	13,651	1,215	75.6	24.0	0.0	0.0	0.4	42	1,153	97	..	..	..	7,467
Dominican Rep	4,164	7,810	920	81.0	18.4	0.0	0.6	0.0	48	897	67	..	..	..	6,325
El Salvador	2,797	4,269	676	44.7	32.7	0.0	2.3	19.4	65	579	71	..	..	..	1,886
Guatemala	4,656	7,313	624	44.7	53.3	0.0	2.3	0.0	73	365	67	..	..	..	2,149
Haiti	1,580	2,088	257	..	72.7	0.0	1.1	0.0	82	31	34	..	..	..	547
Honduras	2,431	3,236	489	51.8	41.1	0.0	6.3	0.0	66	524	55	..	..	..	1,836
Jamaica	2,955	4,009	1,540	87.9	11.9	0.0	0.2	0.0	47	2,352	90	..	..	..	3,557
Mexico	129,294	152,273	1,516	88.3	5.4	1.5	1.6	3.2	22	1,809	95	690	2,285	374	(76,813)
Nicaragua	2,184	2,792	537	44.8	48.2	0.0	0.6	6.3	72	335	48	..	..	..	1,274
Panama	1,610	3,180	1,058	78.9	14.6	0.0	6.8	0.0	37	1,358	76	..	..	..	2,653
Trinidad and Tobago	5,730	8,693	6,718	99.7	0.3	0.0	0.0	0.0	< 5	3,982	99	..	265	663	(9,185)
South America	**290,832**	**382,156**	**1,089**	**70.9**	**14.9**	**1.5**	**11.3**	**1.6**	**25**	**1,639**	**90**	..	..	..	**(181,696)**
Argentina	46,421	57,601	1,535	85.8	5.2	3.2	5.5	0.0	< 5	2,126	95	..	440	598	(24,854)
Bolivia	2,878	4,271	504	78.9	16.8	0.0	4.4	0.0	61	411	60	..	..	732	(2,667)
Brazil	134,792	185,083	1,064	60.3	20.3	2.0	12.4	3.3	27	1,794	95	3,976	1,456	221	37,916
Chile	14,106	23,801	1,544	74.4	17.7	0.0	7.8	0.0	15	2,648	99	..	..	..	15,737
Colombia	25,254	29,245	683	72.8	17.9	0.0	9.4	0.0	36	781	81	4,305	206	101	(44,296)
Ecuador	6,289	8,727	692	84.6	8.4	0.0	7.0	0.0	28	654	80	..	649	..	(13,460)
Guyana	..	..	..	..	..	..	..	..	< 5	..	..	..	..	..	..
Paraguay	3,161	3,756	670	27.8	57.9	0.0	103.8 f	0.1	64	841	75	..	..	..	1,063
Peru	9,770	12,113	459	68.4	18.7	0.0	12.5	0.4	40	704	73	..	129	222	2,677
Suriname	..	..	..	..	..	..	..	..	69	..	..	..	..	..	..
Uruguay	2,441	2,703	803	59.1	15.5	0.0	29.3	0.0	< 5	1,940	98	..	..	..	1,953
Venezuela	45,720	54,856	2,216	89.5	1.0	0.0	9.5	0.0	< 5	2,729	94	319	11,239	3,735	(155,765)
Oceania	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Australia	86,717	115,627	5,975	94.2	4.1	0.0	1.2	0.3	< 5	10,316	100	41,547	560	2,294	(134,092)
Fiji	..	..	..	..	..	..	..	..	< 5	..	..	..	..	..	..
New Zealand	13,671	18,294	4,795	70.3	4.4	0.0	10.1	13.0	< 5	8,828	100	202	..	..	3,308
Papua New Guinea	..	..	..	..	..	..	..	..	> 95	..	..	..	51	385	..
Solomon Islands	..	..	..	..	..	..	..	..	< 5	..	..	..	..	..	..
Developed	..	**6,112,050**	**4,600**	**83.9**	**2.4**	**10.4**	**2**	**0.7**	**14**	**7578.3**	..	..	..	..	**1,105,717**
Developing	**2,789,194**	**3,911,044**	**828**	**73.6**	**21.7**	**1.4**	**2**	**0.7**	**67**	**896.2**	**67**	..	..	..	**(1,071,719)**

One **toe** equals one ton of oil equivalent; one **kgoe** equals one kilogram of oil equivalent.

a. Other renewables refer to biogas, liquid biomass, geothermal, solar, wind, and wave energy. **b**. Solid fuels include biomass and fossil fuels burned directly by a household. **c**. Net Fuel Imports are equal to imports minus exports and includes crude oil, petroleum products, coal and coal products, and natural gas. **d**. World totals are calculated by WRI. **e**. Includes an official estimate of oil sands under active development. **f**. Paraguay exports significant amounts of the hydroelectricity listed here to neighboring countries.

Energy: Technical Notes

DEFINITIONS AND METHODOLOGY

Total Energy Consumption is the amount of primary energy from all sources (coal, nuclear, hydroelectric, etc.) used annually by a particular country or region. Consumption equals indigenous production plus imports minus exports, stock changes, and energy delivered to international marine bunkers. Energy losses from transportation, friction, heat, and other inefficiencies are included here. The original source material published by the International Energy Agency (IEA) refers to these values as Total Primary Energy Supply (TPES). To facilitate comparisons among different sources of energy, the heat content of all energy commodities is presented in metric tons of oil equivalent (toe), which measures the energy contained in a metric ton (1000 kg) of crude oil. One toe is equal to 10^7 kilocalories, 41.868 gigajoules, or 11,628 kilowatt-hours (kWh).

Basic energy statistics are collected by the IEA from a variety of sources. In OECD member countries, national administrations fill out five annual questionnaires. In non-OECD countries, statistics are collected from the distribution of questionnaires, communication with international organizations such as the United Nations, co-operation with national statistical bodies, and direct contact with energy consultants and companies. If data are not available from any of these sources, they are estimated by the IEA. The energy produced by fossil fuels is calculated using conversion factors per unit mass of fuel (e.g., 10,000 kcal/kg of oil). Since energy sources such as coal and crude oil may vary in quality, the IEA uses specific conversion factors supplied by national administrations for the main categories of energy sources and uses (i.e., production, imports, exports). The energy produced by non-fossil fuels is more complicated to measure; the IEA must first assume a primary form of energy to measure using global or regional efficiency averages, and then calculate the primary energy equivalent. Please refer to the original source for further information on the variables and collection methodologies.

Energy Consumption Per Capita is the amount of energy, as defined above, consumed on average by each person, expressed in kilograms of oil equivalent (kgoe). This variable was calculated by dividing total consumption by population figures from the United Nations Population Division.

Energy Consumption by Source data show the amount of energy consumed in five different categories as a percentage of total consumption:

Fossil Fuels include crude oil and natural gas liquids, petroleum products, coal and coal products, and natural gas. Coal and coal products include hard coal, lignite, patent fuel, coke, blast furnace gas, coke-oven gas, brown coal briquettes (BKB), and peat. Oil and natural gas products include crude oil, natural gas liquids, refinery feedstocks, petroleum products, natural gas, gas works gas, and other hydrocarbons. The inclusion of petroleum products accounts for domestic processing of crude oil as well as assorted petroleum imports. Petroleum products refer to refinery gas, ethane, liquified petroleum gas, aviation gasoline, motor gasoline, jet fuels, kerosene, gas/diesel oil, heavy fuel oil, naphtha, white spirit, lubricants, bitumen, paraffin waxes, petroleum coke, and other products.

Solid Biomass includes any plant matter used directly as a fuel or converted into other forms before combustion, including wood; vegetal waste including wood waste and crop waste used for energy; animal materials and wastes; sulphite lyes (also known as black liquor, this is a sludge that contains the lignin digested from wood for paper making); and other solid biomass. Inputs to charcoal production are included here. However, since charcoal is a secondary product, the IEA excludes final charcoal production numbers to avoid double counting.

Nuclear includes all energy produced by nuclear power plants from nuclear fission. The consumption data shown here assume an average thermal efficiency of 33 percent.

Hydroelectric shows the energy content of the electricity produced in hydro power plants. The output from pumped storage plants is not included in these values.

Other Renewables include energy from biogas, liquid biomass, geothermal, solar, ocean, and wave systems. *Biogas energy* is produced by the fermentation of animal dung, human sewage or crop residues. *Liquid biomass energy* is produced from bio-additives such as ethanol (alcohol). *Geothermal technologies* use the heat of the earth to generate energy. *Solar energy* includes the production of electricity from solar photovoltaic cells as well as the production of both electricity and heat from solar thermal energy. Passive solar energy for the direct heating, cooling, and lighting of dwellings or other buildings is not included here. *Ocean energy* includes the production of electricity from the mechanical energy of ocean waves and tides or from the thermal energy (heat) stored in the ocean. *Wind energy* uses the mechanical energy of the wind for generating electricity.

Population Relying on Solid Fuels measures the percentage of the total population that burns solid fuels in their households. Solid fuels include coal or biomass such as dung, charcoal, wood, or crop residues. The World Health Organization (WHO) measures the prevalence of solid fuel usage because the burning of solid fuels in traditional stoves causes high levels of indoor air pollution, emitting dangerous pollutants such as carbon monoxide and particulates.

Electricity Consumption per Capita measures the average kilowatt-hours (kWh) of electrical power generated per person in a particular country or region. Public electricity plants, private electricity plants, and combined heat and power (CHP) plants are all included. Electricity output from crude oil and natural gas liquids is not included here. Electricity consumption equals production and imports minus exports and distribution losses.

Population with Access to Electricity is defined as the percentage of the total population that has electrical power in their home. It includes commercially sold electricity, both on and off the grid. For those countries where access to electricity has been assessed through government surveys, it also includes self-generated electricity.

Proved Fossil Fuel Reserves are generally measured as quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions. In order to facilitate comparisons among different sources of energy, fossil fuel reserves estimates have been converted to metric tons of oil equivalent (toe). A toe measures the energy contained in a metric ton (1000 kg) of crude oil. **Coal** reserves include anthracite, bituminous, sub-bituminous, and lignite coal. The standard conversion factors for one ton of oil equivalent are 1.5 tons of anthracite and bituminous coal and 3 tons of sub-bituminous and lignite coal. **Oil** includes gas condensate and natural gas liquids (NGLs) as well as crude oil. Estimates were converted to metric tons of oil equivalent by BP, the data provider, using individual country conversion factors. **Natural Gas** was converted using the standard conversion factor of 0.9 million metric tons of oil equivalent per billion cubic meters of natural gas.

Net Fuel Imports measures the amount of fossil fuel that enters the national territorial boundaries of a country, whether or not customs clearance has taken place, minus the amount that leaves via export. Fossil fuel includes crude oil and natural gas liquids, petroleum products, coal and coal products, and natural gas. Quantities of crude oil and oil products imported under processing agreements (i.e., refining on account) are included. Quantities of oil in transit are excluded. Re-exports of oil imported for processing within bonded areas are shown as exports of product from the processing country to the final destination. Petroleum products refer to refinery gas, ethane, liquified petroleum gas, aviation gasoline, motor gasoline, jet fuels, kerosene, gas/diesel oil, heavy fuel oil, naphtha, white spirit, lubricants, bitumen, paraffin waxes, petroleum coke, and other petroleum products. Natural gas and gas-works gas are included. Natural gas is reported as coming from the country of origin. Coal imports includes all coal, both primary (including hard coal and lignite/brown coal) and derived fuels (including patent fuel, coke-oven coke, gas coke, BKB, coke oven gas, and blast furnace gas). Peat is also included. In most cases, coal in transit is not included. Regional totals include goods imported from other countries belonging to the same region. Consequently, these totals by no means represent a region's net imports or net exports.

FREQUENCY OF UPDATE BY DATA PROVIDERS

IEA and BP update their energy data annually. WHO updates their information every two years. These updates also often include revisions of past data. Data may therefore differ from those reported in past editions of the World Resources Report.

DATA RELIABILITY AND CAUTIONARY NOTES

Energy

The data on energy balances are based primarily on well-established and institutionalized accounting methodologies and are therefore considered reliable. One exception is fuelwood and other biomass fuels, which are estimated by the IEA based on small sample surveys or other incomplete information. Energy production estimates from nuclear power and renewable sources (hydroelectric, solar, geothermal, and wind power) are calculated using a number of assumptions about primary energy forms and plant efficiencies. As a result, these values may be less reliable than estimates of energy produced from fossil fuels, and the share of renewables in total energy consumption may appear different here than it would from other providers.

IEA data do not distinguish between "no data" (denoted in these tables with "..") and zero values. WRI has distinguished between the two where possible, but some values represented as zero should probably be indicated by ".." and vice versa.

Proven Fossil Fuel Reserves

Every effort is made to come up with a consistent series for reserves based on a common definition; however, in reality, different countries use different methodologies, and the data have varying levels of reliability. Since energy sources such as coal may vary in quality, converting the estimates into toe using standard conversion factors, rather than country specific conversion factors, introduces a level of uncertainty to the reserve estimates shown here.

Percent of Population Relying on Solid Fuels

The estimates of household solid fuel use were compiled with the help of several studies conducted over the past decade. It has been assumed that patterns in solid fuel use have not changed dramatically over this time period.

SOURCES

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Solid Fuel Use: World Health Organization (WHO). 2004. *World Health Report,* Annex Table 7. Geneva: World Health Organization (WHO). Online at http://www.who.int/whr/2004/en/09_annexes_en.pdf.

Proven Reserves Data: BP plc. 2004. *Statistical Review of World Energy.* London: BP plc. Online at http://www.bp.com/statisticalreview2004.

Climate and Atmosphere

Sources: World Resources Institute, International Energy Agency, United Nations Framework Convention on Climate Change

	Carbon Dioxide (CO_2) Emissions (a)				Cumulative CO_2 Emissions (million metric tons)		CO_2 Emissions by Sector (as a percent of total CO_2 emissions)			Emissions (in million metric tons CO_2 equivalent) of			Total GHG Emissions (c) (million metric tons CO_2 equivalent)	Kyoto Protocol Status (year ratified, n.r. = not ratified) (d)
	Total		Per Capita											
	(million metric tons) 2000	(percent change since 1990)	(metric tons per person) 2000	(percent change since 1990)	From Fossil Fuels & Cement 1950-2000	From Land-Use Change 1950-2000	Trans-portation 2000	Industry & Construc-tion 2000	Elec-tricity 2000	Methane 2000	Nitrous Oxide 2000	Fluori-nated Gases (b) 2000	2000	
World	**23,895.7**	**12.7**	**3.9**	**(2.3)**	**781,501**	**315,122**	**24.1**	**18.5**	**38.3**	**5,948.2**	**3,402.9**	**374.3**	**33,309**	**..**
Asia (excl. Middle East)	**7,837.0**	**35.1**	**2.2**	**17.9**	**175,087**	**163,621**	**13.3**	**24.7**	**40.1**	**2,149.9**	**1,395.9**	**123.3**	**11,471**	**..**
Armenia	3.7	(44.5)	1.2	(36.7)	219	..	13.9	34.2	38.9	2.8	0.3	0.0	7	2003
Azerbaijan	29.5	(39.1)	3.6	(46.3)	1,630	..	5.2	17.2	49.8	11.9	0.8	0.2	42	2000
Bangladesh	29.9	105.6	0.2	63.2	433	(273)	10.8	35.4	31.6	47.6	44.8	0.0	122	2001
Bhutan	0.4	203.1	0.2	150.7	4	0	..	..	..	1.1	0.3	0.0	2	2002
Cambodia	0.5	18.8	0.0	(10.9)	18	1,658	..	..	..	68.0	0.1	0.0	69	2002
China	3,473.6	39.3	2.7	26.2	71,662	38,909	6.9	29.0	41.8	802.9	644.7	45.6	4,942	2002
Georgia	6.2	(35.2)	1.2	(32.7)	321	..	27.3	13.5	27.8	4.4	1.1	0.0	12	1999
India	1,008.0	63.7	1.0	36.3	18,195	(1,191)	12.2	21.8	51.8	445.3	399.0	1.8	1,837	2002
Indonesia	286.0	96.8	1.4	69.4	4,213	75,740	22.7	21.0	22.6	169.2	38.7	0.5	495	2004
Japan	1,224.7	12.3	9.6	9.2	37,155	5,008	21.8	20.3	35.7	21.8	37.0	50.3	1,333	2002 e
Kazakhstan	123.7	(51.7)	7.9	(48.1)	8,469	..	5.4	26.4	47.8	27.3	7.8	0.2	159	n.r.
Korea, Dem People's Rep	168.3	(19.2)	7.6	(27.6)	4,987	313	2.5	61.3	16.4	33.5	6.5	0.2	209	2005
Korea, Rep	470.0	85.4	10.0	69.7	6,971	867	20.2	19.1	32.6	25.0	16.1	14.4	525	2002
Kyrgyzstan	4.8	(55.7)	1.0	(60.4)	362	..	13.3	21.1	41.7	2.2	0.1	0.0	7	2003
Lao People's Dem Rep	0.4	78.8	0.1	39.3	11	698	..	..	..	6.2	0.1	0.0	7	2003
Malaysia	123.6	120.3	5.4	70.9	1,714	20,654	26.2	23.1	25.5	30.4	13.3	0.6	169	2002
Mongolia	7.3	(27.1)	2.9	(35.3)	248	69	..	..	..	8.2	12.1	0.0	28	1999
Myanmar	8.9	108.1	0.2	78.1	217	12,571	37.5	18.8	26.6	61.1	12.5	0.0	82	2003
Nepal	3.2	235.0	0.1	163.5	34	3,648	26.0	35.0	0.6	16.4	11.3	0.0	32	n.r.
Pakistan	106.0	62.7	0.7	26.6	1,833	1,292	24.7	26.2	32.6	94.7	84.6	0.2	285	2005
Philippines	75.3	77.5	1.0	43.4	1,507	2,803	33.5	13.3	32.5	34.2	20.8	0.6	133	2003
Singapore	61.1	103.4	15.2	52.8	913	1	9.8	4.1	39.7	1.2	0.9	0.9	64	n.r.
Sri Lanka	11.2	167.6	0.6	142.3	202	873	52.8	10.1	26.6	13.3	2.9	0.0	28	2002
Tajikistan	4.5	(67.5)	0.7	(71.6)	448	..	46.7	0.0	14.0	1.4	0.1	2.3	8	n.r.
Thailand	171.7	93.5	2.8	72.7	2,377	1,407	28.3	22.8	35.0	75.9	13.1	0.6	261	2002
Turkmenistan	34.6	(18.0)	7.4	(35.2)	1,441	..	4.3	0.0	25.8	27.1	0.6	0.0	62	1999
Uzbekistan	121.0	(16.7)	4.9	(31.4)	4,992	..	8.7	16.4	29.9	46.2	13.5	0.1	181	1999
Viet Nam	47.5	147.6	0.6	108.9	854	(1,440)	32.5	26.4	22.8	68.1	12.9	0.1	130	2002
Europe	**6,071.0**	**(18.3)**	**8.3**	**(19.0)**	**292,323**	**14,591**	**13.1**	**13.5**	**33.8**	**987.1**	**518.9**	**77.9**	**7,638**	**..**
Albania	3.1	(55.1)	1.0	(52.6)	183	26	47.8	15.9	8.0	0.5	0.1	0.0	4	2005
Austria	64.4	8.1	7.9	3.1	2,465	45	28.3	25.4	21.1	9.7	2.8	1.1	79	2002 e
Belarus	59.6	(40.5)	5.9	(39.1)	3,358	45	10.5	16.3	53.1	21.6	8.3	0.1	79	n.r. e
Belgium	125.0	13.7	12.2	10.5	5,626	..	20.4	28.4	20.9	11.7	13.3	0.9	148	2002 e
Bosnia and Herzegovina	14.3	(41.6)	3.6	(36.8)	620	0	12.7	14.4	63.2	1.4	0.6	0.6	17	n.r.
Bulgaria	44.7	(43.0)	5.5	(38.6)	2,774	(17)	12.5	22.9	56.4	10.0	18.5	0.2	62	2002 e
Croatia	19.2	(39.9)	4.3	(34.5)	733	(4)	25.3	20.5	23.5	3.8	3.4	0.2	26	n.r. e
Czech Rep	124.1	(19.3)	12.1	(19.0)	6,744	(1)	11.1	20.5	52.1	10.8	8.2	0.4	143	2001 e
Denmark	51.3	2.0	9.6	(1.5)	2,490	8	23.9	10.9	46.4	6.0	9.3	0.5	66	2002 e
Estonia	14.9	(39.7)	10.9	(30.2)	833	16	10.8	7.3	72.3	2.4	0.4	0.0	22	2002 e
Finland	56.6	4.5	10.9	0.6	2,000	241	22.0	21.2	39.8	4.3	7.3	0.3	69	2002 e
France	363.5	(3.6)	6.1	(7.8)	18,619	52	39.3	21.6	12.0	59.3	72.3	7.6	512	2002 e
Germany	837.4	(15.2)	10.2	(18.1)	47,002	188	20.7	15.8	39.0	62.7	60.5	11.0	989	2002 e
Greece	92.2	21.6	8.5	13.4	2,084	(51)	22.7	12.5	51.5	10.9	11.2	2.4	120	2002 e
Hungary	56.9	(18.2)	5.7	(15.3)	3,033	6	16.2	14.1	40.3	11.3	12.9	0.4	76	2002 e
Iceland	2.2	8.5	7.9	(1.9)	81	..	29.2	35.6	0.0	0.3	0.1	0.2	3	2002 e
Ireland	42.8	29.8	11.2	19.5	1,186	(36)	25.8	12.9	38.6	12.9	9.8	0.5	67	2002 e
Italy	446.6	7.0	7.8	5.5	14,625	(5)	26.5	18.7	32.1	37.0	43.5	7.6	531	2002 e
Latvia	6.5	(55.4)	2.7	(49.0)	483	28	33.6	16.4	42.7	2.6	1.2	0.1	10	2002 e
Lithuania	11.6	(47.9)	3.3	(44.3)	747	23	27.2	18.0	34.4	5.9	3.5	0.1	15	2003 e
Macedonia, FYR	8.9	(11.1)	4.4	(16.2)	359	..	11.7	12.3	70.5	1.3	1.1	0.0	11	n.r.
Moldova, Rep	6.7	(65.0)	1.6	(64.3)	629	..	7.8	7.6	61.1	2.6	1.6	0.0	11	2003
Netherlands	174.8	10.4	11.0	3.8	6,370	2	19.1	20.6	31.6	21.6	17.2	4.5	216	2002 e
Norway	35.3	21.7	7.9	15.4	1,203	(18)	33.8	22.8	1.1	7.1	5.1	3.1	51	2002 e
Poland	303.8	(15.2)	7.9	(16.4)	15,873	52	8.7	17.1	53.8	47.2	23.9	0.5	382	2002 e
Portugal	64.8	48.8	6.5	47.1	1,254	(95)	30.5	21.3	35.5	14.3	8.1	0.3	79	2002 e
Romania	90.7	(48.5)	4.0	(46.8)	5,842	82	11.0	22.0	47.3	36.1	7.2	1.7	125	2001 e
Russian Federation	1,540.4	(32.1)	10.6	(30.9)	76,722	13,838	11.6	13.9	56.6	298.7	51.5	14.5	1,919	2004 e
Serbia and Montenegro	44.4	(27.7)	4.2	(30.5)	1,688	3	12.4	16.6	61.1	9.5	6.1	0.8	59	n.r.
Slovakia	36.9	(35.4)	6.9	(37.0)	2,303	22	11.4	29.7	40.5	4.2	3.2	0.3	46	2002 e
Slovenia	15.1	11.3	7.6	7.3	498	8	26.6	19.5	37.6	2.5	2.0	0.2	19	2002 e
Spain	304.9	35.1	7.5	30.3	7,662	(115)	32.3	19.3	32.5	39.6	30.1	7.4	381	2002 e
Sweden	48.8	(2.0)	5.5	(5.3)	3,017	257	48.2	23.8	13.7	7.1	7.1	0.7	64	2002 e
Switzerland	41.8	(6.0)	5.8	(10.4)	1,733	11	37.2	17.8	5.3	5.0	3.7	0.6	50	2003 e
Ukraine	348.4	(44.7)	7.0	(42.2)	21,048	..	4.9	27.6	27.9	153.5	19.9	0.5	517	2004 e
United Kingdom	558.2	(3.3)	9.5	(6.4)	29,791	(21)	24.4	12.2	33.4	51.1	43.8	8.6	660	2002 e
Middle East & N. Africa	**1,531.5**	**58.6**	**3.8**	**27.2**	**27,645**	**3,035**	**17.9**	**20.9**	**30.4**	**458.3**	**175.9**	**5.0**	**2,163**	**..**
Afghanistan	0.9	(65.7)	0.0	(77.7)	74	427	..	..	..	13.2	7.5	0.0	22	n.r.
Algeria	74.2	21.3	2.5	0.3	1,531	115	11.3	9.7	24.9	28.5	9.2	0.4	112	2005
Egypt	127.1	42.1	1.9	16.9	2,417	136	22.4	30.6	27.5	34.3	16.0	0.5	178	2005
Iran, Islamic Rep	297.9	59.1	4.5	35.8	5,528	565	22.9	20.4	22.0	96.9	43.8	0.2	439	n.r.
Iraq	78.5	31.1	3.4	(2.1)	1,704	9	36.6	23.2	23.8	14.4	6.5	0.0	100	n.r.
Israel	62.7	70.7	10.4	27.5	1,177	6	18.6	8.9	57.8	11.4	1.7	1.5	77	2004
Jordan	15.5	51.5	3.1	(2.1)	268	1	24.7	15.0	36.5	7.9	0.2	0.1	24	2003
Kuwait	58.5	173.6	26.0	160.9	1,167	0	9.6	25.7	37.8	9.9	0.2	0.3	69	2005
Lebanon	15.6	127.4	4.5	77.3	330	33	27.8	18.8	40.6	1.3	1.1	0.1	18	n.r.
Libyan Arab Jamahiriya	42.3	48.5	8.1	22.1	885	37	25.3	12.3	32.1	9.6	2.5	0.0	54	n.r.
Morocco	33.2	59.9	1.1	35.0	651	98	6.0	16.6	37.5	10.0	15.7	0.0	58	2002
Oman	25.0	131.0	9.6	63.3	255	0	11.8	30.9	33.0	3.7	1.0	0.1	30	2005
Saudi Arabia	266.1	75.8	12.0	31.4	4,081	0	11.7	10.3	25.4	54.4	8.7	0.7	330	2005
Syrian Arab Rep	51.3	51.8	3.1	16.6	878	6	11.6	21.7	31.9	9.7	9.4	0.2	71	n.r.
Tunisia	20.2	40.4	2.1	21.1	394	184	22.8	23.7	34.6	4.8	5.2	0.1	30	2003
Turkey	223.9	48.7	3.3	25.5	4,085	1,395	17.2	27.3	36.5	97.4	40.6	0.5	356	n.r. e
United Arab Emirates	72.3	66.6	25.6	20.2	1,028	..	8.0	43.0	45.1	35.2	0.1	0.2	108	2005
Yemen	10.4	34.8	0.6	(10.7)	246	18	51.3	5.6	17.4	8.7	5.6	0.0	25	2004

