

SUSTAINING NATURAL CAPITAL

If we truly care about the future of our planet, we must stop leaving it to “them” out there to solve all the problems. It is up to us to save the world for tomorrow; it’s up to you and me.

—Jane Goodall, *Reason for Hope*

Natural capital contributes enormously to human development and welfare. The term natural capital encompasses the sink functions, that is, air and water as receiving media for human-generated pollution and source functions, that is, production based on forests, fisheries, and mineral ores. Protecting sink functions is essential for human health. Protecting the productive or source functions is critical to the economic security of many who depend on these resources for their livelihoods. High-quality natural capital contributes to welfare indirectly as an essential part of the sustained production of economic goods and services. It also contributes to welfare directly as people derive enjoyment from pristine surroundings, old growth forests, and clean lakes and rivers in which to swim and fish.

Chapter 2 demonstrated the importance of human, natural, and physical capital to economic growth and welfare. Because of imperfect substitution, these assets need to grow at undistorted or fairly balanced rates to achieve sustainable economic growth. Distorted or unbalanced growth—signaled by especially rapid accumulation of physical capital, slow accumulation of human capital, and a draw down of natural capital—increases the volatility of growth, disproportionately hurting the poor. An economy fostering unbalanced growth is likely to suffer long-run stagnation (see annex 2).

Economies that derive much of their income from natural resources cannot sustain growth by substituting physical capital accumulation for

deteriorating natural capital (López, Thomas, and Thomas 1998). Environmental degradation is likely to be most devastating for the poor, who often depend on natural resources for their income, with few possibilities for substituting other assets. Especially in the long run, growth approaches that pay attention to environmental quality and resource use efficiency contribute to accumulation, investment, economic growth, and human welfare (Munasinghe 2000).

Yet countries throughout the world have overexploited their forests, fisheries, and mineral wealth and polluted their water and air to accelerate short-term economic growth, with policymakers noting that their approach would increase the welfare of their citizens. While much natural capital has been sacrificed through deforestation, loss of biodiversity, soil degradation, and air and water pollution, access to safe water and sewage treatment and sanitation facilities has often shown improvements as economies grow. This chapter examines the reasons why natural capital tends to be abused and overexploited, especially during rapid economic growth, and what measures can be taken to correct the negative spiral of environmental decline.

The suitability of corrective actions will depend on the nature of the problem and the economic and institutional setting. For example, air quality may be improved by levying a pollution tax on industrial emissions, while production efficiency based on natural resources may be enhanced by such measures as assigning clear property rights to land or giving transferable quotas to fishers. Successful outcomes require active, yet selective, intervention by the state in collaboration with the private sector and civil society.

Extensive Losses

Air pollution from industrial emissions, car exhausts, and fossil fuels burned in homes kills more than 2.7 million people every year, mainly from respiratory damage, heart and lung diseases, and cancer (UNDP 1998). Of those who die prematurely, 2.2 million are rural poor exposed to indoor air pollution from the burning of traditional fuels. Air pollution also reduces economic output because of the loss of productive workdays. (See table 4.1 to understand the magnitude of the losses due to air pollution in different parts of the world. The numbers are simply meant to illustrate the possible impacts of environmental pollution; they are far from being noncontroversial estimates of environmental damage.)

Health costs associated with waterborne diseases and water pollution are also profound. In 1992, more than 2 million children under the age of five died from diseases caused by dirty water. Table 4.2 reports the findings of some studies on the health burden of water- and sanitation-related deficiencies and pollution effects.¹

Table 4.1. Annual Health Costs Associated with Air Pollution

<i>Region and city</i>	<i>Impact</i>	<i>Cost</i>
China: 11 major cities	Economic costs of premature mortality and costs of illness	More than 20 percent of urban income
East Asia: Bangkok, Jakarta, Seoul, Kuala Lumpur, Manila	Number of premature deaths due to air pollution above WHO-defined safe limits	15,600
East Asia: Bangkok, Jakarta, Kuala Lumpur	Economic costs of premature mortality and costs of illness	More than 10 percent of urban income
Newly independent states: Russian Federation (Volgograd); Armenia (urban areas); Azerbaijan (national); Kazakhstan (national)	Number of premature deaths due to air pollution above WHO-defined safe limits	14,458

Note: The estimates are based on different studies applying different methodologies and are not comparable. In many cases, excess mortality is estimated using dose-response functions estimated for industrial economies for marginal changes in pollution, but then applied to nonmarginal changes, which tends to overestimate mortality reductions. Some studies use PPP-adjusted willingness to pay data from industrial economies; others use the cost of illness approach.

Sources: World Bank (1997a, 1999f).

Table 4.2. Annual Health Costs Associated with Waterborne Diseases and Pollution

<i>Region or country</i>	<i>Impact</i>	<i>Cost</i>
Vietnam	Infant deaths avoided yearly by providing access to clean water and sanitation	50,000
China	Premature deaths due to water-related diseases such as diarrhea, hepatitis, and intestinal nematodes	135,000
East Asia	Cost of waterborne diseases	US\$30 billion a year
Moldova	Premature deaths	980–1,850
	Loss of workdays due to illness	2–4 million a year

Source: World Bank (1997a,c; 1999f).

Toxic effluents, such as dioxins, pesticides, organochlorines, grease, oil, acids, alkalis, and heavy metals such as cadmium and lead, from factories, mines, and chemical plants have contaminated major bodies of water in all parts of the world. Workers, farmers, and others who come in contact with the contaminants face severe health hazards. As with air pollution, the poor are hurt the most. As many as 25 million poor agricultural workers in the developing world (11 million in Africa alone) are poisoned by pesticides every year, and hundreds of thousands die (UNDP 1998). Fisheries, which provide a main source of protein for the poor, are also being destroyed by industrial

discharges and water pollution. In Manila Bay, fish yields have declined 40 percent in the last 10 years (UNDP 1998). For a disturbing description of environmental degradation in India, as reported in the press, see box 4.1.

Recent estimates using DALYs suggest that premature death and illness due to major environmental health risks account for approximately one-fifth of the total burden of disease in the developing world (Murray and López 1996).² Of the main environmental risks, which include poor water supply, inadequate sanitation, indoor air pollution, urban air pollution, malaria, and agro-industrial chemicals and waste, 14 percent of the total disease burden is caused by poor water supplies, inadequate sanitation, and indoor air pollution. They affect predominantly children and women in poor families (Lvovsky and others 1999).

Overexploitation and degradation of natural resources are also enormous concerns. Soil degradation is a problem everywhere, especially in Asia and Africa. In China the costs may run as high as 5 percent of GDP (ADB 1997) and for several African countries the annual costs are 1–10 percent of agricultural GDP (Bojo 1996). While the annual losses are worrisome, the cumulative effects are alarming. Desertification, a direct consequence of soil degradation, is estimated to cost US\$42 billion a year

Box 4.1. Environmental Degradation in India

In a special issue, *The Poisoning of India, India Today* (1999) reported the following information:

- Breathing urban India's air is equivalent to smoking 20 cigarettes a day. In the capital, New Delhi, the level of suspended particulate matter is more than twice the safe limit specified by the WHO. (Recent measurements of air pollution in New Delhi indicate that the level of total suspended particulates may be as high as five times the limit considered safe by the WHO.)
- Every year more than 40,000 people die prematurely from the effects of air pollution.
- More than 30 percent of garbage generated in cities is left unattended, becoming a fertile breeding ground for disease.
- Only 8 of India's 3,119 towns and cities have modern wastewater collection and treatment facilities, another 209 have rudimentary facilities, and the rest have none at all.
- One-third of the urban population has no access to sanitation services. In Lucknow, 70 percent of the population sends its waste into the Gomti River.
- Most sewer lines date to colonial times. Thus, 93 percent of Mumbai's sewage is dumped untreated into the sea, killing virtually all large marine life along the coast.
- Dichlorodiphenyltrichloroethane, commonly known as DDT, and benzene hexachlorine, called BHC, account for as much as 40 percent of the total pesticides used in India. Both are neurotoxins that severely impair the central nervous system and cause muscular dystrophy. Chemical analysis reveals their presence in milk, vegetables, cereals, and fruits in increasing quantities.

in lost agricultural productivity alone. It directly puts some 250 million poor people at risk of starvation from reduced crop yields (UNDP 1998).