For more information, please visit http://earthtrends.wri.org/datatables/climate

	Carbon Dioxide (CO_2) Emissions {a}				Cumulative CO_2 Emissions (million metric tons)		CO_2 Emissions by Sector (as a percent of total CO_2 emissions)			Emissions (in million metric tons CO_2 equivalent) of			Total GHG Emissions {c} (million metric tons CO_2 equivalent)	Kyoto Protocol Status (year ratified, n.r. = not ratified) {d}
	Total		Per Capita											
	(million metric tons) 2000	(percent change since 1990)	(metric tons per person) 2000	(percent change since 1990)	From Fossil Fuels & Cement 1950-2000	From Land-Use Change 1950-2000	Trans-portation 2000	Industry & Construc-tion 2000	Elec-tricity 2000	Methane 2000	Nitrous Oxide 2000	Fluori-nated Gases {b} 2000	2000	
Sub-Saharan Africa	**492.1**	**19.7**	**0.8**	**(8.3)**	**13,867**	**39,934**	**..**	**..**	**..**	**498.7**	**350.6**	**8.5**	**1,323**	**..**
Angola	4.9	9.3	0.4	(17.5)	123	507	20.1	42.0	10.4	15.8	6.1	0.0	26	n.r.
Benin	1.7	325.4	0.3	216.7	20	1,030	60.3	9.9	3.3	3.3	2.7	0.0	7	2002
Botswana	4.0	85.9	2.3	45.9	52	560	..	..	..	7.0	4.8	0.0	15	2003
Burkina Faso	1.1	8.9	0.1	(18.0)	19	18	..	..	..	8.8	11.7	0.0	21	2005
Burundi	0.2	23.7	0.0	8.6	5	207	..	..	..	1.8	1.2	0.0	3	2001
Cameroon	3.4	12.2	0.2	(13.4)	75	2,193	62.3	7.4	1.0	11.8	9.8	2.3	27	2002
Central African Rep	0.3	44.4	0.1	14.9	7	255	..	..	..	6.6	5.1	0.0	11	n.r.
Chad	0.1	(9.1)	0.0	(32.0)	6	99	..	..	..	9.6	8.7	0.0	18	n.r.
Congo	0.8	(10.2)	0.2	(34.9)	28	281	59.5	10.8	0.0	3.2	1.0	..	5	n.r.
Congo, Dem Rep	2.5	(42.5)	0.1	(55.6)	153	9,025	26.4	37.4	1.1	32.9	17.2	0.0	53	2005
Côte d'Ivoire	7.1	131.3	0.5	82.6	133	2,592	18.2	8.8	30.9	6.5	2.9	0.0	16	n.r.
Equatorial Guinea	0.7	512.0	1.6	374.3	5	126	..	..	..	0.3	0.2	0.0	1	2000
Eritrea	0.6	..	0.2	..	6	..	33.3	6.7	23.3	0.0	..	0.0	1	n.r.
Ethiopia	3.6	42.0	0.1	5.7	73	240	55.5	27.1	0.6	47.5	12.2	0.0	59	2005
Gabon	1.5	21.5	1.2	(8.0)	69	104	27.3	25.2	29.4	3.8	1.8	0.0	7	n.r.
Gambia	0.3	46.6	0.2	4.4	6	(7)	..	..	..	0.7	0.5	0.0	1	2001
Ghana	5.9	85.9	0.3	44.5	125	794	52.0	14.2	10.4	7.1	7.4	0.2	20	2003
Guinea	1.3	32.1	0.2	0.0	40	297	..	..	..	5.7	2.4	0.0	9	2000
Guinea-Bissau	0.3	36.8	0.2	1.5	6	32	..	..	..	0.9	0.8	0.0	2	n.r.
Kenya	10.2	39.9	0.3	8.1	242	339	41.3	9.7	25.2	21.5	22.6	0.0	53	2005
Lesotho	0.2	35.5	0.1	19.2	3	0	..	..	..	1.2	1.5	0.0	3	2000
Liberia	0.4	(8.8)	0.1	(33.9)	35	1,120	..	..	..	1.2	0.8	0.0	2	2002
Madagascar	2.5	161.9	0.2	94.9	46	1,713	..	..	..	18.9	11.6	0.0	32	2003
Malawi	0.8	30.1	0.1	7.8	26	760	..	..	..	3.6	2.3	0.0	6	2001
Mali	0.6	34.9	0.0	2.1	15	228	..	..	..	12.0	13.8	0.0	25	2002
Mauritania	3.1	19.1	1.2	(8.6)	53	..	..	..	..	4.4	6.4	0.0	14	n.r.
Mozambique	1.2	16.9	0.1	(11.7)	92	264	68.3	5.7	0.8	11.1	3.2	0.0	15	2005
Namibia	1.9	..	1.0	..	18	65	63.1	7.5	1.6	4.5	4.2	0.0	10	2003
Niger	1.2	14.1	0.1	(19.0)	26	20	..	..	..	6.5	5.0	0.0	12	2004
Nigeria	48.1	20.4	0.4	(9.7)	1,054	5,540	42.9	12.7	12.3	72.5	41.6	0.3	163	n.r.
Rwanda	0.6	12.9	0.1	(1.3)	12	212	..	..	..	2.2	1.2	0.0	4	2004
Senegal	3.9	62.0	0.4	26.7	86	102	35.0	16.6	37.0	8.4	6.6	0.0	19	2001
Sierra Leone	0.6	71.8	0.1	58.5	22	379	..	..	..	2.6	0.9	0.0	4	n.r.
Somalia	..	..	..	..	..	148	..	..	..	..	..	..	..	n.r.
South Africa	344.6	16.8	7.8	(2.2)	10,165	49	10.4	17.4	53.8	37.4	25.8	5.4	413	2002
Sudan	5.9	5.4	0.2	(16.6)	166	867	48.1	15.1	23.3	46.6	47.1	0.1	96	2004
Tanzania, United Rep	2.7	16.7	0.1	(13.5)	89	414	53.9	22.2	20.4	31.7	27.1	0.0	59	2002
Togo	1.6	117.7	0.4	65.0	21	245	31.0	52.4	4.8	2.1	2.3	0.0	6	2004
Uganda	1.4	77.4	0.1	29.8	37	1,118	..	..	..	12.4	12.9	0.0	27	2002
Zambia	1.9	(35.6)	0.2	(49.4)	168	6,697	42.1	42.7	3.5	11.2	5.5	0.0	18	n.r.
Zimbabwe	14.1	(5.2)	1.1	(21.6)	468	1,349	15.9	22.1	38.2	11.0	8.6	0.1	33	n.r.
North America	**6283.5**	**18.2**	**19.9**	**6.1**	**229,327**	**(21,005)**	**30.1**	**12.1**	**40.7**	**736.8**	**487.4**	**137.4**	**7,599**	**..**
Canada	521.4	22.1	16.9	9.9	17,275	5,194	29.1	18.2	25.5	123.4	57.5	11.3	675	2002 e
United States	5762.1	17.9	20.2	5.8	212,052	(26,199)	30.2	11.5	42.1	613.4	430.0	126.1	6,924	n.r. e
C. America & Caribbean	**507.5**	**28.6**	**3.0**	**7.8**	**12,276**	**13,469**	**27.6**	**18.3**	**32.9**	**161.7**	**50.5**	**4.7**	**725**	**..**
Belize	0.8	165.9	3.4	106.1	10	949	..	..	..	0.2	0.2	0.0	1	2003
Costa Rica	5.2	67.5	1.3	31.1	104	439	64.5	17.8	1.3	3.6	3.6	0.1	12	2002
Cuba	31.4	(5.7)	2.8	(10.5)	1,151	(399)	6.4	45.2	39.9	9.1	9.3	0.2	50	2002
Dominican Rep	19.9	102.1	2.4	70.8	317	0	35.2	7.7	34.3	5.9	4.3	0.0	30	2002
El Salvador	6.6	148.1	1.1	104.4	111	184	46.7	20.9	20.6	3.2	2.2	0.1	12	1998
Guatemala	10.1	124.0	0.9	71.7	168	2,514	43.7	14.5	25.5	6.2	5.2	0.1	22	1999
Haiti	1.4	35.6	0.2	17.3	31	89	49.6	20.6	13.5	3.4	2.6	0.0	7	2005
Honduras	5.0	97.9	0.8	49.1	89	782	40.8	26.8	23.4	4.9	3.5	0.0	14	2000
Jamaica	10.3	40.8	4.0	29.3	268	117	19.1	5.5	54.1	1.3	1.3	0.1	13	1999
Mexico	385.1	24.7	3.9	4.9	9,238	4,300	28.1	15.9	33.2	111.7	10.0	4.1	511	2000
Nicaragua	3.6	54.2	0.7	16.3	82	2,385	41.9	11.3	40.7	5.3	4.0	0.0	13	1999
Panama	5.7	110.7	1.9	72.2	141	2,110	38.7	18.5	17.4	3.3	2.7	0.0	12	1999
Trinidad and Tobago	18.1	45.2	14.0	36.9	384	..	9.6	40.9	22.5	3.1	0.3	0.0	22	1999
South America	**796.9**	**42.0**	**2.3**	**21.0**	**20,753**	**91,234**	**35.4**	**25.7**	**13.4**	**639.0**	**369.3**	**11.4**	**1,812**	**..**
Argentina	139.0	31.1	3.7	15.0	4,322	2,448	32.2	15.3	19.4	86.7	63.4	0.7	287	2001
Bolivia	11.7	110.0	1.4	68.2	201	3,723	25.0	7.3	10.6	21.3	5.8	0.0	39	1999
Brazil	327.9	53.3	1.9	32.8	7,323	60,946	40.8	30.6	9.2	297.2	207.7	8.3	842	2002
Chile	54.8	72.9	3.6	48.7	1,204	687	30.5	21.7	26.1	14.5	7.5	0.1	77	2002
Colombia	64.0	23.3	1.5	2.4	1,800	4,715	31.4	33.0	11.9	55.5	41.2	0.2	161	2001
Ecuador	20.7	58.8	1.7	31.2	414	2,616	47.0	16.9	11.9	16.2	2.9	0.1	40	2000
Guyana	1.6	44.1	2.1	38.7	60	1,551	..	..	..	1.4	0.8	0.0	4	2003
Paraguay	3.7	70.8	0.7	31.7	68	916	84.9	7.9	0.6	12.3	10.2	0.0	26	1999
Peru	28.2	44.1	1.1	20.8	847	8,316	35.1	30.1	11.6	19.6	21.9	0.1	70	2002
Suriname	2.2	24.0	5.3	17.3	72	0	..	..	..	0.9	0.4	0.0	4	n.r.
Uruguay	6.4	50.1	1.9	39.6	252	(1,084)	41.1	15.0	7.3	18.3	0.7	0.1	26	2001
Venezuela	136.7	24.1	5.6	(0.4)	4,190	6,399	26.9	26.1	14.3	95.1	6.9	1.8	237	2005
Oceania	**369.1**	**26.4**	**12.3**	**8.8**	**10,224**	**6,362**	**..**	**..**	**..**	**155.0**	**43.4**	**..**	**578**	**..**
Australia	332.4	25.8	17.4	10.9	9,184	1,321	22.8	15.9	51.7	113.2	27.0	5.3	491	n.r. e
Fiji	0.7	(13.8)	0.9	(23.3)	26	12	..	..	..	1.0	1.1	..	3	1998
New Zealand	32.6	37.4	8.6	22.0	924	686	39.3	30.4	16.7	36.2	12.4	0.7	73	2002 e
Papua New Guinea	2.4	0.7	0.5	(22.4)	66	4,314	..	..	..	3.9	2.3	..	9	2002
Solomon Islands	0.2	6.2	0.4	(22.6)	4	19	..	..	..	0.1	0.1	0.0	0	2003
Developed	**14679.5**	**(2.0)**	**11.2**	**(6.5)**	**598,135**	**655**	**23.7**	**15.3**	**40.8**	**2,067.1**	**1,134.3**	**281.5**	**18,102**	**..**
Developing	**9268.5**	**47.5**	**1.9**	**25.6**	**186,721**	**310,586**	**16.1**	**24.5**	**36.1**	**3,741.0**	**2,265.7**	**92.8**	**15,285**	**..**

All emissions data are expressed in terms of carbon dioxide (CO_2) equivalent.

a. CO_2 emissions from land-use change are not included here. **b**. Fluorinated gas ('F' gas) emissions include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). **c**. Total emissions of all greenhouse gases (GHGs) include CO_2 emissions from fossil fuels and cement manufacture plus emissions of methane, nitrous oxide, and fluorinated gases. **d**. Status of countries as of July, 2005. **e**. Indicates Annex I (developed) countries, which are subject to different restrictions under the Kyoto Protocol.

Climate and Atmosphere: Technical Notes

DEFINITIONS AND METHODOLOGY

Total Carbon Dioxide (CO_2) Emissions measures the mass of carbon dioxide produced during combustion of solid, liquid, and gaseous fuels, as well as from gas flaring and the manufacture of cement. Data are expressed in million metric tons. CO_2 emissions from land-use change are not included here. These estimates do not include bunker fuels used in international transportation. Where values were originally in given in mass of carbon, WRI multiplied by 3.664 (the ratio of the molecular mass of CO_2 to that of carbon) to convert to mass of CO_2.

CO_2 Emissions Per Capita measures the mass of CO_2 produced per person for a country or region, in metric tons. WRI calculates per capita emissions with population estimates from the United Nations Population Division (2002 revision).

Data on carbon dioxide emissions are obtained from the World Resources Institute's Climate Analysis and Indicators Tool (CAIT). In order to provide the most complete and accurate data set, CAIT compiles data from the International Energy Agency (IEA), the Carbon Dioxide Information Analysis Center (CDIAC), and the Energy Information Agency (EIA). Fossil fuel emissions estimates for 131 countries are available from the IEA and reported in CAIT. WRI used CDIAC data on fossil fuel emissions for the 53 countries that lack IEA data. (Data for Lesotho were obtained from the EIA.) Data on emissions from cement manufacturing were obtained from CDIAC for all countries and added to the fossil-fuel emissions totals by WRI. A complete country-by-country listing of source and notes can be found at http://cait.wri.org/cait.php?page=notes&chapt=2.

Emissions are calculated by the IEA using the Intergovernmental Panel on Climate Change (IPCC) Reference Approach. CDIAC estimates are derived from energy statistics obtained from United Nations Statistical Office questionnaires and supplemented by official national statistical publications. The U.S. Energy Information Administration (EIA) estimates CO_2 emissions by country and year, based on energy balances.

Cumulative CO_2 Emissions from Fossil Fuels and Cement, 1950-2000 represents the total mass of CO_2 produced in all years from 1950 to 2000 as a result of the combustion of solid, liquid, and gaseous fuels, as well as from gas flaring and the manufacture of cement. CO_2 emissions from land use change are not included here. These estimates do not include bunker fuels used in international transportation. To estimate cumulative emissions in recently formed countries, WRI apportions emissions estimates based on current emissions and historical emissions from former countries and territories.

Cumulative CO_2 Emissions from Land-Use Change, 1950-2000 represents the total mass of carbon dioxide (CO_2) absorbed or emitted into the atmosphere between 1950 and 2000 as a result of man-made land-use changes (for example, deforestation, shifting cultivation, and vegetation re-growth on abandoned croplands and pastures). Positive values signify a positive net flux ("source") of CO_2, indicating that carbon dioxide has been released into the atmosphere. Negative values signify a negative net flux ("sink") of CO_2, indicating that carbon dioxide has been absorbed as a result of the re-growth of previously removed vegetation. Data include emissions from living and dead vegetation disturbed at the time of clearing or harvest, emissions from wood products (including fuel wood), and emissions from the oxidation of organic matter in the soil in years following initial cultivation. Ecosystems that are not directly affected by human activities such as agriculture and forestry are not included in these totals. The net flux of CO_2 for each country was calculated by R.A. Houghton at the Woods Hole Research Center based on regional fluxes. WRI calculated cumulative carbon emissions from land-use change using annual country-level data. For more information, refer to "Data Note: Emissions (and Sinks) of Carbon from Land-Use Change," online at http://cait.wri.org.

Carbon Dioxide Emissions by Sector shows the proportion of total CO_2 emissions from fossil fuel burning contributed by transportation, industry, and electricity production. The **Transportation** sector includes fossil fuel emissions from road, rail, air, and other forms of transportation, and agricultural vehicles while they are on highways. Data do not include international aviation or ship emissions. The **Industry and Construction** sectors include fossil fuel emissions in all industries and construction. The **Electricity** sector includes fossil fuel emissions from public electricity generation, combined heat and power generation, and heat plants. Emissions from electricity and heat production for use by the producer (autoproduction) for public or private activities are included here.

The emissions figures presented here are calculated by the IEA using the IPCC Sectoral Approach and default emission factors from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories and the IEA energy balances.

Methane Emissions measures the total release of methane (CH_4) into the earth's atmosphere that results from human activities such as agricultural and industrial methane production. Values are expressed in thousand metric tons of CO_2 equivalent using the global warming potential (GWP), which allows the different gases to be compared on the basis of their effective contributions. One kilogram of methane is 23 times as effective at trapping heat in the earth's atmosphere as a single kilogram of CO_2 (using a time horizon of 100 years).

Nitrous Oxide Total Emissions represents the total release of nitrous oxide (N_2O) into the earth's atmosphere that results from human activities such as agriculture, biomass burning, industrial activities, and livestock management. Values are expressed in thousand metric tons of CO_2 equivalent using the GWP, which allows the different gases to be compared on the basis of their effective contributions. The global warming potential of one kilogram of N_20 is nearly 300 times that of a single kilogram of CO_2 (using a time horizon of 100 years).

Fluorinated Gases Emissions represents the total release of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) into the earth's atmosphere. These three groups of fluorinated gases ("f-gases") persist in the atmosphere for thousands of years. *Hydrofluorocarbons* are a by-product of HFC-23 and HCFC-22 (IPCC Source Categories 2E and 2F), which are used in the production of aerosols, refrigeration/AC compounds, solvents, foams, fire extinguishing compounds, semiconductors, and flat-panel displays. *Perfluorocarbons* are produced in the manufacture of semiconductors and as a byproduct of CF_4 and C_2F_6 in primary aluminum production (IPCC Source Categories 2C, 2E, and 2F). *Sulfur Hexafluoride* emissions are generated from magnesium processing, semiconductor production, and the use and manufacture of gas insulated switchgear in electricity distribution networks (IPCC Source Categories 2C and 2F). Values are expressed in thousand metric tons of CO_2 equivalent using the global warming potential (GWP), which allows the different gases to be compared on the basis of their effective contributions. The global warming potential of one kilogram of a fluorinated gas is several thousand times that of a single kilogram of CO_2 (using a time horizon of 100 years).

Most of the **Methane, Nitrous Oxide, and Fluorinated Gas** data shown here were compiled by WRI from *Non-CO_2 Gases Economic Analysis and Inventory.* This data set was prepared by the U.S. Environmental Protection Agency (EPA), covers 90 countries, and accounts for close to 90 percent of global emissions. The remaining data were either obtained from the EDGAR database of the Dutch National Institute of Public Health and the Environment (RIVM) or estimated by WRI based on regional totals and figures for earlier years. A complete listing of sources by country is available at http://cait.wri.org/cait.php?page=notes&chapt=2.

Total GHG Emissions include the total mass of carbon dioxide (CO_2) emitted from fossil fuel and cement manufacturing plus the CO_2 emissions equivalent of methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) in the year 2000. Data shown here exclude CO_2 from land-use change.

Kyoto Protocol Status indicates the year that a country ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC). Ratification (or its equivalents of acceptance, approval, or accession) binds the state to observe the treaty. The Kyoto Protocol was established in 1997 by the third session of the Conference of Parties (COP-3) to the UNFCCC. Upon ratification, Annex I (industrialized) countries commit themselves to reducing their collective emissions of six greenhouse gases by at least 5 percent from 1990 levels during the first commitment period, which is 2008-2012. Compared to emissions levels that would be expected by 2010 without emissions-control measures, the Protocol target represents a 30 percent cut. Under the Protocol, both developed and developing countries agree to limit emissions and promote adaptation to future climate change, submit information on their national climate-change program and inventories, promote technology transfer, cooperate on scientific and public research, and promote public awareness and education. The Protocol came into force on February 16, 2005, following ratification by Russia in November, 2004. More information is available in *A Guide to the Climate Change Convention Process,* online at http://unfccc.int/resource/process/guideprocess-p.pdf.

FREQUENCY OF UPDATE BY DATA PROVIDERS

Carbon dioxide emissions, cumulative emissions, and non-CO_2 greenhouse gas emissions are updated by WRI's CAIT tool when new data are available; most CO_2 emissions data are updated annually, while non-CO_2 GHG emissions are updated intermittently by RIVM and the EPA. Sectoral emissions data are updated by the IEA every year; as of spring, 2005, data are available from the original source through 2002. Sectoral emissions data from 2000 are included here to enable direct comparisons with the emissions data in this table.

DATA RELIABILITY AND CAUTIONARY NOTES

CO_2 Emissions: The IPCC Reference Approach (used here for most emissions estimates) can overestimate emissions because it uses energy supply data rather than combustion data. In a few cases, the estimates shown here differ significantly (by more than 5 percent) from those reported by individual countries or by the UNFCCC. This is because some countries use different energy figures than the IEA and WRI or treat bunker fuels differently. Other countries calculate emissions with specific calorific values instead of the averages used by the IEA.

Emissions data are synthesized by WRI from three different data sets, which presents both advantages and disadvantages. On the one hand, "filling" the gaps from different data sources improved the ability to make cross-country comparisons and related analyses. Yet comparability can be endangered when data points from different sources (using different methodologies) are placed side-by-side. For a complete discussion of CAIT's methodology, see http://cait.wri.org/downloads/cait_ghgs.pdf.

Cumulative CO_2 Emissions from Land-Use Change: CO_2 emissions estimates from land-use change are considerably less reliable than other CO_2 and GHG emissions estimates; as a result, data should be treated as order-of-magnitude estimates. The data provider states that yearly flux estimates are uncertain on the order of ±150 percent for large fluxes, and ±50 million tons of carbon per year for estimates near zero. The cumulative emissions presented here, however, are more accurate than the data for individual years. More information is available at: http://cait.wri.org/downloads/DN-LUCF.pdf.

CO_2 Emissions by Sector: Data shown in these columns are calculated using the IPCC Sectoral Approach, which surveys actual consumption of fossil fuels by each sector in order to calculate emissions. Other columns in the table have been calculated using the IPCC Reference Approach. While in theory the numbers should be identical, in practice there are minor variations between the data produced by the two methodologies.

Methane, Nitrous Oxide, and Fluorinated Gas Emissions: Generally, estimates of non-CO_2 GHG emissions are less certain than CO_2 emissions estimates. Estimates of nitrous oxide emissions are less certain than methane and fluorinated gas estimates. This data set provides a sound basis for comparability, however, since the methods used are comparable to IPCC methodologies, the global totals comply with budgets used in atmospheric studies, and the data were based on international information sources.

The data presented here may not match the official methane emissions estimates submitted by countries to the UNFCCC. In most cases, however, the differences are not substantial. In the year 2000, WRI estimated methane and nitrous oxide emissions for some countries (accounting for about 10 percent of all emissions); these estimates should be considered rough approximations.

SOURCES

Total and Cumulative Emissions: World Resources Institute. 2005. Climate Analysis Indicators Tool (CAIT), version 2.0. Washington D.C.: World Resources Institute. Online at http://cait.wri.org.

CO_2 Emissions by Sector: International Energy Agency (IEA). 2003. *CO_2 Emissions from Fossil Fuel Combustion* (2003 Edition). Paris: Organization for Economic Cooperation and Development (OECD). Database online at http://data.iea.org/ieastore/default.asp.

Kyoto Protocol, Year Ratified: United Nations Framework Convention on Climate Change (UNFCCC). 2005. *Kyoto Protocol Status of Ratification.* Bonn: UNFCCC. Online at http://unfccc.int/files/essential_background/kyoto_protocol/application/pdf/kpstats.pdf.

9 Water Resources and Fisheries

Source: Food and Agriculture Organization of the United Nations

	Actual Renewable Water Resources (a)		Annual Water Withdrawals					Inland and Marine Fisheries Production (thousand metric tons) (c)				Trade in Fish and Fisheries Products (million $US) (c)			Fish Protein as a Percent of Animal Protein Supply
				Per Capita	Withdrawals by Sector (percent), 2000 (b)			Capture		Aquaculture		2000-2002			
	Total (km^3)	Per Capita (m^3 per person)	Total (km^3) 2000	(m^3 per person) 2000	Agri-culture	Indus-try	Dom-estic	1990-1992	2000-2002	1990-1992	2000-2002	Imports	Exports	Number of Fishers 2000	2002
World	..	**8,549**	**3,802.3**	**633**	**70**	**20**	**10**	**84,529.0**	**93,650.8 d**	**14,074.7 d**	**37,694.7 d**	**60,312.2**	**56,520.1**	**34,501,411**	**15**
Asia (excl. Middle East)	..	**4,079**	**2,147.5**	**631**	**81**	**12**	**7**	**34,528.9**	**44,189.1**	**11,745.9**	**33,275.1**	**22,301.9**	**19,051.0**	**28,890,352**	..
Armenia	11	3,450	3.0	949	66	4	30	2.2	0.8	3.4	1.1	3.0	0.7	244	1
Azerbaijan	30	3,585	17.2	2,114	68	28	5	36.1	13.7	1.7	0.2	1.6	2.2	1,500	1
Bangladesh	1,211	8,089	79.4	576	96	1	3	684.2	1,058.8	210.1	718.8	6.2 e	328.3 e	1,320,480	52
Bhutan	95	40,860	0.4	204	95	1	4	0.3	0.3	0.0	0.0	..	..	450	..
Cambodia	476	32,876	4.1	311	98	1	2	106.3	372.9	7.2	14.3	3.2	27.9	73,425	57
China	2,830	2,206	630.3	494	68	26	7	7,449.7	16,690.0	7,206.8	26,132.7	1,927.0	4,029.1	12,233,128	19
Georgia	63	12,481	3.6	685	59	21	20	66.9	2.2	1.4	0.1	1.4	0.3	1,900	1
India	1,897	1,754	645.8	635	86	5	8	2,867.6	3,799.4	1,212.6	2,084.6	23.1	1,351.8	5,958,744	14
Indonesia	2,838	12,749	82.8	391	91	1	8	2,704.3	4,300.8	522.6	855.6	88.2	1,536.6	5,118,571	57
Japan	430	3,365	88.4	696	62	18	20	8,598.8	4,715.7	808.7	797.7	14,204.2	786.3	260,200	45
Kazakhstan	110	7,116	35.0	2,238	82	17	2	70.7	27.7	8.7	0.7	16.5	15.2	16,000	2
Korea, Dem People's Rep	77	3,387	9.0	405	55	25	20	406.0	208.1	56.7	64.7	25.8	138.2	129,000	27
Korea, Rep	70	1,454	18.6	397	48	16	36	2,321.9	1,828.6	364.9	294.9	1,619.9	1,195.9	176,928	40
Kyrgyzstan	21	3,952	10.1	2,048	94	3	3	0.3	0.1	0.9	0.1	1.4	0.0	154	1
Lao People's Dem Rep	334	57,638	3.0	567	90	6	4	18.6	31.2	10.4	50.6	2.0	0.1	15,000	40
Malaysia	580	23,316	9.0	392	62	21	17	966.3	1,270.6	65.8	158.4	335.9	359.6	100,666	38
Mongolia	35	13,232	0.4	178	52	28	20	0.1	0.2	..	..	0.4	0.1	0	0
Myanmar	1,046	20,870	33.2	699	98	1	1	731.6	1,183.1	14.0	113.8	1.4	210.4	610,000	46
Nepal	210	8,171	10.2	433	96	1	3	5.5	17.1	10.1	16.2	0.3	0.0	50,000	4
Pakistan	223	1,415	169.4	1,187	96	2	2	504.0	604.7	11.8	13.8	0.3	136.7	272,273	3
Philippines	479	5,884	28.5	377	74	9	17	1,875.4	1,961.2	391.8	423.9	89.0	396.4	990,872	39
Singapore	1	139	..	..	..	..	..	10.6	3.8	2.1	4.9	509.8	380.0	364	..
Sri Lanka	50	2,602	12.6	678	95	2	2	185.9	290.9	5.5	9.3	73.2	106.3	146,188	51
Tajikistan	16	2,537	12.0	1,965	92	5	4	0.2	0.1	3.1	0.1	0.2	..	200	0
Thailand	410	6,459	87.1	1,429	95	2	2	2,664.2	2,950.3	338.7	702.4	947.7	4,027.6	354,495	40
Turkmenistan	25	5,004	24.6	5,308	98	1	2	38.4	12.6	2.2	0.0	0.2	0.3	611	3
Uzbekistan	50	1,904	58.3	2,342	93	2	5	5.8	3.2	21.7	4.8	1.8	0.1	4,800	0
Viet Nam	891	10,805	71.4	914	68	24	8	826.1	1,483.0	164.4	515.9	44.9	1,764.2	1,000,000	29
Europe	..	**10,655**	**400.3**	**581**	**33**	**52**	**15**	**19,025.1**	**15,773.3**	**1,470.1**	**2,064.1**	**23,051.7**	**19,356.0**	**855,333**	**12**
Albania	42	13,056	1.7	551	62	11	27	5.3	3.5	2.1	0.5	6.5	7.0	1,590	2
Austria	78	9,569	2.1	261	1	64	35	0.5	0.4	3.1	2.5	177.6	11.9	2,300	4
Belarus	58	5,887	2.8	278	30	46	23	1.8	2.4	13.3	6.1	91.6	18.3	5,000	8
Belgium	18	1,770	..	..	..	..	..	39.5	29.7	0.8	1.7	1,030.7	520.2	544	..
Bosnia and Herzegovina	38	8,958	..	..	..	..	..	2.0	2.5	..	4.7	15.6	0.2	3,500	4
Bulgaria	21	2,721	10.5	1,296	19	78	3	41.1	9.5	7.9	3.0	14.7	5.8	1,483	2
Croatia	106	23,890	..	..	..	..	..	26.7	20.3	6.8	8.4	62.4	62.5	65,151	9
Czech Rep	13	1,286	2.6	250	2	57	41	..	4.8	..	19.6	84.0	31.0	2,243	5
Denmark	6	1,116	1.3	238	42	26	32	1,726.9	1,495.5	42.4	39.1	1,781.8	2,762.9	6,711	10
Estonia	13	9,794	0.2	120	5	39	56	266.6	106.6	1.0	0.3	45.7	112.0	13,346	13
Finland	110	21,093	2.5	479	3	84	14	140.6	150.5	18.6	15.4	129.6	15.3	5,879	14
France	204	3,371	40.0	674	10	74	16	595.1	620.3	250.6	256.0	3,082.0	1,067.7	26,113	9
Germany	154	1,866	47.1	572	20	68	12	259.7	213.8	78.6	56.4	2,343.5	1,098.0	4,358	6
Greece	74	6,764	7.8	712	81	3	16	141.2	94.2	14.1	93.6	319.2	221.3	19,847	11
Hungary	104	10,579	7.6	763	32	59	9	11.1	6.8	15.4	12.5	48.3	5.1	4,900	2
Iceland	170	582,192	0.2	543	0	66	34	1,375.8	2,031.0	2.7	3.9	65.2	1,309.5	6,100	29
Ireland	52	13,003	1.1	296	0	77	23	232.9	305.0	27.2	58.3	121.5	407.7	8,478	6
Italy	191	3,336	44.4	771	45	37	18	391.4	295.4	161.4	205.3	2,719.2	392.7	48,770	11
Latvia	35	15,507	0.3	124	12	33	55	341.4	126.1	1.9	0.4	43.5	93.0	6,571	7
Lithuania	25	7,276	0.3	76	7	15	78	330.3	127.0	4.5	1.9	78.5	57.4	4,700	27
Macedonia, FYR	6	..	..	..	..	..	..	0.2	0.2	1.0	1.3	6.7	0.1	8,472	3
Moldova, Rep	12	..	2.3	539	33	58	9	0.9	0.4	5.1	1.3	7.3	0.2	40	8
Netherlands	91	5,608	7.9	500	34	60	6	415.5	492.7	68.9	62.3	1,241.8	1,522.5	3,743	11
Norway	382	83,919	2.2	489	10	67	23	2,015.3	2,710.0	147.5	518.6	627.9	3,488.7	23,552	26
Poland	62	1,598	16.2	419	8	79	13	452.9	221.7	28.7	34.7	334.0	247.2	8,640	12
Portugal	69	6,821	11.3	1,125	78	12	10	310.3	192.9	5.9	8.1	914.3	284.2	25,021	21
Romania	212	9,512	23.2	1,031	57	34	9	86.3	7.3	29.7	9.9	38.8	2.4	8,519	2
Russian Federation	4,507	31,653	76.7	527	18	63	19	6,481.5	3,611.6	156.4	88.5	333.9	1,437.9	316,300	13
Serbia and Montenegro	209	..	..	..	..	..	..	3.0	1.2	2.3	2.7	35.1	0.3	1,429	1
Slovakia	50	9,266	..	..	..	..	..	..	1.5	..	0.9	34.7	2.0	215	5
Slovenia	32	16,080	..	..	..	..	..	3.9	1.8	0.9	1.2	28.7	6.0	231	4
Spain	112	2,711	35.6	874	68	19	13	1,086.7	1,006.9	199.2	296.2	3,640.0	1,777.8	75,434	18
Sweden	174	19,581	3.0	335	9	54	37	265.2	315.1	8.1	5.7	748.4	522.7	2,783	14
Switzerland	54	7,468	2.6	359	2	74	24	3.2	1.6	1.2	1.1	358.3	3.1	522	7
Ukraine	140	2,898	37.5	755	52	35	12	667.0	339.4	67.7	30.9	101.1	31.7	120,000	13
United Kingdom	147	2,474	9.5	163	3	75	22	788.0	726.2	55.9	167.3	2,249.4	1,305.9	17,847	10
Middle East & N. Africa	..	**1,505**	**324.6**	**807**	**86**	**6**	**8**	**2,096.7**	**3,048.9**	**117.7**	**525.5**	**827.6**	**1,354.7**	**746,955**	**10**
Afghanistan	65	2,608	23.3	1,087	98	0	2	1.1	0.9	..	..	..	..	1,500	..
Algeria	14	443	6.1	201	65	13	22	88.5	127.0	0.2	0.4	11.9	5.0	26,151	6
Egypt	58	794	68.7	1,013	78	14	8	272.6	412.7	62.5	353.1	147.1	1.6	250,000	23
Iran, Islamic Rep	138	1,970	72.9	1,097	91	2	7	267.7	348.4	23.1	60.0	30.9 f	48.1 f	138,965	7
Iraq	75	2,917	42.7	1,839	92	5	3	18.1	16.8	2.7	1.7	0.1	0.0	12,000	..
Israel	2	255	2.0	338	63	7	31	6.7	5.2	14.0	21.2	135.9	7.5	1,535	7
Jordan	1	157	1.0	202	75	4	21	0.4	0.5	0.0	0.5	25.5	1.2	721	6
Kuwait	0	8	0.4	198	52	3	45	4.8	5.9	0.0	0.3	16.7	3.6	670	6
Lebanon	4	1,189	1.4	394	67	1	33	1.6	3.8	0.1	0.5	48.3	0.2	9,825	8
Libyan Arab Jamahiriya	1	106	4.8	919	89	3	8	26.5	33.4	0.1	0.1	9.8	10.1	9,500	9
Morocco	29	934	12.8	438	90	2	8	571.9	958.5	0.6	1.6	10.4	913.4	106,096	17
Oman	1	337	1.4	518	91	2	7	115.2	131.0	0.0	0.0	8.1	62.0	28,003	..
Saudi Arabia	2	96	17.3	782	89	1	10	42.3	51.4	2.2	7.0	123.2	9.8	25,360	6
Syrian Arab Rep	26	1,441	19.9	1,205	95	2	3	4.0	8.0	3.7	6.2	56.5	0.0	11,292	3
Tunisia	5	459	2.7	286	82	2	16	86.7	96.9	0.9	1.8	16.3	88.8	50,815	13
Turkey	229	3,171	37.5	550	74	11	15	394.5	532.6	7.6	69.1	37.1	93.7	33,614	11
United Arab Emirates	0	49	2.3	818	68	9	23	94.2	105.2	0.0	0.0	98.3	52.9	15,543	12
Yemen	4	198	6.6	368	95	1	4	79.8	138.7	..	..	5.9	38.0	12,200	16

For more information, please visit http://earthtrends.wri.org/datatables/freshwater