At least 10–12 million hectares of forest land disappear each year. Unsustainable logging practices and forest conversion to agriculture and pasturelands account for the bulk of the losses (Brown, Flavin, and French 1998; World Bank 1999d). Declining yields of timber and nontimber forest products, reduced soil and water conservation services, and loss of carbon sequestration functions translate into net economic losses of US\$1 billion to US\$2 billion a year to the global economy (calculated from World Bank data). In 1997, forest fires caused haze and smoke-related damage of US\$4 billion in Indonesia and extensive damage in neighboring Malaysia and Singapore (EEPSEA 1998). Future generations will bear the cost of the associated, if hard to quantify, loss of biodiversity.

Like the forest fires in Indonesia, the impacts of local environmental neglect are not confined to political boundaries. Witness the increasing desertification, coastal zone degradation, global climate change, transboundary acid rain, and depletion of the ozone layer (GEF 1998; Watson and others 1998). Global climate change during the 21st century could result in increases in the intensity and frequency of floods and droughts, inundation of low-lying coastal areas, more frequent outbreaks of infectious diseases, and accelerated dieback of forests. Climate change will also hurt food security by reducing agricultural output in developing countries and poses a threat to human health and safety. It could cost the world economy as much as US\$550 billion a year and developing countries are likely to bear an inequitable proportion of the burden (Furtado and others 1999).

“Genuine savings” provides a useful concept to capture the degradation of natural capital that can be used to assess the environmental health of countries. Genuine savings equal gross domestic savings minus depreciation of physical capital, minus depletion of minerals and energy, minus net depletion of forests, minus pollution damage, plus investments in human capital. For the developing world as a whole, in 1997 gross domestic savings were 25 percent of GDP. Net domestic savings (after correcting for the depreciation of physical capital) were about 16 percent of GDP, but corrected further for depletion of natural capital (such as forest, energy, and minerals) and damage from carbon dioxide emissions, the domestic savings were a little more than 10 percent of GDP (World Bank 1999e). After including human capital investment, the genuine savings rose to about 14 percent. This includes Nepal, where forest depletion alone was estimated at 10.3 percent, overwhelming the country’s gross domestic savings of 10 percent, and the Russian Federation, where depletion of energy resources (oil, coal, and natural gas) reduced savings by more than 9 percent per year.

Significant Benefits of Environmental Action

From an economic point of view, not all pollution is to be fully controlled nor all natural resource degradation is to be fully reversed. Pollution and natural resource degradation are to be controlled to the point where the marginal (social) damages equal the marginal (social) costs of abatement or control, that is, the optimal level of environmental protection.

The present discounted cost of providing everyone in China with access to clean water within 10 years, for example, is US\$40 billion, and the present value of benefits is US\$80 billion to US\$100 billion (World Bank 1997a). Doing the same in Indonesia would cost an estimated US\$12 billion to US\$15 billion, with corresponding benefits of US\$25 billion to US\$30 billion. In Moldova piped water of adequate quality would cost US\$23 million to US\$38 million a year to provide, but would bring benefits of US\$70 million to US\$120 million (World Bank 1999f). Controlling air pollution in China would cost an estimated US\$50 billion, but would yield benefits of about US\$200 billion in reduced illness and death (World Bank 1997a).

With the payoffs so large, why do environmental degradation and destruction continue?³ The main reason is that private returns on investment in environmental protection are significantly smaller than private costs (Dasgupta and Mäler 1994; Hammer and Shetty 1995). Many of the benefits are distributed to society at large, now and in the future, rather than to the private agent making the investments. Thus, individuals, who see only their own private, short-term gains, seldom factor the cost of degradation—spread inequitably across the current generation and affecting future generations as well—into their decisionmaking. This classic case of externalities and market failure provides strong justification for public policy actions to create markets or marketlike conditions that align private incentives with the social costs and benefits of providing environmental services.