	Actual Renewable Water Resources {a}		Annual Water Withdrawals					Inland and Marine Fisheries Production (thousand metric tons) {c}				Trade in Fish and Fisheries Products (million $US) {c}		Number of Fishers	Fish Protein as a Percent of Animal Protein Supply
					Withdrawals by Sector (percent), 2000 {b}			Capture		Aquaculture		2000-2002			
	Total (km^3)	Per Capita (m^3 per person)	Total (km^3) 2000	Per Capita (m^3 per person) 2000	Agri-culture	Indus-try	Dom-estic	1990-1992	2000-2002	1990-1992	2000-2002	Imports	Exports	2000	2002
Sub-Saharan Africa	**..**	**6,322**	**113.4**	**173**	**88**	**4**	**9**	**4,126.4**	**5,159.6**	**25.4**	**63.1**	**812.1**	**1,862.1**	**1,995,694**	**20**
Angola	184	13,070	0.3	28	61	16	22	121.3	250.6	..	..	17.5	22.4	30,364	34
Benin	25	3,585	0.3	40	74	11	15	35.3	37.1	..	0.0	7.2	2.3	61,793	21
Botswana	14	8,022	0.1	81	43	19	38	1.0	0.1	..	..	6.9	0.0	2,620	3
Burkina Faso	13	933	0.8	66	88	0	11	7.2	8.5	0.0	0.0	1.4	0.1	8,300	8
Burundi	4	509	0.2	37	82	1	17	20.8	11.8	0.0	0.1	0.1	0.2	7,030	17
Cameroon	286	17,520	1.0	65	74	8	18	70.7	114.4	0.1	0.2	23.7	0.5	24,500	34
Central African Rep	144	36,912	0.0	6	4	19	77	13.2	15.0	0.2	0.1	0.3	0.2	5,410	9
Chad	43	4,857	0.2	30	80	1	19	70.0	84.0	..	..	0.3	0.0	300,000	15
Congo	832	217,915	0.0	11	10	30	59	44.4	43.3	0.2	0.2	19.2	2.2	10,500	43
Congo, Dem Rep	1,283	..	0.4	7	31	16	52	171.7	214.6	0.7	2.6	33.5	0.4	108,400	43
Côte d'Ivoire	81	4,794	0.9	59	65	12	23	88.3	76.4	0.2	1.0	154.3	125.7	19,707	..
Equatorial Guinea	26	51,282	0.1	232	1	16	83	3.6	3.5	..	..	4.2	0.7	9,218	..
Eritrea	6	1,466	0.3	82	95	1	4	..	9.9	..	..	0.2	1.3	14,500	11
Ethiopia	110	1,519	2.6	40	93	6	1	4.6	14.5	0.0	0.0	0.2	0.0	6,272	2
Gabon	164	121,392	0.1	102	40	11	48	22.0	43.7	0.0	0.2	12.4	13.5	8,258	33
Gambia	8	5,472	0.0	24	67	11	22	21.5	36.4	0.0	0.0	0.7	2.8	2,000	61
Ghana	53	2,489	0.5	27	48	15	37	393.9	423.6	0.4	5.7	100.4	74.8	230,000	64
Guinea	226	26,218	1.5	187	90	2	8	49.5	100.2	0.0	0.0	6.6	2.0	10,707	43
Guinea-Bissau	31	20,156	0.1	81	91	1	9	5.2	5.0	..	..	0.2	4.4	2,500	6
Kenya	30	932	1.6	52	64	6	30	187.2	174.9	1.2	0.8	4.2	37.8	59,565	8
Lesotho	3	1,678	0.1	30	19	41	40	0.0	0.0	0.0	0.0	..	..	60	0
Liberia	232	66,533	0.1	36	56	15	28	8.3	11.5	0.0	0.0	2.1	0.1	5,143	26
Madagascar	337	18,826	15.0	937	96	2	3	102.3	136.4	0.7	7.7	10.0	106.9	83,310	17
Malawi	17	1,401	1.0	88	81	5	15	68.9	41.6	0.2	0.6	0.4	0.2	42,922	26
Mali	100	7,458	6.9	582	99	0	1	69.3	103.3	0.0	0.5	1.8	0.4	70,000	13
Mauritania	11	3,826	1.7	642	88	3	9	66.6	81.5	..	..	1.0	99.0	7,944	9
Mozambique	216	11,266	0.6	36	87	2	11	32.5	34.8	0.0	0.2	7.6	98.9	20,000	17
Namibia	18	8,921	0.3	142	63	5	33	374.6	587.4	0.0	0.1	16.5	334.6	2,700	14
Niger	34	2,710	2.2	204	95	1	4	3.0	20.2	0.0	0.0	0.6	2.4	7,983	3
Nigeria	286	2,252	8.0	70	69	10	21	287.5	458.2	13.3	26.9	197.6	17.6	481,264	29
Rwanda	5	613	0.1	10	39	14	48	3.2	6.9	0.1	0.4	0.1	..	5,690	8
Senegal	39	3,811	1.6	169	90	4	6	334.9	393.7	0.0	0.1	1.0	245.5	55,547	44
Sierra Leone	160	30,960	0.4	86	93	2	5	63.6	77.6	0.0	0.0	4.1	13.7	17,990	61
Somalia	14	1,309	3.3	378	100	0	0	24.1	19.4	..	..	0.1	3.1	18,900	..
South Africa	50	1,106	15.3	348	73	10	17	574.4	720.0	4.3	4.1	56.1	291.1	10,500	9
Sudan	65	1,879	37.3	1,187	97	1	3	33.2	56.3	0.2	1.2	0.6	0.3	27,700	2
Tanzania, United Rep	91	2,416	2.0	57	93	1	6	357.1	331.1	0.4	0.4	0.4	107.4	92,529	27
Togo	15	2,930	0.2	36	47	8	45	13.0	22.1	0.1	0.4	10.9	6.3	14,120	40
Uganda	66	2,472	0.3	13	39	15	45	241.6	220.7	0.1	2.7	0.1	54.8	57,862	23
Zambia	105	9,630	1.7	167	76	8	16	66.4	65.6	2.5	4.2	1.9	0.4	23,833	22
Zimbabwe	20	1,547	2.6	207	86	5	10	23.1	13.0	0.1	2.2	4.9	3.4	1,804	4
North America	**..**	**19,992**	**525.3**	**1,663**	**38**	**48**	**14**	**6,908.1**	**6,071.6**	**409.1**	**628.6**	**11,651.6**	**6,345.6**	**303,784**	**7**
Canada	2,902	91,419	46.0	1,494	12	69	20	1,471.7	1,026.2	44.9	151.0	1,371.2	2,883.9	8,696	10
United States	3,069	10,333	479.3	1,682	41	46	13	5,291.2	4,866.7	364.2	477.5	10,268.5	3,210.5	290,000	6
C. America & Caribbean	**..**	**6,924**	**100.7**	**603**	**75**	**6**	**18**	**1,753.9**	**1,989.7**	**50.1**	**147.4**	**455.2**	**1,525.4**	**446,390**	**9**
Belize	19	71,111	0.1	519	0	89	11	2.3	30.4	0.2	4.2	2.3	18.6	1,872	18
Costa Rica	112	26,447	2.7	681	53	17	29	16.8	34.4	1.6	12.7	25.0	129.9	6,510	4
Cuba	38	3,365	8.2	732	69	12	19	147.0	46.6	9.8	27.0	36.4	86.2	11,865	14
Dominican Rep	21	2,367	3.4	405	66	2	32	16.4	14.2	0.6	2.8	60.7	1.5	9,286	13
El Salvador	25	3,815	1.3	205	59	16	25	10.6	21.0	0.4	0.5	9.2	26.4	24,534	6
Guatemala	111	8,788	2.0	176	80	13	6	6.7	28.6	1.0	5.7	10.5	25.4	17,275	3
Haiti	14	1,663	1.0	123	94	1	5	5.1	5.0	..	..	5.9	3.6	4,700	9
Honduras	96	13,513	0.9	133	81	11	8	16.5	12.8	4.4	12.4	13.0	72.8	21,000	2
Jamaica	9	3,513	0.4	159	49	17	34	16.0	5.7	3.3	5.1	47.5	8.5	23,465	17
Mexico	457	4,357	78.2	791	77	5	17	1,297.3	1,388.6	24.6	67.9	165.1	659.1	262,401	8
Nicaragua	197	35,142	1.3	256	83	3	14	5.2	24.8	0.1	5.8	6.6	72.6	14,502	8
Panama	148	46,579	0.8	279	28	5	66	155.2	260.2	3.7	3.1	14.6	304.8	13,062	8
Trinidad and Tobago	4	2,938	0.3	237	6	27	67	12.3	10.6	0.0	0.0	9.2	10.8	7,297	14
South America	**..**	**47,044**	**164.4**	**474**	**68**	**12**	**19**	**15,272.4**	**16,314.5**	**198.1**	**868.6**	**568.9**	**5,231.8**	**784,051**	**6**
Argentina	814	20,941	29.1	784	74	9	16	632.9	928.4	0.4	1.5	58.5	810.7	12,320	4
Bolivia	623	69,378	1.4	167	83	3	13	5.7	5.9	0.3	0.4	6.7	0.0	7,754	3
Brazil	8,233	45,573	59.3	345	62	18	20	762.9	798.6	24.6	210.1	271.3	289.3	290,000	4
Chile	922	57,639	12.5	824	64	25	11	5,851.3	4,122.9	49.5	501.1	49.8	1,867.4	50,873	9
Colombia	2,132	47,469	10.7	254	46	4	50	119.9	131.6	15.6	63.9	74.8	177.4	129,410	5
Ecuador	432	32,747	17.0	1,367	82	5	12	282.1	499.2	100.5	66.2	10.4	651.6	162,870	6
Guyana	241	314,211	1.6	2,163	97	1	2	39.6	50.1	0.1	0.6	2.4	55.9	6,571	38
Paraguay	336	55,833	0.5	89	72	9	20	14.5	25.0	0.1	0.1	1.4	0.1	4,469	4
Peru	1,913	69,395	20.1	776	82	10	8	7,089.7	9,137.2	5.9	8.2	20.9	1,136.1	66,361	25
Suriname	122	277,904	0.7	1,565	93	3	4	8.3	18.4	0.0	0.4	3.5	9.0	3,628	22
Uruguay	139	40,419	3.1	941	96	1	2	120.1	109.0	0.0	0.0	13.9	104.0	4,023	4
Venezuela	1,233	47,122	8.4	345	47	7	45	335.2	430.1	1.3	16.0	55.4	130.4	44,302	..
Oceania	**..**	**54,637**	**26.2**	**900**	**72**	**10**	**18**	**817.5**	**1,104.2**	**58.4**	**122.3**	**643.2**	**1,793.6**	**85,324**	**9**
Australia	492	24,708	23.9	1,250	75	10	15	221.8	193.1	14.4	35.3	529.5	933.5	13,800	7
Fiji	29	33,707	0.1	85	78	11	11	29.1	43.6	0.0	1.7	21.5	38.1	8,985	30
New Zealand	327	83,760	2.1	558	42	9	49	394.8	556.9	42.9	83.0	55.4	671.6	1,928	12
Papua New Guinea	801	137,252	0.1	14	1	43	56	26.4	122.8	0.0	0.0	7.4	68.3	16,000	..
Solomon Islands	45	91,039	..	..	..	..	..	49.7	28.8	0.0	0.0	0.5	15.0	11,000	76
Developed	**..**	**11,514**	**1,221.2**	**956**	**46**	**40**	**14**	**35,555.2**	**27,917.4**	**2,806.4**	**3,641.1**	**49,698.5**	**28,159.2**	**1,467,401**	**12**
Developing	**..**	**7,762**	**2,583.9**	**545**	**81**	**11**	**8**	**48,719.3**	**65,694.4**	**11,281.5**	**34,059.6**	**10,704.1**	**28,378.4**	**32,640,482**	**18**

a. Although data were obtained from FAO in 2004, they are long-term averages originating from multiple sources and years. For more information, please consult the original source at http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastat/water_res/index.htm. **b**. Sectoral withdrawal data may not add up to 100 percent because of rounding. **c**. Figures are three-year averages for the range of years specified. **d**. World totals were calculated by WRI. **e**. Year ending 30 June. **f**. Year beginning 20-23 March.

Water Resources and Fisheries: Technical Notes

DEFINITIONS AND METHODOLOGY

Actual Renewable Water Resources, measured in cubic kilometers per year (km^3/year), gives the maximum theoretical amount of water actually available for each country, although in reality a portion of this water may be inaccessible to humans. Actual renewable water resources are defined as the sum of internal renewable resources (IRWR) and external renewable resources (ERWR), taking into consideration the quantity of flow reserved to upstream and downstream countries through formal or informal agreements or treaties and possible reduction of external flow due to upstream water abstraction. IRWR include the average annual flow of rivers and the recharge of groundwater (aquifers) generated from endogenous precipitation—the precipitation occurring within a country's borders. ERWR represent the portion of the country's renewable water resources that is not generated within the country. ERWR include inflows from upstream countries (groundwater and surface water) and a portion of the water of border lakes or rivers.

Per Capita Actual Renewable Water Resources are measured in cubic meters per person per year (m3/person/year). Per capita actual water resources were calculated by WRI using population data from the United Nations Population Division for the year 2004.

Annual Water Withdrawals, measured in cubic kilometers per year, is the gross amount of water extracted from any source, either permanently or temporarily, for a given use. It can be either diverted towards distribution networks or directly used. It includes consumptive use, conveyance losses, and return flow. Total water withdrawal is the sum of estimated water use by the agricultural, domestic, and industrial sectors. It does not include precipitation.

Per Capita Annual Withdrawals were calculated by WRI using national population data from the UN Population Division for the year 2000.

Withdrawals by Sector, expressed as a percentage, refers to the proportion of water used for one of three purposes: agriculture, industry, or domestic uses. All water withdrawals are allocated to one of these three categories. **Agricultural** uses of water primarily include irrigation and, to a lesser extent, livestock. **Industrial** use measures consumption by self-supplied industries not connected to any distribution network for manufacturing, cooling machinery and equipment, producing energy, cleaning and washing manufactured goods, and as a solvent. **Domestic** uses include drinking water plus water withdrawn for homes, municipalities, commercial establishments, and public services (e.g., hospitals).

Freshwater resources data were provided by AQUASTAT, a global database of water statistics maintained by the Food and Agriculture Organization of the United Nations (FAO). AQUASTAT collects its information from a number of sources—national water resources and irrigation master plans; national yearbooks, statistics, and reports; and national or international surveys.

When possible, FAO cross-checks information between countries to improve assessments in countries where information is limited. When several sources give different or contradictory figures, preference is always given to information collected at national or sub-national level. This preference is based on the assumption that no regional information can be more accurate than studies carried out at the country level. Unless proven inaccurate, official rather than unofficial sources were used. In the case of shared water resources, a comparison between countries was made to ensure consistency at river-basin level.

Inland and Marine Fisheries Production, Capture data refer to the nominal catch of fish, crustaceans, molluscs, aquatic mammals, and other aquatic animals taken for commercial, industrial, recreational, and subsistence purposes from marine, brackish, and inland waters. The harvest from aquaculture and other kinds of farming are excluded. Statistics for aquatic plants are also excluded from country totals. Total capture production includes freshwater fish (carp, tilapias, etc.), diadromous fish (river eels, salmon, etc.), marine fish (flounders, cods, redfishes, tunas, mackerels, sharks, etc.) crustaceans (lobster, shrimp, etc.), and molluscs (oyster, clams, squid, etc.). Data include all quantities caught and landed for both food and feed purposes but exclude catch discarded at sea.

Inland and Marine Fisheries Production, Aquaculture data refer to the harvest of fish, molluscs, crustaceans, and other aquatic animals cultivated in marine, inland, or brackish environments. Data do not include capture production. Statistics for aquatic plants are also excluded. Aquaculture is defined by FAO as "the farming of aquatic organisms, including fish, molluscs, crustaceans, and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. [It] also implies ownership of the stock being cultivated." Aquatic organisms that are exploitable by the public as a common property resource are not included in aquaculture production.

Production of fish, crustaceans, and molluscs is expressed in live weight, the nominal weight of the aquatic organisms at the time of harvest. For a more detailed listing of the species mentioned above, refer to the original source at http://www.fao.org/waicent/faostat/agricult/fishitems-e-e.html.

Most fisheries statistics are collected by FAO from questionnaires sent to national fisheries agencies. When these data are missing or considered unreliable, FAO estimates fishery production based on regional fishery organizations, project documents, industry magazines, or statistical interpolations. Regional totals represent a sum of available data and may be incomplete.

Trade in Fish and Fisheries Products measures the value of all fisheries products, excluding non-edible shells and aquatic plants, entering (referred to as imports) or leaving (referred to as exports) a country's borders each year through trade. The totals reported here incorporate the same species as the FAO's Yearbook of Fishery Statistics (ftp://ftp.fao.org/fi/stat/summary/default.htm). The value of this trade is expressed in millions of U.S. dollars.

In accordance with internationally recommended practice, import statistics include fish caught by foreign fishing craft, whether or not processed on board, landed in domestic ports; export statistics include fish caught by domestic fishing craft, whether or not processed on board, landed in foreign ports. As such, landbound countries can therefore export marine fish and fish products. Exports are generally on a free-on-board basis (i.e., not including insurance or freight costs). Regional totals are calculated by adding up imports or exports of each country included in that region. The regional totals should not be taken as a net trade for that region, since much trade occurs intra-regionally.

Number of Fishers includes the number of people employed full or part-time in commercial and subsistence fishing (both personnel on fishing vessels and on shore), operating in freshwater, brackish, and marine areas, and in aquaculture production activities. Data on people employed in fishing and aquaculture are collected by the FAO through annual questionnaires submitted to the national reporting offices of the member countries. When possible, other national and regional published sources are also used to estimate figures.

Fish Protein as a Percent of Animal Protein Supply is defined as the quantity of protein from both freshwater and marine fish, seafood, and derived products available for human consumption as a percentage of all available animal protein. FAO calculates per capita protein supply for all products, including fish, in its

collection of Supply/Utilization Accounts (SUAs) and food balance sheets. For each product, the SUA traces supplies from production, imports, and stocks to its utilization in different forms—addition to stocks; exports; animal feed; seed; processing for food and non-food purposes; waste (or losses); and lastly as food available for human consumption, where appropriate. For more detailed information, please refer to the following article: "Supply Utilization Accounts and Food Balance Sheets in the Context of a National Statistical System," maintained on-line by FAO at http://www.fao.org/es/ESS/Suafbs.htm.

FREQUENCY OF UPDATE BY DATA PROVIDERS

Most freshwater data are not available in a time series and are updated intermittently; the global data set maintained on-line by AQUASTAT contains data collected over a time span of up to 30 years. Fisheries production and trade data are updated annually by the Fishery Information, Data and Statistics Unit (FIDI) of FAO. Number of fishers data are updated by FIDI every 2-4 years. The FAO updates the data on fish protein annually; the most recent updates incorporated in these tables are from July 2004.

DATA RELIABILITY AND CAUTIONARY NOTES

Water Resources and Withdrawals: While AQUASTAT represents the most complete and careful compilation to date of statistics on country-level water resources, the quality of the primary information on which it relies varies. Information sources are numerous but rarely complete. Some governments will keep internal water resources information confidential because they are competing for water resources with bordering countries. Many instances of water scarcity are highly localized and are not reflected in national statistics. In addition, the accuracy and reliability of information vary greatly among regions, countries, and categories of information, as does the year in which the information was gathered. All data should be considered order-of-magnitude estimates.

Actual Renewable Water Resources: Exchanges between countries are complicated when a river crosses the same border several times. Part of the incoming water flow may thus originate from the same country in which it enters, making it necessary to calculate a "net" inflow to avoid double counting of resources. In addition, the water that is actually accessible to humans for consumption is often much smaller than the total renewable water resources indicated in the data table.

Actual Renewable Water Resources Per Capita: Water resources data are from a different set of years than the population data used in the calculation. While the water resources data are usually long-term averages, inconsistencies may arise when combining it with 2000 population data. For more information about the collection methodology and reliability of the UN population data, please refer to the notes accompanying the Demographics and Education table.

Total Fisheries Production and Trade in Fish and Fisheries Products: While FISHSTAT provides the most extensive global time series of fishery statistics since 1950, there are some problems associated with the data. Country-level data are often submitted with a 1-2 year delay. Statistics from smaller artisanal and subsistence fisheries are particularly sparse. While these statistics provide a good overview of regional fisheries trends, data should be used with caution and supplemented with estimates from regional organizations, academic literature, expert consultations, and trade data. For more information, consult *Fishery Statistics Reliability and Policy Implications,* published by the FAO Fisheries Department and available on-line at http://www.fao.org/DOCREP/FIELD/006/Y3354M/Y3354M00.HTM.

Number of Fishers data are gross estimates. Many countries do not submit data on fishers, or submit incomplete information; some countries have occasionally omitted fish farmers from the total or included subsistence and sport fishers, as well as family members living on fishing. Apart from the gaps and the heavy presence of estimates due to non-reporting, the information provided by national statistical offices may not be strictly comparable due to the utilization of different definitions and methods in the assessment of the number of people engaged in fishing and aquaculture. FAO recognizes that these statistics are incomplete and may not accurately reflect the current level of employment in the fishing sector.

Fish Protein as a Percent of Total Protein Supply: Food supply is different from actual consumption. Figures do not account for discards (including bones) and losses during storage and preparation. Supply data should only be used to assess food security if they are combined with an analysis of food availability and accessibility. Nonetheless, the data are subject to "vigorous consistency checks." According to FAO, the food supply statistics, "while often far from satisfactory in the proper statistical sense, do provide an approximate picture of the overall food situation in a country and can be useful for economic and nutritional studies, for preparing development plans and for formulating related projects." For more information see *Food Balance Sheets: A Handbook,* maintained on-line by FAO at http://www.fao.org/DOCREP/003/X9892E/X9892E00.htm.

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Biodiversity

Sources: United Nations Environment Programme - World Conservation Monitoring Centre, Ramsar Convention Bureau, United Nations Educational, Scientific, and Cultural Organization, International Union for Conservation of Nature and Natural Resources

	Protected Areas					Number of Known and Threatened Species						Net Legal Trade in Selected Wildlife Products as Reported by CITES {c}		
	All Areas Under IUCN Management Categories I-V, 2004 {a}		Marine Areas, IUCN Categories	Wetlands of International	Biosphere	Mammals		Birds		Plants {b}				
	Total Area (1000 ha)	Percent of Total Land Area	I-VI, Number 2004	Importance, Number 2005	Reserves, Number 2004	Known Species 2004	Number Threat-ened 2003	Known Species 2004	Number Threat-ened 2003	Known Species 2004	Number Threat-ened 2003	Live Primates 2002	Live Parrots 2002	Animal Skins {d} 2002
World	**806,722** e	**6.1** e	**3,459** e	**1,420**	**459**	**4,629** f	**..**	**10,000** g	**..**	**270,000** h	**..**	**..**	**..**	**..**
Asia (excl. Middle East)	**191,450**	**7.9**	**661**	**145** i	**67**	**..**	**..**	**..**	**..**	**..**	**..**	**(19,001)**	**43,634**	**(723,299)**
Armenia	299	10.1	..	2	..	78	9	302	12	3,553	1	..	..	0
Azerbaijan	394	4.6	3	3	..	82	11	364	11	4,300	0	2	(1)	0
Bangladesh	66	0.5	5	2	..	131	22	604	23	5,000	12	..	335	0
Bhutan	1,181	29.6	..	..	..	92	21	625	18	5,468	7	..	..	0
Cambodia	3,750	20.5	2	3	1	127	23	521	24	..	31	..	..	(1)
China	105,527	11.3	41	30	26	502	80	1,221	82	32,200	443	(14,322)	(53,326)	45,767
Georgia	290	4.2	2	2	..	98	11	268	8	4,350	0	4	(5)	670
India	15,291	4.9	120	19	4	422	85	1,180	79	18,664	246	4	75	(95)
Indonesia	8,607	4.5	116	2	6	667	146	1,604	121	29,375	383	(3,250)	15,817	(873,858)
Japan	3,123	8.4	164	13	4	171	37	592	53	5,565	12	5,978	17,489	292,287
Kazakhstan	7,742	2.9	1	2	..	145	15	497	23	6,000	1	12	3	0
Korea, Dem People's Rep	316	2.6	..	..	2	105	12	369	22	2,898	3	4	59	45,256
Korea, Rep	350	3.6	7	2	2	89	12	423	34	2,898	0	194	48	30,095
Kyrgyzstan	608	3.1	..	1	2	58	6	207	4	4,500	1	..	..	0
Lao People's Dem Rep	..	..	..	..	..	215	30	704	21	8,286	19	..	..	0
Malaysia	1,366	4.1	67	4	..	337	50	746	40	15,500	683	196	3,791	(491,605)
Mongolia	20,992	13.5	..	11	4	140	13	387	22	2,823	0	..	..	0
Myanmar	174	0.3	1	1	..	288	39	1,047	41	7,000	38	(2)	3	0
Nepal	1,127	7.6	..	4	..	203	29	864	31	6,973	7	..	2	(2)
Pakistan	3,509	4.0	5	19	1	195	17	625	30	4,950	2	..	(476)	(3)
Philippines	1,513	5.1	38	4	2	222	50	590	70	8,931	212	(2,654)	(591)	11
Singapore	3	5.2	2	..	..	73	3	400	10	2,282	54	10	29,328	81,980
Sri Lanka	637	9.6	19	3	3	123	21	381	16	3,314	280	5	199	0
Tajikistan	2,603	18.3	..	5	..	76	7	351	9	5,000	2	..	..	0
Thailand	6,516	12.7	19	10	4	300	36	971	42	11,625	84	310	15,650	103,742
Turkmenistan	1,883	4.0	..	1	1	103	12	318	13	..	0	..	..	0
Uzbekistan	2,050	4.6	..	1	1	91	7	343	16	4,800	1	..	20	0
Viet Nam	1,099	3.4	12	1	4	279	41	837	41	10,500	145	(5,142)	2	(133,885)
Europe	**137,694**	**6.1**	**761**	**788** i	**172**	**..**	**..**	**..**	**..**	**..**	**..**	**9,783**	**137,082**	**1,429,081**
Albania	56	2.0	7	2	..	73	1	303	9	3,031	0	..	..	0
Austria	2,346	28.0	..	17	5	101	5	412	8	3,100	3	7	868	7,969
Belarus	1,304	6.3	..	7	3	71	6	226	4	2,100	0	8	..	1
Belgium	83	2.7	2	9	..	92	9	427	10	1,550	0	1,135	(2,138)	64
Bosnia and Herzegovina	27	0.5	..	1	..	78	8	312	8	..	1	..	(2)	0
Bulgaria	593	5.4	1	10	16	106	12	379	11	3,572	0	(1)	26	36
Croatia	339	6.0	18	4	1	96	7	365	9	4,288	0	11	56	26
Czech Rep	196	2.5	..	11	7	88	6	386	9	1,900	4	31	(24,481)	8
Denmark	933	21.8	72	38 j	1	81	4	427	10	1,450	3	(1)	(905)	2,917
Estonia	350	7.6	..	11	1	67	4	267	3	1,630	0	4	0	130
Finland	1,044	3.1	14	11	2	80	3	421	10	1,102	1	(1)	1	81
France	1,624	3.0	83	22 j	10	148	16	517	15	4,630	2	3,373	30,981	272,532
Germany	10,445	29.3	40	32	14	126	9	487	14	2,682	12	705	3,602	266,995
Greece	239	1.8	14	10	2	118	11	412	14	4,992	2	269	17,170	2,343
Hungary	821	8.8	..	23	5	88	7	367	9	2,214	1	37	(610)	(2,744)
Iceland	476	4.7	9	3	..	33	7	305	0	377	0	..	97	1
Ireland	78	1.1	12	45	2	63	4	408	8	950	1	(2)	42	2
Italy	2,160	7.2	55	46	8	132	12	478	15	5,599	3	241	51,086	524,785
Latvia	818	12.7	1	6	1	68	4	325	8	1,153	0	(2)	1	43
Lithuania	592	9.2	3	5	..	71	5	227	4	1,796	0	12	236	0
Macedonia, FYR	180	7.1	..	1	..	89	9	291	9	3,500	0	..	(176)	0
Moldova, Rep	47	1.4	..	2	..	50	4	203	8	1,752	0	..	98	0
Netherlands	175	4.9	10	49 j	1	95	9	444	11	1,221	0	819	(15,041)	45
Norway	1,952	6.1	18	37 j	..	83	9	442	6	1,715	2	(1)	1,849	32
Poland	3,417	11.0	6	8	9	110	12	424	12	2,450	4	19	649	196
Portugal	399	4.4	26	12	1	105	15	501	15	5,050	15	11	19,732	0
Romania	476	2.0	8	2	3	101	15	365	13	3,400	1	44	16	79
Russian Federation	90,223	5.4	47	35	34	296	43	645	47	11,400	7	146	780	1,338
Serbia and Montenegro	327	3.2	2	5	2	96	10	381	10	4,082	1	550	(1,241)	220
Slovakia	357	7.3	..	13	4	87	7	332	11	3,124	2	12	(621)	41
Slovenia	293	14.4	2	2	2	87	7	350	7	3,200	0	..	878	456
Spain	4,059	8.0	38	49	27	132	20	515	20	5,050	14	101	34,436	304,775
Sweden	4,364	9.8	95	51	1	85	5	457	9	1,750	3	(3)	(784)	6
Switzerland	1,185	28.7	..	11	2	93	4	382	8	3,030	2	(13)	174	55,422
Ukraine	1,937	3.3	17	33	6	120	14	325	13	5,100	1	5	1,264	160
United Kingdom	3,731	15.3	153	159 j	9	103	10	557	10	1,623	13	2,266	17,798	(8,970)
Middle East & N. Africa	**33,360**	**2.7**	**91**	**77** i	**26**	**..**	**..**	**..**	**..**	**..**	**..**	**194**	**40,945**	**63,360**
Afghanistan	219	0.3	..	..	..	144	12	434	17	4,000	1	..	..	0
Algeria	11,864	5.1	4	26	6	100	12	372	11	3,164	2	..	3	0
Egypt	4,536	4.6	17	2	2	118	6	481	17	2,076	2	..	39	55,111
Iran, Islamic Rep	10,376	6.4	7	22	9	158	21	498	18	8,000	1	..	(1)	0
Iraq	1	0.0	..	..	..	102	9	396	18	..	0	..	(1)	0
Israel	379	18.4	19	2	1	115	13	534	18	2,317	0	(250)	9,873	(464)
Jordan	913	10.2	1	1	1	93	7	397	14	2,100	0	265	4,980	0
Kuwait	0	0.0	4	..	..	23	1	358	12	234	0	..	2,618	0
Lebanon	4	0.3	1	4	..	70	5	377	10	3,000	0	20	1,415	1,651
Libyan Arab Jamahiriya	122	0.1	3	2	..	87	5	326	7	1,825	1	78	3	0
Morocco	326	0.8	4	4	2	129	12	430	13	3,675	2	(3)	7	19
Oman	22	0.1	4	..	..	74	12	483	14	1,204	6	..	384	0
Saudi Arabia	3,922	2.0	3	..	..	94	9	433	17	2,028	3	28	7,790	3,108
Syrian Arab Rep	..	..	..	1	..	82	3	350	11	3,000	0	..	1	0
Tunisia	28	0.2	2	1	4	78	10	360	9	2,196	0	18	75	15
Turkey	571	0.7	14	9	..	145	15	436	14	8,650	3	34	2,211	3,847
United Arab Emirates	0	0.0	..	..	..	30	5	268	11	..	0	2	1,112	60
Yemen	..	..	..	..	1	74	6	385	14	1,650	159	..	..	12

For more information, please visit http://earthtrends.wri.org/datatables/biodiversity

	Protected Areas					Number of Known and Threatened Species						Net Legal Trade in Selected Wildlife Products as Reported by CITES {c}		
	All Areas Under IUCN Management Categories I-V, 2004 {a}		Marine Areas, IUCN Categories	Wetlands of International		Mammals		Birds		Plants {b}				
	Total Area (1000 ha)	Percent of Total Land Area	I-VI, Number 2004	Importance, Number 2005	Biosphere Reserves, Number 2004	Known Species 2004	Number Threatened 2003	Known Species 2004	Number Threatened 2003	Known Species 2004	Number Threatened 2003	Live Primates 2002	Live Parrots 2002	Animal Skins {d} 2002
Sub-Saharan Africa	**142,025**	**5.9**	**153**	**102** i	**50**	**..**	**..**	**..**	**..**	**..**	**..**	**(8,916)**	**(198,174)**	**(383,039)**
Angola	5,271	4.2	4	..	..	296	11	930	20	5,185	26	(1)	(4)	0
Benin	778	6.7	..	2	2	159	6	485	2	2,500	14	..	2	(2,500)
Botswana	10,499	18.1	..	1	..	169	6	570	9	2,151	0	2	50	4
Burkina Faso	3,135	11.5	..	3	2	129	6	452	2	1,100	2	..	0	0
Burundi	146	5.4	..	1	..	116	7	597	9	2,500	2	..	(6)	0
Cameroon	3,456	7.4	2	..	3	322	42	936	18	8,260	334	(3)	(16,490)	(20)
Central African Rep	7,320	11.8	..	..	2	187	11	663	3	3,602	15	(1)	(10)	(4)
Chad	11,494	9.0	..	2	..	104	12	531	5	1,600	2	1	2	(43,538)
Congo	4,861	14.1	..	1	2	166	14	597	4	6,000	35	..	(8,201)	0
Congo, Dem Rep	11,868	5.1	..	2	3	430	29	1,148	30	11,007	65	..	(5,966)	0
Côte d'Ivoire	1,953	6.1	3	1	2	229	23	702	11	3,660	105	(4)	(4,017)	0
Equatorial Guinea	455	16.8	3	3	..	153	17	418	6	3,250	61	..	..	0
Eritrea	501	4.1	..	..	..	70	9	537	7	..	3	..	..	0
Ethiopia	5,518	4.9	..	..	..	288	35	839	20	6,603	22	..	(1)	(207)
Gabon	80	0.3	2	3	1	166	11	632	5	6,651	107	6	(28)	(5)
Gambia	1	0.0	5	1	..	133	3	535	2	974	4	60	..	0
Ghana	1,104	4.6	..	6	1	249	15	729	8	3,725	117	(11)	2	(6)
Guinea	51	0.2	..	12	4	215	18	640	10	3,000	22	(27)	(10,068)	(10)
Guinea-Bissau	..	..	..	1	1	101	5	459	1	1,000	4	(3)	(4)	0
Kenya	3,485	6.0	11	4	6	407	33	1,103	28	6,506	103	1	(1)	(2,461)
Lesotho	7	0.2	..	1	..	59	3	311	7	1,591	1	..	..	0
Liberia	129	1.3	1	1	..	183	20	576	11	2,200	46	..	(1,656)	(1)
Madagascar	1,404	2.4	7	3	3	165	49	262	34	9,505	276	2	(3,754)	(8,036)
Malawi	1,059	8.9	..	1	1	207	7	658	13	3,765	14	..	6	(60)
Mali	4,532	3.6	..	1	1	134	12	624	5	1,741	6	..	(12,750)	(56,413)
Mauritania	250	0.2	5	3	..	94	7	521	5	1,100	0	..	0	0
Mozambique	3,285	4.2	6	1	..	228	12	685	23	5,692	46	..	(19)	(291)
Namibia	3,214	3.9	4	4	..	192	10	619	18	3,174	24	2	828	(101)
Niger	9,694	8.2	..	7	2	123	10	493	2	1,460	2	(7)	1	0
Nigeria	3,254	3.6	..	1	1	290	25	899	9	4,715	170	(3)	0	(4)
Rwanda	194	7.7	..	..	1	206	13	665	9	2,288	3	..	..	0
Senegal	2,096	10.7	7	4	3	191	11	612	5	2,086	7	(1)	(20,245)	(5)
Sierra Leone	145	2.0	..	1	..	197	12	626	10	2,090	47	..	(100)	0
Somalia	180	0.3	1	..	..	182	15	642	13	3,028	17	..	..	0
South Africa	6,460	5.3	27	17	4	320	29	829	36	23,420	75	(678)	(114,898)	(49,156)
Sudan	8,616	3.5	1	..	2	302	16	952	10	3,137	17	(90)	(154)	(107,111)
Tanzania, United Rep	13,786	14.6	8	4	3	375	34	1,056	37	10,008	239	(844)	(39)	(1,384)
Togo	429	7.5	..	2	..	175	7	565	2	3,085	10	(24)	(508)	(1,500)
Uganda	1,763	7.3	..	2	1	360	29	1,015	15	4,900	38	3	(24)	(2)
Zambia	6,366	8.4	..	2	..	255	11	770	12	4,747	8	3	100	(27,609)
Zimbabwe	3,103	7.9	..	..	..	222	8	661	10	4,440	17	1	(465)	(88,934)
North America	**131,738**	**6.7**	**659**	**57** i	**60**	**..**	**..**	**..**	**..**	**..**	**..**	**20,739**	**36,241**	**(25,113)**
Canada	52,069	5.3	219	36	13	211	16	472	19	3,270	1	1,209	3,473	(12,497)
United States	79,664	8.4	399	21	47	468	40	888	71	19,473	240	19,530	32,759	(12,616)
C. America & Caribbean	**6,041**	**2.2**	**397**	**101** i	**32**	**..**	**..**	**..**	**..**	**..**	**..**	**(1,525)**	**(2,370)**	**595,983**
Belize	633	28.6	22	1	..	147	5	544	3	2,894	30	(2)	1	0
Costa Rica	477	9.3	21	11	2	232	13	838	18	12,119	110	4	1,918	0
Cuba	96	0.9	36	6	6	65	11	358	18	6,522	163	(3)	(20,103)	0
Dominican Rep	1,113	22.9	14	1	1	36	5	224	16	5,657	30	57	526	0
El Salvador	..	..	3	1	..	137	2	434	3	2,911	25	(7)	(6)	(1)
Guatemala	594	5.4	3	4	2	193	7	684	10	8,681	85	7	2,270	0
Haiti	7	0.3	..	..	..	41	4	271	15	5,242	28	..	..	0
Honduras	529	4.7	18	5	1	201	10	699	6	5,680	111	..	1,429	0
Jamaica	0	0.0	4	1	..	35	5	298	12	3,308	208	..	12	0
Mexico	1,205	0.6	37	55	16	544	72	1,026	57	26,071	261	341	12,152	602,606
Nicaragua	777	6.0	5	8	2	181	6	632	8	7,590	39	2	(5,038)	(4)
Panama	483	6.5	14	4	2	241	17	904	20	9,915	195	..	2,580	(6,629)
Trinidad and Tobago	24	4.8	9	1	..	116	1	435	2	2,259	1	..	308	0
South America	**106,018**	**5.9**	**196**	**76** i	**40**	**..**	**..**	**..**	**..**	**..**	**..**	**(1,518)**	**(46,218)**	**(917,236)**
Argentina	5,911	2.1	29	13	11	375	32	1,038	55	9,372	42	3	(16,517)	(230,030)
Bolivia	12,082	11.1	..	8	3	361	26	1,414	30	17,367	70	2	..	(33,720)
Brazil	32,866	3.9	82	8	5	578	74	1,712	120	56,215	381	(4)	983	2,769
Chile	2,650	3.5	27	9	7	159	22	445	32	5,284	40	13	167	103
Colombia	9,786	8.6	13	3	5	467	39	1,821	86	51,220	222	3	9	(547,545)
Ecuador	2,308	9.3	4	11	3	341	34	1,515	69	19,362	..	1	..	1
Guyana	486	2.3	..	..	..	237	13	786	3	6,409	23	(918)	(12,264)	(1,000)
Paraguay	1,391	3.5	..	6	1	168	11	696	27	7,851	10	..	(6,552)	(91,317)
Peru	4,010	3.1	3	10	3	441	46	1,781	94	17,144	274	(298)	(3,301)	(197)
Suriname	1,846	12.7	7	1	..	203	12	674	0	5,018	27	(318)	(9,859)	0
Uruguay	30	0.2	4	2	1	118	6	414	24	2,278	1	2	(1,004)	(83)
Venezuela	31,357	34.2	19	5	1	353	26	1,392	25	21,073	67	(4)	2,120	(16,217)
Oceania	**58,396**	**6.9**	**541**	**74** i	**12**	**..**	**..**	**..**	**..**	**..**	**..**	**247**	**(11,136)**	**(38,122)**
Australia	51,895	6.7	339	64	12	376	63	851	60	15,638	56	266	(95)	(10,147)
Fiji	16	9.9	15	..	..	15	5	112	13	1,518	66	..	18	(1)
New Zealand	6,401	24.0	76	5	..	73	8	351	74	2,382	21	(24)	(1,459)	106
Papua New Guinea	7	0.0	14	2	..	260	58	720	33	11,544	142	..	..	(28,080)
Solomon Islands	..	..	1	..	..	72	20	248	21	3,172	16	..	(9,594)	0
Developed	**353,555**	**6.3**	**2,010**	**963** i	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**35,832**	**84,241**	**1,637,264**
Developing	**454,467**	**5.9**	**1,430**	**464** i	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**(35,821)**	**(84,241)**	**(1,635,648)**

a. Extent of protected areas may include marine components that artificially inflate the percentage of land area protected. **b.** Total plant species refer to vascular plants only. Threatened plant species include both vascular plants and mosses. **c.** CITES trade is expressed as the balance of imports minus exports; negative numbers represent net exports. d. Trade in animal skins includes the skins of crocodiles, wild cats, lizards, and snakes. **e.** Global totals were calculated by WRI. **f.** Global estimate is from Wilson and Reeder's *Mammal Species of the World*, 1993. **g.** Estimate from Birdlife International's *Avibase* database. **h.** 1992 estimate from *Scientific American*. **i.** Transboundary sites may be included more than once in regional totals. See technical notes for full details. **j.** Includes sites in overseas territories.

Biodiversity: Technical Notes

VARIABLE DEFINITIONS AND METHODOLOGY

A **Protected Area** is defined by the World Conservation Union (IUCN) as "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means." Since September 2002 the World Database on Protected Areas (WDPA) consortium has been working to produce an improved and updated database, available to the public and maintained by the United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC). The WDPA contains summary information for over 100,000 sites, including the legal designation, name, IUCN Management Category, size in hectares, location (latitude and longitude), and year of establishment. WRI calculated protected area data using the 2004 WDPA database.

IUCN categorizes protected areas by management objective and has identified six distinct categories of protected areas. WRI has calculated **Total Area** in thousand hectares and **Percent of Land Protected** for categories I-V.

Category Ia. Strict nature reserve: a protected area managed mainly for scientific research and monitoring; an area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features, and/or species.

Category Ib. Wilderness area: a protected area managed mainly for wilderness protection; a large area of unmodified or slightly modified land and/or sea retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.

Category II. National park: a protected area managed mainly for ecosystem protection and recreation; a natural area of land and/or sea designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations; (b) exclude exploitation or occupation inimical to the purposes of designation of the area; or (c) provide a foundation for spiritual, scientific, educational, recreational, and visitor opportunities, all of which must be environmentally and culturally compatible.

Category III. Natural monument: a protected area managed mainly for conservation of specific natural features; an area containing one or more specific natural or natural/cultural features that is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities, or cultural significance.

Category IV. Habitat/species management area: a protected area managed mainly for conservation through management intervention; an area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.

Category V. Protected landscape/seascape: a protected area managed mainly for landscape/seascape conservation and recreation; an area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological, and/or cultural value, and often with high biological diversity.

Category VI. Managed mainly for the sustainable use of natural ecosystems. These areas contain predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while also providing a sustainable flow of natural products and services to meet community needs.

IUCN defines a **Marine Protected Area** (MPA) as: "any area of intertidal or subtidal terrain, together with its overlying water and associated flora and fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment."

These MPAs include areas that are fully marine or littoral. "Littoral" is defined as any site which is known to incorporate at least some intertidal area.

Many MPAs have large terrestrial areas. The extent of the marine portion of most protected areas is rarely documented. The degree of protection varies from one country to another, and may bear little relationship to the legal status of any site. The total number of marine areas in IUCN categories I-VI is shown in this table.

Wetlands of International Importance, or Ramsar sites, are defined under the Wetlands Convention, signed in Ramsar, Iran, in 1971. In order to qualify as a Ramsar site, an area must have "international significance in terms of ecology, botany, zoology, limnology or hydrology." The Convention on Wetlands is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. As of January 2005 there were 1420 Ramsar sites in 146 countries with an overall extent of 123,914,362 hectares.

Biosphere Reserves are terrestrial and coastal environments recognized under United Nations Educational, Scientific, and Cultural Organization's (UNESCO's) Man and the Biosphere Programme. Selected for their value to conservation, they are intended to foster the scientific knowledge and skills necessary for improving the balance between people and nature, and for promoting sustainable development. Ideally, biosphere reserves perform three main roles: (a) conservation in situ of natural and semi-natural ecosystems and landscapes; (b) the establishment of demonstration areas for ecologically and socio-culturally sustainable resource use; and (c) the provision of logistic support for research, monitoring, education, training, and information exchange. Biosphere reserves normally consist of three elements: a minimally disturbed core area for conservation and research; a buffer zone where traditional land uses, research, and ecosystem rehabilitation may be permitted; and a transition area. Biosphere reserves are nominated by national governments and remain under the sovereign jurisdiction of the state where they are located. As of November 2004 there were 459 biosphere reserves in 97 countries.

The **Total Number of Known Species** refers to the total number of a particular type of species in a given country. Data on **known mammals** exclude marine mammals. Data on **known birds** include only birds that breed in that country, not those that migrate or winter there. The number of **known plants** includes higher plants only: ferns and fern allies, conifers and cycads, and flowering plants.

The number of known species is collected by WCMC from a variety of sources, including, but not limited to, national reports from the Convention on Biodiversity, other national documents, independent studies, and other texts. Data are updated on a continual basis as they become available; however, updates vary widely by country. While some countries (WCMC estimates about 12) have data that were updated in the last six months, other species estimates have not changed since the data were first collected in 1992.

The **Number of Threatened Species** listed for all countries includes all species that are "critically endangered, endangered, or vulnerable" as defined by the IUCN, but excludes introduced species, species whose status is insufficiently known (categorized by IUCN as "data deficient"), those known to be extinct, and those for which status has not been assessed (categorized by IUCN as "not evaluated"). Species are classified as vulnerable or endangered if they face a risk of extinction in the wild in the immediate future (critically endangered), in the near-term (endangered), or in the medium-term (vulnerable). Threat categories are assigned based on total population size, distribution, and rates of decline. **Threatened birds** include breeding bird species plus all species that are known to migrate or winter in a given country. Where possible, **threatened mammals** include marine mammals.

Net Legal Trade in Selected Wildlife Products is the balance of imports minus exports of live primates, live parrots, and animal skins reported by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Negative values represent net exports. **Live primates** includes all species of monkeys, apes, and prosimians listed under CITES that were traded live in 2002. **Live parrots** includes individuals from the Psittaciformes species listed under CITES that were traded live in 2002. **Animal skins** includes whole skins of all crocodile, cat, lizard, and snake species that were traded in 2002. Data are obtained from trade records submitted by parties to the CITES convention and compiled by the secretariat in the CITES Trade Database.

International trade in wildlife and wildlife products, worth billions of dollars annually, causes serious declines in the numbers of many species of animals and plants. In response, CITES entered into force in 1975 with the purpose of protecting wildlife against overexploitation and preventing international trade from threatening species with extinction. Species are listed in appendices to CITES according to their degree of rarity and the threat posed by trade. International trade in either the listed species themselves or in products derived from the species requires permits or certificates for export, import, and re-export.

FREQUENCY OF UPDATE BY DATA PROVIDERS

Protected Areas data are updated annually by the WDPA. **Wetlands of International Importance** and **Biosphere Reserves** information is updated several times a year as new sites are added. Data for **Known Species** are updated when new information is provided to WCMC (see above). **Threatened Species** data are updated by IUCN on a continual basis. Species trade data are published in annual reports; the data presented here were published in 2004.

DATA RELIABILITY AND CAUTIONARY NOTES

Protected Areas: Due to variations in consistency and methodology of collection, data on protected areas are highly variable among countries. Some countries update their information with greater regularity or have more accurate data on extent of coverage. Many countries have an underreported number and/or extent of protected areas within their borders. Please see http://parksdata.conserveonline.org for the latest revision.

Biosphere Reserves and Wetlands of International Importance: Reserves can be conterminous or overlapping. Regional wetland totals may include some double counting of sites that are contained in more than one country. A full listing of these sites is available at http://www.unesco.org/mab/BR-WH.htm and at http://www.unesco.org/mab/BR-Ramsar.htm.

Number of Known Species: Values are preliminary estimates based on a compilation of available data from a large variety of sources. They are not based on species checklists. Data have been collected over the last decade without a consistent approach to taxonomy. This can result in significant variations in data quality among countries. Additionally, while the number of species in each country does change, not all countries have been updated; some data may not reflect recent trends. At best, only about 2% of the total species of the world are represented in the UNEP-WCMC Species Database. For this reason, it is important to recognize that numbers of known species in this table are vast underestimates of the actual species worldwide. Data for plant species are less reliable and consistent than data for birds and mammals. Global estimates were not obtained from UNEP-WCMC; see below for citations.

Number of Species Threatened: The total number of threatened species in species groups worldwide are frequently underestimated. For all species groups, there are many species that have yet to be described and whose status is yet unknown. In addition, while threat assessments have been conducted for all described species of mammals and birds, only a small portion of described plant species have been assessed.

Net Legal Trade in Selected Wildlife Products: Data on net exports and net imports as reported by CITES correspond to legal international trade and are based on permits issued, not actual items traded. Figures may be overestimates if not all permits are used that year. Some permits issued in one year are used at a later date; therefore, numbers of exports and imports may not match exactly for any given year. Species traded within national borders and illegal trade in wildlife and wildlife products are not reflected in these figures. CITES trade data also do not reflect legal trade between non-CITES members. In addition, data on mortality of individuals during capture or collection, transit, or quarantine are also not reflected in these numbers.

SOURCES

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11 Land Use and Human Settlements

Sources: Food and Agriculture Organization of the United Nations, University of Maryland, United Nations Environment Programme, United Nations Population Division, World Bank, United Nations Human Settlements Programme

	Land Area Classifications Percent of Total Land Area That Is:														
		Forested				Agricultural								Percent of Population Living in Cities With More Than	
	Total Land Area (1000 ha)	MODIS Satellite {a} Imagery, 2000		FAO {b} Estimates,		Arable and Permanent Cropland		Permanent Pasture		Dry-lands {c}	Population Density (people per km^2)	Urban Population as a Percent of Total		100,000 People	1 Million People	Percent of Urban Population Living in Slum Conditions
	2002	>50% Cover	>10% Cover	>10% Cover		2002	1992	2002	1992		2000	2000	1990	2002	2002	2001
World	**13,066,880**	**24**	**50**	**29**	**30**	**12**	**12**	**27**	**26**	**..**	**45**	**47**	**43**	**..**	**..**	**32**
Asia (excl. Middle East)	**2,406,300**	**21**	**38**	**20**	**20**	**21**	**20**	**34**	**34**	**..**	**135**	**35**	**30**	**19**	**12**	**40**
Armenia	2,820	9	23	12	10	20	20	30	24	98	104	65	67	56	47	2
Azerbaijan	8,260	8	27	13	11	24	22	32	26	84	94	51	54	29	25	7
Bangladesh	13,017	11	35	9	8	65	64	5	5	0	958	23	20	13	10	85
Bhutan	4,700	61	73	64	64	4	3	9	7	0	44	8	6	0	0	44
Cambodia	17,652	47	82	52	55	22	22	8	8	0	73	17	13	11	8	72
China	932,742	15	31	17	15	17	14	43	43	34	133	36	27 e	17	11	38
Georgia	6,949	42	67	43	43	15	16	28	30	34	76	53	55	38	28	9
India	297,319	11	44	20	19	57	57	4	4	60	309	28	26	19	11	56
Indonesia	181,157	78	100	55	62	19	16	6	7	3	111	42	31	24	16	23
Japan	36,450	71	87	64	64	13	14	1	1	0	336	65	63	..	..	6
Kazakhstan	269,970	1	4	4	4	8	13	69	69	99	6	56	57	34	8	30
Korea, Dem People's Rep	12,041	..	..	68	68	22	21	0	0	0	185	60	58	34	14	1
Korea, Rep	9,873	59	76	63	63	19	21	1	1	0	472	80	74	78	69	37
Kyrgyzstan	19,180	2	9	5	4	7	7	49	47	55	25	34	38	20	0	52
Lao People's Dem Rep	23,080	76	98	53	55	4	4	4	3	0	22	19	15	3	0	66
Malaysia	32,855	82	97	59	66	23	23	1	1	0	70	62	50	40	19	2
Mongolia	156,650	3	8	7	7	1	1	83	78	65	2	57	57	31	0	65
Myanmar	65,755	61	86	51	59	16	15	0	1	..	70	28	25	16	10	26
Nepal	14,300	34	71	26	32	23	17	12	12	9	160	14	9	7	5	92
Pakistan	77,088	1	7	3	3	29	27	6	6	83	179	33	31	24	17	74
Philippines	29,817	50	89	19	22	36	33	5	4	0	252	59	49	28	20	44
Singapore	67	11	29	3	3	3	3	..	..	0	6478	100	100	..	..	0
Sri Lanka	6,463	33	91	30	35	30	29	7	7	24	283	21	21	14	13	14
Tajikistan	13,996	0.1	3	3	3	8	7	23	25	40	43	26	32	15	0	56
Thailand	51,089	28	82	29	31	38	40	2	2	7	119	31	29	17	14	2
Turkmenistan	46,993	0.0	0.3	8	8	4	3	65	66	100	10	45	45	25	0	2
Uzbekistan	41,424	0.0	2	4	4	12	12	54	55	99	56	37	40	29	13	51
Viet Nam	32,549	43	86	30	28	27	21	2	1	0	236	24	20	17	12	47
Europe	**2,260,099**	**32**	**65**	**45**	**45**	**13**	**14**	**8**	**8**	**..**	**31**	**73**	**72**	**..**	**..**	**6**
Albania	2,740	16	67	34	37	26	26	16	15	0	108	42	36	15	0	7
Austria	8,273	55	75	46	45	18	18	23	24	0	97	66	66	..	..	6
Belarus	20,748	47	70	45	33	28	30	15	15	..	48	70	66	47	18	6
Belgium {d}	3,282	24	48	23	22	26	24	21	211	0	310	97	96	..	..	15
Bosnia and Herzegovina	5,120	57	92	44	44	21	20	20	23	0	78	43	39	20	0	8
Bulgaria	11,063	29	66	33	31	32	39	16	16	53	73	69	66	33	15	6
Croatia	5,592	44	81	32	31	28	24	28	19	0	79	58	54	23	0	8
Czech Rep	7,728	41	68	33	33	43	..	13	..	13	130	74	75	26	13	6
Denmark	4,243	13	48	11	10	54	60	9	5	0	124	85	85	..	..	6
Estonia	4,239	74	94	46	43	15	27	2	6	0	30	69	71	36	0	12
Finland	30,459	50	96	65	65	7	8	0	0	0	15	61	61	..	..	6
France	55,010	26	61	28	27	36	35	18	20	0	108	76	74	..	..	6
Germany	34,895	36	62	30	30	34	34	14	15	5	231	88	85	..	..	4
Greece	12,890	16	62	27	25	30	31	36	41	45	83	60	59	..	..	6
Hungary	9,210	18	61	20	19	52	54	12	13	46	108	64	62	38	26	6
Iceland	10,025	3	35	0	0	0	0	23	23	..	3	92	91	..	..	6
Ireland	6,889	25	62	9	7	16	15	48	49	0	54	59	57	..	..	1
Italy	29,411	26	58	33	32	38	40	15	15	21	191	67	67	..	..	6
Latvia	6,205	70	95	45	43	30	28	10	13	0	37	67	70	43	0	6
Lithuania	6,268	45	75	31	30	48	49	8	7	0	54	67	68	40	0	6
Macedonia, FYR	2,543	28	69	35	35	24	26	25	25	37	79	59	58	28	0	8
Moldova, Rep	3,288	5	44	10	9	65	67	12	11	100	127	46	47	30	0	31
Netherlands	3,388	13	42	9	9	28	27	30	31	0	383	64	60	..	..	9
Norway	30,625	24	61	27	26	3	3	1	0	0	14	76	72	..	..	6
Poland	30,629	31	60	29	28	46	48	13	13	19	124	62	61	35	15	6
Portugal	9,150	11	70	40	34	30	33	16	9	29	109	53	47	..	..	14
Romania	22,987	34	66	27	26	43	43	21	21	38	94	55	53	33	10	19
Russian Federation	1,688,850	32	65	50	50	7	8	5	5	22	9	73	73	49	23	6
Serbia and Montenegro	10,200	31	65	28	28	37	40	18	21	..	103	52	51	25	16	5
Slovakia	4,808	49	73	44	41	32	..	18	..	0	110	57	57	12	0	6
Slovenia	2,014	69	89	55	54	10	12	15	16	0	98	51	51	13	0	6
Spain	49,944	13	48	28	27	37	40	23	21	69	81	76	75	..	..	6
Sweden	41,162	56	90	60	60	7	7	1	1	0	20	83	83	..	..	6
Switzerland	3,955	40	67	29	28	11	11	28	29	0	174	68	68	..	..	6
Ukraine	57,935	16	52	16	15	58	59	14	13	65	82	67	67	41	19	6
United Kingdom	24,088	21	57	12	11	24	27	46	48	0	242	89	89	..	..	6
Middle East & N. Africa	**1,291,988**	**1**	**3**	**2**	**2**	**8**	**8**	**28**	**24**	**..**	**31**	**58**	**54**	**39**	**24**	**36**
Afghanistan	65,209	0.1	1	2	2	12	12	46	46	94	33	22	18	18	9	99
Algeria	238,174	0.1	1	1	1	3	3	13	13	21	13	57	51	32	12	12
Egypt	99,545	0.0	0.5	0	0	3	3	..	..	8	68	42	43	38	28	40
Iran, Islamic Rep	163,620	1	2	4	4	10	11	27	27	90	40	64	56	46	26	44
Iraq	43,737	0.0	1	2	2	14	13	9	9	100	53	68	70	63	34	57
Israel	2,171	0.3	9	6	4	20	20	7	7	69	287	92	90	81	62	2
Jordan	8,893	0.0	0.2	1	1	4	4	8	9	72	56	79	72	58	47	16
Kuwait	1,782	..	..	0	0	1	0	8	8	92	126	96	95	69	69	3
Lebanon	1,023	1	26	3	4	31	30	2	1	59	334	87	83	66	53	50
Libyan Arab Jamahiriya	175,954	0.0	0.1	0	0	1	1	8	8	23	3	85	80	94	62	35
Morocco	44,630	0.2	5	7	7	21	22	47	47	92	65	56	48	36	16	33
Oman	30,950	0.0	0.1	0	0	0	0	3	3	14	8	76	62	47	0	61
Saudi Arabia	214,969	0.0	0.0	1	1	2	2	79	56	24	10	86	78	5	0	20
Syrian Arab Rep	18,378	0.1	4	2	2	29	30	45	44	98	89	50	49	41	27	1
Tunisia	15,536	0.3	3	3	3	32	31	31	29	94	58	63	58	25	17	4
Turkey	76,963	7	28	13	13	37	36	17	16	77	88	65	59	44	26	43
United Arab Emirates	8,360	0.0	0.0	4	3	3	1	4	3	0	34	85	83	81	50	2
Yemen	52,797	0.0	1	1	1	3	3	30	30	30	34	25	21	17	9	65

For more information, please visit http://earthtrends.wri.org/datatables/forests

	Total Land Area (1000 ha) 2002	Land Area Classifications Percent of Total Land Area That Is: Forested: MODIS Satellite {a} Imagery, 2000 >50% Cover	Forested: MODIS Satellite {a} Imagery, 2000 >10% Cover	Forested: FAO {b} Estimates, >10% Cover 2000	Forested: FAO {b} Estimates, >10% Cover 1990	Agricultural: Arable and Permanent Cropland 2002	Agricultural: Arable and Permanent Cropland 1992	Agricultural: Permanent Pasture 2002	Agricultural: Permanent Pasture 1992	Drylands {c}	Population Density (people per km^2) 2000	Urban Population as a Percent of Total 2000	Urban Population as a Percent of Total 1990	Percent of Population Living in Cities With More Than: 100,000 People 2002	Percent of Population Living in Cities With More Than: 1 Million People 2002	Percent of Urban Population Living in Slum Conditions 2001
Sub-Saharan Africa	**2,362,209**	**18**	**52**	**20**	**22**	**8**	**7**	**35**	**35**	**..**	**27**	**34**	**28**	**22**	**13**	**73**
Angola	124,670	25	83	56	57	3	3	43	43	19	10	33	26	24	20	83
Benin	11,062	0.3	94	24	30	25	16	5	5	88	55	42	35	28	0	84
Botswana	56,673	0.1	21	21	23	1	1	45	45	100	3	50	42	0	0	61
Burkina Faso	27,360	0.0	32	26	26	16	13	22	22	100	43	17	14	10	0	77
Burundi	2,568	8	95	3	9	53	51	39	33	0	225	9	6	5	0	65
Cameroon	46,540	57	91	50	55	15	15	4	4	13	32	49	40	25	18	67
Central African Rep	62,298	58	98	37	37	3	3	5	5	20	6	41	38	21	0	92
Chad	125,920	0.4	18	10	11	3	3	36	36	68	6	24	21	9	0	99
Congo	34,150	70	94	65	65	1	1	29	29	0	10	52	48	22	0	90
Congo, Dem Rep	226,705	72	99	58	60	3	3	7	7	0	21	30	28	30	19	50
Côte d'Ivoire	31,800	21	98	22	30	22	19	41	41	..	49	44	40	36	24	68
Equatorial Guinea	2,805	89	94	62	66	8	8	4	4	0	16	45	35	23	0	87
Eritrea	10,100	0.0	3	13	14	5	..	69	..	83	32	19	16	22	0	70
Ethiopia	100,000	9	52	4	5	11	10	20	41	58	59	15	13	5	4	99
Gabon	25,767	87	97	82	82	2	2	18	18	0	5	81	68	49	0	66
Gambia	1,000	2	73	43	39	26	16	46	45	97	116	26	25	15	0	67
Ghana	22,754	12	91	27	32	28	19	37	37	66	82	44	37	20	13	70
Guinea	24,572	25	98	28	30	6	6	44	44	14	33	33	25	20	19	72
Guinea-Bissau	2,812	45	108	61	67	19	15	38	38	6	38	32	24	20	0	93
Kenya	56,914	3	37	29	31	9	8	37	37	68	53	36	25	16	9	71
Lesotho	3,035	0.5	62	0	0	11	11	66	66	0	59	18	17	9	0	57
Liberia	9,632	81	99	31	38	6	6	21	21	0	26	45	42	43	43	56
Madagascar	58,154	19	76	20	22	6	6	41	41	23	27	26	24	12	8	93
Malawi	9,408	7	90	22	28	26	21	20	20	0	96	15	12	9	0	91
Mali	122,019	0.1	13	11	11	4	2	25	25	80	10	30	24	12	9	93
Mauritania	102,522	0.0	0.0	0	0	0	0	38	38	46	3	58	44	23	0	94
Mozambique	78,409	20	95	38	39	6	5	56	56	38	22	32	21	19	9	94
Namibia	82,329	0.0	4	10	11	1	1	46	46	91	2	31	27	11	0	38
Niger	126,670	0.0	0.2	1	2	4	3	9	8	62	9	21	16	11	0	96
Nigeria	91,077	7	59	15	19	36	36	43	44	58	124	44	35	35	18	79
Rwanda	2,467	11	90	12	17	56	48	19	26	0	293	14	5	4	0	88
Senegal	19,253	2	39	32	34	13	12	29	30	94	48	47	40	35	24	76
Sierra Leone	7,162	54	99	15	20	8	8	31	31	0	62	37	30	26	22	96
Somalia	62,734	0.1	12	12	13	2	2	69	69	80	14	33	29	21	12	97
South Africa	121,447	3	38	7	7	13	12	69	68	66	36	56	49	39	29	33
Sudan	237,600	3	24	25	28	7	6	49	47	67	13	36	27	26	18	86
Tanzania, United Rep	88,359	11	85	41	42	6	5	40	40	..	37	32	22	14	7	92
Togo	5,439	2	90	9	13	48	40	18	18	34	80	33	29	15	0	81
Uganda	19,710	18	95	17	21	37	35	26	26	16	97	12	11	5	5	93
Zambia	74,339	20	91	42	53	7	7	40	40	16	14	35	39	36	16	74
Zimbabwe	38,685	3	78	49	57	9	8	44	44	67	32	34	29	28	18	3
North America	**1,879,066**	**29**	**55**	**24**	**23**	**12**	**12**	**13**	**14**	**..**	**16**	**79**	**75**	**27**	**13** f	**6**
Canada	922,097	36	62	25	25	5	5	2	2	16	3	79	77	58 f	31 f	6
United States	915,896	23	49	23	23	19	20	26	26	41	30	79	75	27 f	8 f	6
C. America & Caribbean	**264,826**	**27**	**66**	**29**	**33**	**16**	**15**	**38**	**37**	**..**	**64**	**67**	**64**	**41**	**26**	**24**
Belize	2,280	73	92	59	74	4	4	2	2	0	11	48	48	0	0	62
Costa Rica	5,106	59	97	39	42	10	10	46	46	0	77	59	54	36	36	13
Cuba	10,982	29	90	21	19	34	39	26	25	11	101	75	74	..	..	2
Dominican Rep	4,838	30	89	28	28	33	32	43	43	5	171	58	55	47	32	38
El Salvador	2,072	34	95	6	9	44	41	38	31	0	295	58	49	32	27	35
Guatemala	10,843	53	98	26	31	18	16	24	23	0	105	45	41	22	21	62
Haiti	2,756	8	82	3	6	40	40	18	18	3	289	36	30	23	21	86
Honduras	11,189	51	98	48	53	13	17	13	13	0	58	44	40	33	20	18
Jamaica	1,083	58	96	30	34	26	22	21	22	31	235	52	52	35	0	36
Mexico	190,869	21	56	28	31	14	14	42	41	69	51	75	73	54	32	20
Nicaragua	12,140	44	95	25	34	18	13	40	40	0	39	56	53	33	25	81
Panama	7,443	57	96	38	45	9	9	21	20	0	39	56	54	34	34	31
Trinidad and Tobago	513	60	91	50	55	24	24	2	2	4	251	74	69	31	0	32
South America	**1,752,020**	**44**	**81**	**50**	**52**	**7**	**7**	**29**	**29**	**..**	**19**	**80**	**74**	**54**	**36**	**36**
Argentina	273,669	9	40	12	13	13	11	52	52	53	13	90	87	64	42	33
Bolivia	108,438	49	74	48	50	3	2	31	31	..	8	62	56	39	31	61
Brazil	845,942	49	93	64	66	8	7	23	22	15	20	81	75	54	36	37
Chile	74,880	25	41	21	21	3	4	17	17	21	20	86	83	70	36	9
Colombia	103,870	66	104	44	45	4	5	40	39	17	37	75	69	54	36	22
Ecuador	27,684	53	83	37	42	11	11	18	18	63	44	60	55	50	35	26
Guyana	19,685	91	102	79	81	3	3	6	6	0	4	36	33	30	0	5
Paraguay	39,730	37	95	57	60	8	6	55	55	55	13	55	49	25	25	25
Peru	128,000	58	72	51	53	3	3	21	21	37	20	73	69	48	28	68
Suriname	15,600	85	89	86	86	0	0	0	0	0	3	74	65	..	..	7
Uruguay	17,502	4	97	7	4	8	7	77	77	0	19	92	89	51	51	7
Venezuela	88,205	56	96	54	57	4	4	21	21	49	27	87	84	58	37	41
Oceania	**849,088**	**10**	**30**	**24**	**23**	**6**	**6**	**49**	**51**	**..**	**4**	**73**	**70**	**..**	**..**	**4**
Australia	768,230	4	24	20	20	6	6	52	55	86	3	91	85	..	..	2
Fiji	1,827	..	..	45	46	16	14	10	10	0	45	49	42	21	0	68
New Zealand	26,799	43	73	29	28	13	13	52	52	0	14	86	85	..	..	1
Papua New Guinea	45,286	89	99	66	69	2	2	0	0	1	12	13	13	7	0	19
Solomon Islands	2,799	82	90	88	89	3	3	1	1	0	15	16	14	0	0	8
Developed	**5,462,781**	**25**	**51**	**31**	**30**	**12**	**12**	**22**	**22**	**..**	**23**	**72**	**70**	**..**	**..**	**8**
Developing	**7,623,524**	**23**	**49**	**25**	**26**	**12**	**11**	**30**	**29**	**..**	**60**	**40**	**35**	**25**	**15**	**43**

a. 500 km resolution imagery processed by the Global Land Cover Facility (GLCF) at the University of Maryland. **b**. Forest Resource Assessment by the United Nations Food and Agriculture Organization of the United Nations (FAO) **c**. Drylands area is determined using aridity zones; arid, semi-arid and dry sub-humid zones are included. Hyper-arid (bare sand deserts) are excluded. Climate data from 1950 to 1981 were analyzed to produce these estimates. **d.** Land area data includes Luxembourg. **e**. Data for 1990 and 2000 do not include Hong Kong or Macau. **f**. Data are from national censuses.

11 Land Use and Human Settlements: Technical Notes

DEFINITIONS AND METHODOLOGY

Total Land Area is measured in thousand hectares and excludes the area under inland water bodies. Inland water bodies generally include major rivers and lakes. Data on land area were provided to the Food and Agriculture Organization (FAO) by the United Nations Statistical Division.

Forested Area is calculated by WRI as a percentage of total land area using data from MODIS satellite imagery analyzed by the Global Land Cover Facility (GLCF) at the University of Maryland and from FAO's *Global Forest Resources Assessment 2000* (FRA 2000).

MODIS Satellite Imagery identifies the percent of tree crown cover for each 500-meter pixel image of land area based on one year of MODIS photography. Data were aggregated to country-level by the GLCF at the request of WRI. The values presented here show the percentage of total land area with more than 10 percent or 50 percent of the ground covered by tree crowns.

The Food and Agriculture Organization (FAO) Estimates are drawn from *FRA 2000*. Forest area includes both natural forests, composed primarily of native tree species, and plantations, forest stands that are established artificially. If no other land use (such as agro-forestry) predominates, any area larger than 0.5 hectares with tree crowns covering more than 10 percent of the ground is classified as a forest. Forest statistics are based primarily on forest inventory information provided by national governments; national gathering methodologies can be found at http://www.fao.org/forestry/fo/fra/index.jsp. FAO harmonized these national assessments with the 10-percent forest definition mentioned above. In tropical regions, national inventories are supplemented with high resolution Landsat satellite data from a number of sample sites covering a total of 10 percent of the tropical forest zone. Where only limited or outdated inventory data were available, FAO used linear projections and expert opinion to fill in data gaps. If no forest statistics existed for 1990 and 2000, FAO projected forward or backward in time to estimate forest area in the two reference years.

Arable and Permanent Cropland is calculated by WRI as a percent of total land area. Arable land is land under temporary crops (double-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens, and land temporarily fallow (less than five years). Abandoned land resulting from shifting cultivation is not included in this category. Permanent cropland is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber; this category includes land under trees grown for wood or timber. Wherever possible, data on agricultural land use are reported by country governments in questionnaires distributed by FAO. However, a significant portion of the data is based on both official and unofficial estimates.

Permanent Pasture is calculated by WRI as a percent of total land area. Permanent pasture is land used long-term (five years or more) for herbaceous forage crops, either cultivated or growing wild. Shrublands and savannas may be classified in some cases as both forested land and permanent pasture.

Drylands is calculated by WRI as the percent of total land area that falls within three of the world's six aridity zones—the arid, semi-arid, and dry sub-humid zones. The United Nations Convention to Combat Desertification (UNCCD) adopted this definition of drylands in order to identify areas where efforts combating land degradation should be focused and methods for attaining sustainable development should be promoted. The world is divided into six aridity zones based on the aridity index—the ratio of mean annual precipitation (PPT) to mean annual potential evapotranspiration (PET). Drylands of concern to the UNCCD include those lands with an aridity index between .05 and .65 (excluding polar and sub-polar regions). Ratios of less than .05 indicate hyper-arid zones, or true deserts. Ratios of 0.65 or greater identify humid zones. The areas with an aridity index between .05 and .65 encompass the arid, semi-arid, and dry sub-humid areas. See the UNCCD's website at http://www.unccd.int/main.php for more information. Climatic data from 1950 to 1981 were used to define aridity zone boundaries for the globe with a resolution of about 50 km.

Population Density is calculated by WRI as the number of persons per square kilometer of land area using FAO land-area data shown in the first column. Population data are from the United Nations Population Division.

Urban Population as a Percent of Total is the proportion of a country's total population that resides in areas defined as urban in each of the countries of the world. These definitions vary slightly from country to country. Many countries define an urban area by the total number of inhabitants in a population agglomeration. Typically the threshold for considering a region urban is between 1,000 and 10,000 inhabitants. Other countries specify several of their cities or provinces as urban, and the remaining population is defined as rural. Estimates of the proportion of the population living in urban areas are obtained from national sources. Censuses and population registers are the most common sources of those counts. Once values of the urban proportion at the national level are established, they are applied to estimates and projections of the total national population from *World Population Prospects: The 2002 Revision.*

Percent of Population Living in Cities with More Than 100,000 and 1 Million People indicates population distribution and levels of urbanization within a country. WRI calculated percentages from the *Urban Population in World Bank Regions by City Size* data set and total population figures from the UN Population Division. Urban population data were primarily collected from national statistical offices, international organizations such as the United Nations, and the World Gazetteer web site. Data from national census bureaus in several OECD countries (Canada, United States) were added to complement this data set.

Percent of Urban Population Living in Slum Conditions is the proportion of a country's urban population that is living in households classified as slum dwellings. A slum household is defined by the United Nations Human Settlements Program (UN-HABITAT) as a group of individuals living under the same roof that lacks one or more of the following conditions: "secure tenure status, adequate access to improved water, adequate access to improved sanitation and other infrastructure, structural quality of housing, and sufficient living area."

While the same methodology was used to determine the slum population in all countries, data sources vary. Where available, household surveys, such as Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS), were the common sources of data. An effort was made to ensure that households were not counted twice, in the event that they lacked more than one of the indicators. In the absence of household surveys, or when household surveys did not provide answers for the desired indicators, the slum populations were estimated. Estimates were derived from a statistical model using available country data and the Human Development Index (HDI) of the United Nations Development Programme (UNDP).

FREQUENCY OF UPDATE BY DATA PROVIDERS

Total Land Area, Arable and Permanent Cropland Area, and Permanent Pasture data are updated annually by the FAO. **Population** data are updated every two years by the United Nations Population Division. **Forested Land Area** based on **Modis Satellite Imagery** was released by the GLCF in 2002. The *FRA* is published by the **FAO** every 5 years; data in this table are from the 2000 release. **Drylands Area** data were prepared in 1991; no update is planned. Data on urban population by city size are updated continually by the World Bank. **Urban Population Living in Slum Conditions** is the first global compilation of such data.

DATA RELIABILITY AND CAUTIONARY NOTES

Land-area data are intended for broad estimations only and not for strict comparisons. Land-area classification is inherently subjective; experts often express different opinions on the criteria for categorizing ecosystem and use types, and the resolution of the underlying satellite and survey information can vary widely among data sets. In addition, the information on land-area types shown here is from different sources and represents different time periods. They are not intended to represent exclusive land-cover types; some degree of overlap is present.

Forest Cover: As shown in the table, forest cover estimates differ widely based on collection methodology and classification used. FAO uses a more complex definition of forests than is used in the MODIS data set, requiring that there be 10 percent tree cover and that forestry be the predominant land use in the survey area. Thus some areas with tree cover of more than 10 percent may not be counted as forest if the predominant land use is determined to be agriculture, urban settlement, or some other nonforestry use. Because the MODIS tree-cover data set makes no such distinction, the tree cover in the "10 percent and above" categories will sum to a larger area than the FAO forest area for most countries.

MODIS Satellite Imagery: Following publication of the Global Land Cover Characteristics (GLCC) database by GLCF, a number of scientific teams assessed the accuracy of the GLCC's approach by comparing the results with higher-resolution satellite imagery. These teams found that the accuracy of the GLCF's approach was, depending on the assessment approach, in a range from 60 to nearly 80 percent, meaning that the assessment teams' classification of a given area agreed with the GLCF's classification between 60 and 80 percent of the time.

FAO Estimates: FAO acknowledges that the quality of primary data available remains poor, particularly for tropical countries, open woodland areas, and non-production forests. In most tropical countries, forests are not monitored comprehensively or frequently enough to map their extent accurately or to track their rate of change. In the absence of inventory data for specific dates (1990 and 2000), FAO's latest estimates of forest area and change over time are often based on projections and expert opinion and thus remain educated guesses. Just one or two satellite images appear to have been the prime source of new information for some countries with poor inventory data. Open woodlands are difficult to monitor by remote sensing techniques, and government forestry agencies tend not to survey them as part of normal forest inventories. Non-production forests are not included in these totals, even though many appear to meet the FAO definition of forests. While the quality of data from developed countries is generally better than from developing countries, problems still arise with estimates because of differences in national forestry definitions and systems of measurement, and the use of different reference periods. In northern countries, the boundary between forest and tundra is vague. For a discussion of some data reliability issues associated with *FRA 2000,* see http://pdf.wri.org/fra2000.pdf.

Drylands: The accuracy of land-area totals is limited by the 50-kilometer resolution of the data set. The climate data set was derived from a limited number of field observations. Actual boundaries between aridity zones are neither abrupt nor static, making delineated borders somewhat artificial. The data should therefore be considered useful as a general indicator of the extent of drylands within each country, rather than as an exact depiction of the climatic situation on the ground. Alternative methods for measuring extent of drylands area include use of soil moisture and agricultural production systems, although these methods may also be subject to similar problems such as low-resolution data, limited field observations, and subjectivity when delineating exact boundaries on the ground.

Percent of Urban Population Living in Slum Conditions: UN-HABITAT's definition of slum conditions, described above, may not always measure living conditions with sufficient precision. Sub-national coverage for the household surveys varies as does the international coverage for the different indicators. Despite these drawbacks, this is the most reliable global data set available on this complex issue.

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Food and Agriculture

Source: Food and Agriculture Organization of the United Nations, International Federation of Organic Agriculture Movements, United States Department of Agriculture

	Land			Intensity of Agricultural Inputs				Per Capita Food Production Index (1999-2001 =100)		Food Aid, Security, and Nutrition				
	Agricultural Land (a) (000 ha) 2002	Irrigated Cropland as a Percent of Total 2002	Organic Cropland as a Percent of Total 2003	Labor (workers per ha) 2001	Fertilizer (kg/ha) 2001	Mechan-ization (tractors per 000 ha) 2001	Water Withdrawals (meters^3/ha) 2000	1983	2003	Cereals Received as Food Aid (000 metric tons) 2002	Net Cereal Imports (b) as a Percent of Consumption 2002	Cereal Fed to Livestock as a Percent of Total Consumption 2003	Calorie Supply Per Capita (kilocalories /person/day) 2002	Share of Calorie Supply From Animal Products (percent) 2002
World	**1,534,466**	**18.1**		**0.87**	**90.1**	**17.5**		**87.1**	**101.4**	**8,610**	**..**	**36.9**	**2,804**	**16.7**
Asia (excl. Middle East)	**500,878**	**34.2**	**..**	**2.02**	**139.0**	**12.3**	**..**	**..**	**..**	**2,182**	**..**	**20.6**	**2,682**	**14.3**
Armenia	560	50.0	..	0.36	8.9	32.7	3,464	..	114.6	16	46.1	29.2	2,268	16.1
Azerbaijan	2,009	72.4	0.20	0.50	6.1	15.0	6,108	..	118.3	5	21.5	21.6	2,575	14.6
Bangladesh	8,429	54.5	..	4.58	170.8	0.7	8,999	91.8	97.8	353	6.6	0.0	2,205	3.1
Bhutan	165	24.2	..	5.83	..	..	2,500	119.4	76.2	0	22.5	..	..	..
Cambodia	3,807	7.1	..	1.22	..	0.5	1,052	89.6	99.9	25	3.4	..	2,046	9.4
China (c)	153,956	35.7	0.06	3.29	227.6 e	7.2	3,149	52.1	109.1	..	(1.4)	28.1	2,951	20.9
Georgia	1,064	44.1	..	0.48	26.3	16.1	2,005	..	112.3	18	48.3	39.3	2,354	17.6
India (d)	170,115	33.6	0.03	1.57	102.1	9.0	3,291	83.0	98.4	128	(5.5)	4.9	2,459	7.7
Indonesia	33,700	14.3	0.09	1.48	78.5 e	2.1	2,254	76.2	104.2	204	11.5	7.4	2,904	4.3
Japan	4,762	54.7	0.10	0.54	282.4	423.0	11,435	112.9	95.7	..	67.6	45.8	2,761	20.7
Kazakhstan	21,671	10.8	..	0.06	2.3	2.3	1,321	..	107.5	..	(47.4)	47.2	2,677	25.6
Korea, Dem People's Rep	2,700	54.1	..	1.21	100.5 e	25.9	2,480	108.7	106.0	975	26.5	..	2,142	6.5
Korea, Rep	1,877	60.6	0.05	1.20	379.4 e	106.5	..	76.7	92.4	..	65.0	46.3	3,058	15.6
Kyrgyzstan	1,411	76.0	..	0.38	18.8	18.0	6,587	..	99.0	2	11.5	39.8	2,999	19.6
Lao People's Dem Rep	1,001	17.5	0.01	2.15	12.8	1.1	..	68.9	112.6	6	1.4	..	2,312	7.1
Malaysia	7,585	4.8	..	0.24	149.1	5.7	736	60.8	108.4	..	69.0	41.4	2,881	18.1
Mongolia	1,200	7.0	..	0.26	2.7	4.2	195	132.4	95.8	..	58.2	..	2,249	39.7
Myanmar	10,611	18.8	..	1.71	9.0 e	1.0	3,110	84.2	116.2	..	(3.6)	4.9	2,937	4.8
Nepal	3,294	34.5	0.00	3.33	22.7	1.4	3,307	88.1	99.3	..	0.3	..	2,453	6.5
Pakistan (d)	22,120	80.5	0.08	1.14	132.9	14.5	7,407	78.8	97.9	1	(13.6)	3.9	2,419	18.1
Philippines	10,700	14.5	0.02	1.18	73.4 e	1.1	2,099	95.5	106.1	68	19.6	23.7	2,379	15.7
Singapore	2	..	..	..	..	32.5	..	893.0	71.0	..	..	14.1	..	..
Sri Lanka	1,916	33.3	0.65	2.02	127.7 e	4.2	6,280	115.4	100.1	81	29.0	..	2,385	7.1
Tajikistan	1,057	68.0	..	0.77	11.4	28.4	12,745	..	120.6	121	37.2	12.9	1,828	9.2
Thailand	19,367	25.6	0.02	1.12	92.0 e	11.4	4,597	90.2	103.2	1	(26.5)	..	2,467	12.0
Turkmenistan	1,915	94.0	..	0.38	54.0	26.1	14,182	..	98.1	..	..	18.3	2,742	15.4
Uzbekistan	4,827	88.7	..	0.62	149.1	35.2	11,210	..	103.4	119	3.8	18.6	2,241	17.5
Viet Nam	8,895	33.7	0.08	3.30	225.9 e	18.4	6,615	64.7	113.8	60	(5.5)	10.0	2,566	12.1
Europe	**303,993**	**8.3**	**..**	**0.10**	**73.4**	**36.1**	**..**	**..**	**107.5 f**	**96**	**..**	**51.3**	**3,331**	**27.7**
Albania	699	48.6	..	1.07	26.8 e	11.4	1,522	89.6	105.0	25	44.9	..	2,848	28.6
Austria	1,462	0.3	11.60	0.13	148.1	224.5	14	96.7	91.7	..	(9.7)	..	3,673	33.1
Belarus	5,730	2.3	..	0.11	121.5	11.5	134	..	110.9	..	11.9	50.8	3,000	26.2
Belgium	..	..	1.45	..	..	..	..	..	96.8	..	52.6	..	3,584	30.5
Bosnia and Herzegovina	1,093	0.3	..	0.11	38.8	26.2	..	..	83.8	54	28.2	62.2	2,894	13.5
Bulgaria	3,583	16.5	0.00	0.06	43.2 e	6.7	425	145.2	101.0	3	(25.0)	39.1	2,848	24.5
Croatia	1,588	0.3	0.00	0.10	110.7	1.5	..	..	92.6	..	(8.3)	71.1	2,799	19.2
Czech Rep	3,305	0.7	5.09	0.14	119.2 e	28.6	17	..	90.5	..	(1.6)	..	3,171	27.0
Denmark	2,284	19.6	6.65	0.05	134.2	53.5	234	87.5	101.4	..	(12.5)	..	3,439	38.1
Estonia	631	0.6	3.00	0.12	42.6	79.7	7	..	107.5	..	25.4	..	3,002	27.0
Finland	2,208	2.9	7.00	0.06	135.1	88.2	30	124.9	101.6	..	(6.0)	..	3,100	37.5
France	19,583	13.3	1.70	0.04	213.3	64.5	200	99.4	93.0	..	(55.0)	..	3,654	37.1
Germany	11,997	4.0	4.10	0.08	217.4	85.8	775	101.0	93.2	..	(22.2)	..	3,496	30.6
Greece	3,846	37.2	0.86	0.20	111.9 e	64.9	1,621	100.1	95.9	..	22.0	..	3,721	21.8
Hungary	4,804	4.8	1.70	0.10	94.5 e	23.6	511	115.5	95.3	..	(44.7)	..	3,483	32.6
Iceland	7	..	0.70	..	.. e	1288.4	29	129.7	104.3	..	..	..	3,249	41.5
Ireland	1,123	..	0.70	0.15	562.2	144.8	0	89.8	92.4	..	24.6	..	3,656	31.1
Italy	11,064	24.9	8.00	0.12	128.1	148.2	1,849	106.8	91.4	..	25.9	..	3,671	25.9
Latvia	1,861	1.1	0.81	0.08	35.0	30.1	19	..	111.0	..	(8.6)	..	2,938	28.2
Lithuania	2,989	0.2	0.25	0.07	54.2	34.2	6	..	109.6	..	(6.1)	..	3,325	26.3
Macedonia, FYR	612	9.0	..	0.19	36.4	88.2	..	..	91.1	..	29.1	44.9	2,655	21.8
Moldova, Rep	2,143	14.0	..	0.22	14.9	19.1	..	..	102.8	..	(24.9)	59.7	2,806	16.2
Netherlands	949	59.5	2.19	0.26	443.5	159.4	2,853	101.5	92.6	..	68.3	..	3,362	34.2
Norway	871	14.6	3.13	0.12	200.3	151.1	259	118.5	97.5	..	25.7	68.0	3,484	33.0
Poland	14,226	0.7	0.36	0.30	110.0 e	91.4	94	111.4	97.5	..	0.3	..	3,375	26.1
Portugal	2,705	24.0	2.20	0.23	76.9	62.5	3,258	68.2	97.4	..	64.8	..	3,741	29.1
Romania	9,899	31.1	0.27	0.16	37.2 e	16.6	1,339	124.2	106.2	1	(3.4)	59.2	3,455	20.5
Russian Federation	125,300	3.7	0.00	0.06	12.7	6.2	108	..	110.4	1	(16.9)	49.0	3,072	22.3
Serbia and Montenegro	3,724	0.8	0.30	0.26	66.7	109.2	..	..	97.7	0	(8.0)	65.6	2,678	35.0
Slovakia	1,559	11.7	2.20	0.17	74.5 e	14.7	..	..	91.0	..	(1.5)	..	2,889	27.5
Slovenia	198	1.5	1.91	0.09	357.0	562.6	..	..	106.4	..	37.3	..	3,001	32.1
Spain	18,715	20.2	2.28	0.07	122.3	48.4	1,331	74.4	106.5	..	28.4	..	3,371	27.8
Sweden	2,682	4.3	6.09	0.05	98.5	61.2	98	115.1	99.7	..	(11.8)	..	3,185	33.7
Switzerland	433	5.8	10.00	0.36	225.5	256.9	114	112.5	99.2	..	32.5	59.0	3,526	33.8
Ukraine	33,457	6.8	0.58	0.11	14.2	9.5	588	..	95.6	12	(53.8)	45.8	3,054	20.5
United Kingdom	5,803	2.9	4.22	0.09	327.9	87.7	47	107.0	96.8	..	2.1	..	3,412	30.6
Middle East & N. Africa	**100,520**	**28.7**	**..**	**0.51**	**66.8**	**17.2**	**..**	**..**	**..**	**2,232**	**..**	**33.2**	**3,110**	**9.9**
Afghanistan	8,054	29.6	..	0.74	2.3	0.1	2,836	..	..	388	..	..	..	..
Algeria	8,265	6.8	..	0.31	12.8 e	11.4	481	76.2	109.7	43	73.8	25.4	3,022	9.9
Egypt	3,400	100.0	0.19	2.52	392.0	26.8	16,364	68.6	95.7	11	34.1	32.7	3,338	7.6
Iran, Islamic Rep	17,088	43.9	..	0.38	80.1 e	14.3	..	72.6	106.7	10	24.1	21.2	3,085	9.5
Iraq	6,090	57.9	..	0.10	105.0 e	9.8	7,108	..	..	1,333	..	16.1	..	..
Israel	424	45.8	0.90	0.16	210.8	57.8	3,055	124.8	99.2	..	75.8	66.7	3,666	21.8
Jordan	400	18.8	..	0.48	55.9 e	14.4	1,896	110.0	121.9	205	91.4	49.8	2,674	9.2
Kuwait	15	86.7	..	0.93	..	5.9	23,333	56.7	103.9	..	114.4	42.9	3,010	17.4
Lebanon	313	33.2	0.07	0.14	187.1 e	26.5	2,757	78.1	96.1	48	81.6	40.0	3,196	17.0
Libyan Arab Jamahiriya	2,150	21.9	..	0.05	34.0 e	15.8	1,987	107.7	95.4	..	91.3	20.9	3,320	10.4
Morocco	9,283	14.5	0.14	0.44	37.1 e	4.6	1,180	80.3	116.7	4	43.8	27.1	3,052	7.7
Oman	81	76.5	..	..	..	1.9	15,340	107.9	86.7	..	84.2	..	..	..
Saudi Arabia	3,794	42.7	..	0.19	101.1 e	2.6	4,075	72.7	100.7	..	62.9	69.9	2,845	13.7
Syrian Arab Rep	5,421	24.6	0.00	0.28	54.9	18.4	3,537	115.2	112.5	5	7.5	34.7	3,038	13.6
Tunisia	4,908	7.8	0.36	0.19	20.4 e	7.2	445	87.0	89.2	..	90.6	36.4	3,238	10.7
Turkey	28,523	18.3	0.14	0.55	63.4 e	33.3	1,044	97.3	95.2	..	5.0	36.0	3,357	9.5
United Arab Emirates	266	28.6	..	0.31	147.1	1.5	6,371	32.7	52.5	..	84.5	12.8	3,225	22.5
Yemen	1,669	30.0	..	1.80	10.2	4.1	3,786	99.8	98.9	184	91.3	0.9	2,038	7.0

For more information, please visit http://earthtrends.wri.org/datatables/agriculture

	Land			Intensity of Agricultural Inputs				Per Capita Food Production Index (1999-2001 =100)		Food Aid, Security, and Nutrition				
	Agricultural Land (a) (000 ha) 2002	Irrigated Cropland as a Percent of Total 2002	Organic Cropland as a Percent of Total 2003	Labor (workers per ha) 2001	Fertilizer (kg/ha) 2001	Mechan-ization (tractors per 000 ha) 2001	Water Withdrawals (meters^3/ha) 2000	1983	2003	Cereals Received as Food Aid (000 metric tons) 2002	Net Cereal Imports (b) as a Percent of Consumption 2002	Cereal Fed to Livestock as a Percent of Total Consumption 2003	Calorie Supply Per Capita (kilocalories /person/day) 2002	Share of Calorie Supply From Animal Products (percent) 2002
Sub-Saharan Africa	**182,680**	**3.7**	**..**	**1.02**	**11.4**	**1.3**	**..**	**92.4**	**97.4 f**	**3,145**	**..**	**7.0**	**2,262**	**6.6**
Angola	3,300	2.3	..	1.27	..	3.1	64	91.9	104.1	217	42.7	..	2,083	8.5
Benin	2,815	0.4	0.00	0.68	13.7	0.1	84	62.4	99.0	6	16.5	..	2,548	4.4
Botswana	380	0.3	..	0.94	12.3	15.8	161	162.2	100.4	..	168.2	12.2	2,151	18.1
Burkina Faso	4,400	0.6	..	1.34	0.4	0.5	179	72.8	108.6	21	7.3	4.8	2,462	4.6
Burundi	1,351	5.5	..	2.40	2.8	0.1	153	117.0	98.8	55	7.2	..	1,649	2.1
Cameroon	7,160	0.5	0.09	0.52	7.3 e	0.1	102	103.0	105.0	0	20.3	..	2,273	5.7
Central African Rep	2,024	..	..	0.63	0.3	0.01	1	88.9	101.5	5	21.1	..	1,980	9.9
Chad	3,630	0.6	..	0.76	4.8	0.05	53	92.0	101.4	16	5.5	..	2,114	6.6
Congo	240	0.4	..	2.60	21.0	3.0	18	125.8	97.6	14	102.6	..	2,162	6.1
Congo, Dem Rep	7,800	0.1	..	1.66	0.2	0.3	14	151.0	89.6	45	23.7	0.0	1,599	2.2
Côte d'Ivoire	6,900	1.1	..	0.42	9.2 e	0.6	82	83.2	91.8	13	43.3	1.9	2,631	4.1
Equatorial Guinea	230	..	..	0.59	..	0.7	4	96.6	90.4	..	..	..	..	..
Eritrea	503	4.2	..	2.87	10.9 e	0.9	574	..	74.6	184	471.3	2.7	1,513	5.4
Ethiopia	10,671	1.8	..	2.10	11.8 e	0.3	231	..	99.6	1,219	7.4	1.1	1,857	4.9
Gabon	495	3.0	..	0.42	0.6	3.0	104	119.3	95.4	..	68.5	..	2,637	12.7
Gambia	255	0.8	..	2.11	3.1	0.2	91	133.2	65.5	7	49.1	0.0	2,273	5.6
Ghana	6,331	0.2	0.16	0.95	5.3	0.6	43	57.7	107.6	43	18.2	3.2	2,667	4.5
Guinea	1,540	6.2	..	2.23	2.1	0.4	919	97.1	103.6	32	26.0	..	2,409	3.6
Guinea-Bissau	548	3.1	..	0.92	4.4	0.03	286	83.4	93.6	6	38.1	..	2,024	6.5
Kenya	5,162	1.7	0.00	2.34	29.1 e	2.4	223	96.6	94.2	84	22.2	1.9	2,090	11.9
Lesotho	334	0.3	..	0.84	34.0	6.0	31	119.9	104.2	38	240.7	6.8	2,638	4.3
Liberia	600	0.5	..	1.33	..	0.5	101	141.0	84.8	37	74.0	..	1,900	2.9
Madagascar	3,550	30.7	..	1.63	2.5	1.0	4,089	128.6	94.0	40	5.2	..	2,005	9.5
Malawi	2,440	1.2	0.01	1.98	11.7	0.6	362	82.4	79.5	156	17.9	2.3	2,155	2.7
Mali	4,700	2.9	..	0.99	8.9	0.6	1,469	104.0	96.3	7	4.7	1.5	2,174	9.6
Mauritania	500	9.8	..	1.28	5.8 e	0.8	3,000	109.1	97.6	63	..	0.0	2,772	17.5
Mozambique	4,435	2.4	..	1.82	5.9	1.4	133	99.7	98.1	95	27.8	1.0	2,079	2.3
Namibia	820	0.9	..	0.38	0.4	3.8	205	134.4	90.7	41	123.4	..	2,278	15.9
Niger	4,500	1.5	..	1.00	1.1	0.03	462	115.4	99.8	17	8.7	2.7	2,130	5.1
Nigeria	33,000	0.7	..	0.49	7.1	1.0	179	62.4	97.0	13	14.1	1.8	2,726	3.2
Rwanda	1,385	0.4	..	2.99	0.2	0.1	25	126.4	103.4	20	8.7	7.4	2,084	2.9
Senegal	2,500	2.8	0.10	1.26	12.0	0.3	598	72.2	86.0	2	58.4	0.0	2,280	9.1
Sierra Leone	600	5.0	..	1.86	0.5	0.1	643	137.3	96.6	50	52.8	0.0	1,936	3.8
Somalia	1,071	18.7	..	2.57	0.5	1.6	3,075	..	..	16	..	5.0	..	..
South Africa	15,712	9.5	0.05	0.11	48.5 e	4.6	708	94.6	100.1	21	11.4	34.4	2,956	12.2
Sudan	16,653	11.7	..	0.46	5.1 e	0.7	2,195	89.7	102.0	126	25.0	7.4	2,228	20.4
Tanzania, United Rep	5,100	3.3	0.14	2.93	1.6 e	1.5	374	129.3	97.3	51	7.7	2.2	1,975	6.3
Togo	2,630	0.7	..	0.45	7.3	0.03	30	93.0	96.2	..	16.0	13.9	2,345	3.4
Uganda	7,200	0.1	1.39	1.29	0.8	0.7	17	114.0	99.1	113	6.4	4.4	2,410	6.2
Zambia	5,289	0.9	0.06	0.58	6.9 e	1.1	250	107.6	102.7	35	75.8	3.4	1,927	4.9
Zimbabwe	3,350	3.5	..	1.08	45.4 e	7.2	670	95.5	85.1	174	61.7	8.5	1,943	7.7
North America	**223,951**	**10.4**	**..**	**0.02**	**99.0**	**24.8**	**..**	**82.8**	**97.5 f**	**..**	**..**	**62.5**	**3,756**	**27.6**
Canada	45,879	1.7	1.30	0.01	53.6 e	16.0	118	87.1	95.2	..	(47.5)	72.0	3,589	26.7
United States	178,068	12.6	0.23	0.02	110.7	27.1	1,105	82.3	97.8	..	(40.5)	61.3	3,774	27.7
C. America & Caribbean	**42,178**	**19.3**	**..**	**0.40**	**66.9**	**10.6**	**..**	**..**	**..**	**415**	**..**	**45.1**	**2,878**	**17.1**
Belize	102	2.9	1.30	0.25	45.2	11.6	2	67.7	94.0	..	31.7	..	2,869	20.7
Costa Rica	525	20.6	3.11	0.62	223.2 e	13.3	2,834	72.4	88.5	..	81.6	54.7	2,876	20.0
Cuba	3,788	23.0	0.16	0.17	46.1 e	19.3	1,264	128.3	107.9	1	61.8	..	3,152	12.3
Dominican Rep	1,596	17.2	0.40	0.37	61.1 e	1.2	1,404	138.2	102.6	..	61.4	57.1	2,347	14.8
El Salvador	910	4.9	0.31	0.85	80.4 e	3.8	934	88.2	95.1	70	40.8	33.9	2,584	13.2
Guatemala	1,905	6.8	0.33	1.03	107.6 e	2.3	844	85.1	95.5	118	46.1	29.4	2,219	9.2
Haiti	1,100	6.8	..	1.98	12.7	0.1	1,022	151.6	98.8	144	61.2	2.0	2,086	7.0
Honduras	1,428	5.6	0.06	0.54	106.1	3.6	486	114.6	101.1	27	52.4	42.8	2,356	14.4
Jamaica	284	8.8	0.26	0.93	73.4	10.8	730	86.4	97.8	..	80.8	33.8	2,685	14.6
Mexico	27,300	23.2	0.20	0.31	68.3 e	11.9	2,210	94.2	100.8	..	31.8	47.5	3,145	19.4
Nicaragua	2,161	4.3	0.14	0.18	8.9 e	1.3	393	107.0	110.7	55	19.6	30.6	2,298	7.8
Panama	695	5.0	0.24	0.36	42.0 e	7.2	357	126.9	98.5	..	51.5	32.1	2,272	23.9
Trinidad and Tobago	122	3.3	..	0.40	14.3 e	22.1	139	100.1	114.3	..	97.7	34.8	2,732	15.8
South America	**126,594**	**8.3**	**..**	**0.21**	**78.7**	**10.4**	**..**	**76.0**	**107.5 f**	**289**	**..**	**52.4**	**2,851**	**21.2**
Argentina	35,000	4.5	1.70	0.04	24.6 e	8.6	791	83.8	99.6	..	(174.9)	38.6	2,992	29.9
Bolivia	3,106	4.2	1.04	0.49	3.7	1.9	524	63.7	110.0	77	27.3	36.5	2,235	16.2
Brazil	66,580	4.4	0.24	0.19	102.9 e	12.1	562	68.5	114.2	..	12.8	62.3	3,050	22.1
Chile	2,307	82.4	1.50	0.43	209.1 e	23.5	3,468	67.5	102.0	..	31.4	50.9	2,863	21.4
Colombia	3,850	23.4	0.24	0.87	145.9	4.9	1,082	87.7	98.7	..	48.6	35.4	2,585	16.0
Ecuador	2,985	29.0	0.74	0.42	117.1 e	4.9	4,653	68.6	103.5	63	23.5	40.0	2,754	18.2
Guyana	510	29.4	0.01	0.11	25.5 e	7.1	3,226	65.0	105.2	26	(22.8)	8.1	2,692	16.0
Paraguay	3,115	2.2	0.38	0.23	21.5	5.3	147	81.4	107.4	..	(3.6)	3.0	2,565	22.1
Peru	4,310	27.7	0.42	0.71	74.7 e	3.1	3,900	66.8	105.7	124	38.7	40.6	2,571	13.1
Suriname	67	76.1	0.28	0.45	83.6	19.9	9,194	149.1	104.1	..	(12.5)	..	2,652	13.1
Uruguay	1,340	13.5	4.00	0.14	86.7 e	24.6	2,264	92.2	101.8	..	(18.9)	15.0	2,828	29.7
Venezuela	3,408	16.9	..	0.23	88.0 e	14.4	1,168	99.1	91.6	..	37.4	23.1	2,336	17.4
Oceania	**53,664**	**5.4**	**..**	**0.06**	**59.9**	**7.2**	**..**	**90.4**	**98.7 f**	**..**	**..**	**62.5**	**..**	**..**
Australia	48,600	5.2	2.20	0.01	47.1	6.2	356	85.3	95.9	..	156.4	64.8	3,054	33.8
Fiji	285	1.1	0.04	0.46	35.1	24.6	190	86.2	96.1	..	93.5	..	2,894	16.4
New Zealand	3,372	8.5	0.33	0.05	267.2	22.5	270	88.2	110.4	..	29.9	41.6	3,219	33.0
Papua New Guinea	870	..	0.41	2.22	13.7	1.3	1	103.4	98.0	..	85.2	..	..	..
Solomon Islands	75	..	..	2.27	..	0.1	..	121.1	96.7	..	85.6	..	2,265	7.5
Developed	**635,324**	**10.7**	**..**	**0.07**	**79.9**	**30.5**	**..**	**100.1**	**98.5 f**	**397**	**..**	**56.3**	**3,314**	**26.3**
Developing	**904,850**	**23.2**	**..**	**1.42**	**98.6**	**8.3**	**..**	**73.4**	**103.8 f**	**7,962**	**..**	**23.8**	**2,674**	**13.5**

a. Excludes land used for permanent pasture. **b**. Net cereal imports are calculated as imports minus exports; negative values denote countries that are net exportes of cereal. Includes food received as food aid. Values do not account for changes in cereal stocks. As a result, some numbers may be negative or greater than 100. **c.** Data for China generally include Taiwan. **d**. Data for Kashmir-Jammu are generally included under India and excluded from Pakistan. Data for Sikkim are included under India. **e**. Data are collected from July 1, 2001 to June 30, 2002. **f.** Regional totals are obtained directly from FAO, so regional definitions may vary slightly from those used by WRI.

Food and Agriculture: Technical Notes

DEFINITIONS AND METHODOLOGY

Agricultural Land, in thousand hectares, is the total area of all arable and permanent cropland. Arable land is land under temporary crops (those that are sown and harvested in the same agricultural year), temporary meadows for mowing or pasture, land under market and kitchen gardens, and land temporarily fallow (less than five years). Abandoned land resulting from shifting cultivation is not included under this category. Permanent cropland is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, including land under trees grown for wood or timber. Land in permanent pasture is not included here.

Irrigated Cropland as a Percent of Total refers to the proportion of agricultural land equipped to provide water to crops. These include areas equipped for full and partial control irrigation, spate irrigation areas, and equipped wetland or inland valley bottoms.

Organic Cropland as a Percent of Total shows the portion of agricultural land converted to certified organic agriculture or in the process of conversion. Definitions of organic agriculture vary among countries. According to the International Federation of Organic Agriculture Movements (IFOAM), "Organic agriculture is an agricultural production system that promotes environmentally, socially, and economically sound production of food and fibers, and excludes the use of synthetically compounded fertilizers, pesticides, growth regulators, livestock feed and additives, and genetically modified organisms." Data are obtained directly from IFOAM. The data shown here include pastures used for grazing. Data on land under organic management are a result of surveys undertaken between October and December of 2003 and research conducted by IFOAM. Experts from member organizations, certification bodies, and other institutions were asked to contribute statistics.

Intensity of Agricultural Inputs: Labor shows the labor input intensity of agricultural systems per hectare of agricultural land. WRI calculates labor intensity by dividing the number of agricultural workers by agricultural land area. Agricultural workers include all economically active persons engaged in agriculture, hunting, forestry, or fishing. According to the International Labor Organization (ILO), the economically active population "comprises all persons of either sex who furnish the supply of labor for the production of economic goods and services." The ILO derives the labor estimates from population censuses and sample surveys of the economically active population. When country data are missing, the ILO estimates figures from similar neighboring countries or by using special models of activity rates. The UN Food and Agriculture Organization (FAO) provided the annual figures used for these calculations through interpolating and extrapolating the ILO's decennial series.

Intensity of Agricultural Inputs: Fertilizer measures the mass in kilograms of the nutrients nitrogen (N), potash (K_2O), and phosphate (P_2O_5) consumed annually per hectare of cropland. Some countries report data based on the fertilizer year; i.e., 2001 data actually encompassed July 1, 2001 to June 30, 2002. Data are collected through the FAO fertilizer questionnaire, with support from the Ad Hoc Working Party on Fertilizer Statistics.

Intensity of Agricultural Inputs: Mechanization shows the number of tractors used in agriculture per thousand hectares of arable and permanent cropland. WRI calculates the intensity of tractor use with FAO's estimates on agricultural land area and the total number of tractors for each country. Tractors generally refer to total wheeled and crawler tractors, excluding garden tractors. Tractor intensity is useful for understanding the nature of production systems, as tractors tend to be used in areas with flatter lands and scarce labor. Information on agricultural machinery is reported to FAO by country governments through surveys.

Intensity of Agricultural Inputs: Water Withdrawals measures the volume of water used in the agricultural sector per square hectare of arable and permanent cropland. Water use for agriculture is defined as the water withdrawals that are attributed to the agricultural sector, used primarily for irrigation. WRI calculates water intensity using water-use data from FAO's AQUASTAT information system and agricultural land-use data from the FAOSTAT database. To estimate agricultural water use, an assessment has to be made both of irrigation water requirements and of water withdrawal for agriculture. AQUASTAT collects its information from a number of sources, including national water resources and irrigation master plans; national yearbooks, statistics and reports; reports from FAO; international surveys; and results from surveys made by national or international research centers.

The **Per Capita Food Production Index** shows the food output, excluding animal feed, of a country's agriculture sector relative to the base period 1999-2001. The per capita food production index covers all edible agricultural products that contain nutrients; coffee and tea are excluded. For a given year and country, the index is calculated by taking the disposable average output of all food commodities in terms of weight or volume during the period of interest and dividing that year's output by the average of the 1999-2001 output, and then multiplying by 100. In other words, the index values shown in this table indicate per capita food production levels larger than 1999-2001 levels if their values are larger than 100. Data shown here are for 1983 and 2003.

Cereals Received as Food Aid represents the total shipments of cereals transferred to recipient countries on a total-grant basis or on highly concessional terms. Cereals include wheat, barley, maize, rye, oats, millet, sorghum, rice, buckwheat, alpiste/canary seed, fonio, quinoa, triticale, wheat flour, and the cereal component of blended foods. To facilitate comparisons between deliveries of different commodities, processed and blended cereals are converted into their grain equivalent with specific conversion factors. Information on food aid shipments is provided to the FAO by the World Food Program (WFP).

Net Cereal Imports as a Percent of Consumption indicates whether countries are able to produce sufficient grain for domestic consumption. It is calculated by dividing the sum of net imports (imports minus exports) by total cereal consumption (production plus imports, minus exports). Cereals imported as food aid are included in net imports. This variable does not account for changes in cereal stocks. As a result, some numbers may be negative or greater than 100. Cereals include wheat, barley, maize, rye, oats, millet, sorghum, rice, buckwheat, alpiste/canary seed, fonio, quinoa, triticale, wheat flour, and the cereal component of blended foods. Import and export data have, for the most part, been supplied to FAO by governments, national publications and, most frequently, FAO questionnaires.

Cereal Fed to Livestock as a Percent of Total Consumption is calculated by dividing the total feed grain consumed by total domestic grain consumed. Grains include wheat, rice, corn, barely, sorghum, millet, rye, oats, and mixed grains. Grain consumption includes all domestic use during the local marketing year of the individual country. It is the sum of feed, food, seed, and industrial uses. Data are collected from a variety of sources. Whereas the FAO is required to use official country estimates, the USDA supplements official estimates with data collected from other sources. The international portion of the USDA data is updated with input from agricultural attachés stationed at U.S. embassies around the world, U.S. Foreign Agricultural Service (FAS) commodity analysts, and country and commodity analysts with the USDA's Economic Research Service (ERS). WRI calculates the percentage shown here from USDA grain consumption and feed estimates.

Calorie Supply Per Capita refers to the amount of available food per person per day, expressed in kilocalories. **Share of Calorie Supply from Animal Products** refers to the percent of available food that is derived from animal products, including all types of meat and fish; animal fats and fish oils; edible offal; milk, butter, cheese, and cream; and eggs and egg products. FAO compiles statistics on apparent food consumption based on Supply/Utilization Accounts (SUAs) maintained in FAOSTAT, its online statistical service. SUAs are time-series data using statistics on supply and utilization. For each food product, the SUA traces supplies from production, imports, and stocks to utilization in different forms—addition to stocks, exports, animal feed, seed, processing for food and non-food purposes, waste (or losses), and lastly, as food available to the population. For internal consistency, total food supply equals total utilization. FAO derives caloric values by applying the appropriate food composition factors to the quantities of the processed commodities, rather than examining primary commodities. Per capita supplies are derived from the total supplies available for human consumption by dividing the quantities of food by the total population actually partaking of the food supplies during the reference period.

FREQUENCY OF UPDATE BY DATA PROVIDERS

Data from FAO are updated annually, with the exception of production data, which are updated three times each year, and trade data, which are updated semiannually. Data on international organic agriculture was first published by IFOAM in 1998 and are updated annually. The USDA's Foreign Agricultural Service updates international grain production estimates every month.

DATA RELIABILITY AND CAUTIONARY NOTES

Agricultural Land and Irrigated Cropland: Data are compiled from various sources (national publications, FAO questionnaires, international publications, etc.). As a result, definitions and coverage do not always conform to FAO recommendations and may not always be completely consistent across countries.

Organic Cropland as a Percent of Total: Data for organic agriculture are collected by IFOAM from a variety of sources, including member organizations, certification bodies, and other institutions. Data collection methods vary depending on the institution and the country. Figures for percent of total agricultural land under organic management are calculated by IFOAM. Data on total agricultural land used in these calculations are different from those provided by FAO for total arable and permanent cropland.

Labor: Values vary widely among and within countries according to labor scarcity, production technologies, and costs of energy and machinery. The annual figures for total number of agricultural workers were obtained by interpolating and extrapolating past trends (1950-2000) taken from ILO decennial population series. As a result, fluctuations in the labor force may not be captured in annual figures. Labor intensity may be overestimated in countries with substantial fishing or forestry industries, since the total agricultural labor force includes some workers engaged in these activities.

Fertilizer: Data are excluded for some countries with a relatively small area of cropland, such as Iceland and Singapore. In these cases, the calculation of fertilizer consumed per hectare of cropland yields an unreliable number.

Mechanization: Data collection methods differ across countries, resulting in varying degrees of reliability. Some caution should be used in interpreting tractors-in-use figures because the data do not account for variations in the size and horsepower of different tractors.

Water Withdrawals: While AQUASTAT represents the most complete and careful compilation of water resources statistics to date, freshwater data are generally of poor quality. Sources of information vary but are rarely complete. Access to information on water resources is still sometimes restricted for reasons related to political sensitivity at the regional level. The accuracy and reliability of the information vary greatly among regions and countries. Data are typically collected in different years for different countries and interpolated or extrapolated to a single year.

Per Capita Food Production Index: Indices are not directly measured; they are derived from a set of formulas and algorithms. The calculation therefore contains an unavoidable amount of subjectivity. Reliability is limited by the accuracy and precision of agricultural production and price data. While these data can illustrate rough comparisons and trends over time, rigid score comparisons and rankings are discouraged. The country-level indices reported here may differ from other calculations of agricultural production due to varying concepts of production, coverage, weights, time reference of data, and methods of calculation.

Cereals Received as Food Aid: Data on shipments and receipts of food aid are governed by established accounting procedures and are generally considered to be reliable. These measurements represent the amount of cereals distributed to recipient countries; they are not a measure of consumption.

Cereal Fed to Livestock as a Percent of Total Consumption: As with any large and complex data set, there are numerous difficulties involved with maintaining accuracy and standardizing reporting standards across countries and commodities. In general, these data should be considered accurate, but users should exercise the usual caution in attempting to create reliable cross-country comparisons.

Calorie Supply: Figures shown here represent only the average calorie supply available for the population as a whole and do not necessarily indicate what is actually consumed by individuals. Even if data are used as approximations of per capita consumption, it is important to note that there is considerable variation in consumption among individuals. Food supply data are only as accurate as the underlying production, trade, and utilization data.

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Total Agricultural Land, Irrigation, Labor, Fertilizer, Mechanization, Food Production Indices, Food Aid, and Calorie Supply: Food and Agriculture Organization of the United Nations (FAO). 2004. FAOSTAT on-line statistical service. Rome: FAO. Available at http://apps.fao.org.

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Chapter 1

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Chapter 2

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Chapter 3

Main Text

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Chapter 4

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Index

D

E

F

G

H

N

O

P

R

S

T

U

V

W

Z