Policy distortions reflecting undervaluation of the environment contribute to pollution and degradation (Dasgupta and Mäler 1994). For example, agricultural subsidies on inputs and price supports for outputs make forest management noncompetitive and create pressures to convert forests to pastures. Energy subsidies to keep consumer prices low contribute to overconsumption and excessive pollution. Tax exemptions, subsidies to firms operating on frontier land, road construction in ecologically fragile areas, and a host of other short-sighted policies also lead to degradation and mismanagement of resources and threaten vulnerable populations who live in these areas (Chomitz and Gray 1996; Cropper, Griffiths, and Mani 1997). By removing subsidies and imposing environmental

taxes, policy reforms can alleviate distortions and allow prices to reach their optimal level.

Several other contributory factors and false notions stand in the way of efficient management of natural capital: the grow-now-and-clean-up-later mind-set, corruption, ill-defined property rights, and inadequate funds for environmental management. Often, information gaps prevent a full understanding of the causes and consequences of environmental degradation, and public indifference hinders their resolution. Fostering international action is difficult despite existing momentum for environmental protection (box 4.2). The relative contribution of these factors differs from country to country and needs to be assessed before effective public actions can be determined.

The Growth–Natural Capital–Welfare Nexus

After dispelling the idea that environmental degradation can wait for redress after other pressing reforms have been addressed (the grow-now-and-clean-up-later mind-set), we will explore empirical evidence that links growth to the quality of natural capital.

Grow Now and Clean Up Later

The growing evidence to the contrary has not dispelled the perception that the environment is a luxury good that will be demanded as incomes rise with economic growth. As a result, developing countries tend to ignore environmental concerns as policymakers focus almost exclusively on accelerating economic growth. They support their position by citing examples of industrial countries that paid scant attention to environmental degradation in the early phases of their growth and arrested and reversed the problem later. However, they ignore the potential enormity of economic, social, and ecological costs and the reality that sometimes the damage is irreversible.

While air and water pollution levels appear to be reversible, their impacts on human well-being often are not. Promises of future remedial action can hardly compensate for welfare losses by the present generation. Only a policy of clean growth is consistent with intergenerational equity. Furthermore, investing in pollution control up-front will yield positive returns in other areas. For example, improved health outcomes can lead to a more favorable accumulation of human capital and more sustained growth.⁴

A grow-now-and-clean-up-later approach also tends to be inequitable; the poor and disadvantaged suffer the brunt of environmental pollution and resource degradation. For instance, when industrial toxic effluents and

Box 4.2. Worldwide Efforts for Environmental Action

In June 1992, representatives of 178 nations met in Rio de Janeiro to agree on measures for ensuring environmentally and socially sustainable development. The Earth Summit captured government interest in translating broad policy goals into concrete actions. The commitment of leaders from around the world to sustainable development was enshrined in Agenda 21, the key document of the summit. Agenda 21 activities are organized under environmental and development themes: quality of life, efficient use of natural resources, protection of the global commons, management of human settlements, and sustainable economic growth. Agenda 21 recognizes that the persistence of severe poverty in several parts of the world alongside a standard of living based on wasteful consumption of resources in other parts is incompatible with sustainability, and that environmental management needs to be practiced by developing and industrial countries alike. A consensus was reached that, to implement Agenda 21, countries should prepare a national sustainable development strategy.

In 1987, donors of the International Development Agency initiated national environmental action plans for all agency borrowers. Before receiving funds, borrowers were required to present a long-term strategy for maintaining the country's natural

environment, the health and safety of its population, and its cultural heritage during economic development efforts. This practice spread to other countries, and 100 nations have prepared national sustainable development strategies or national environmental action plans to guide their thinking on environmental management. These plans have been useful in identifying environmental problems, fostering national ownership of environmental planning, and creating the political climate necessary to encourage effective action for policy reforms. They have also been useful in identifying country policy frameworks and designing a strategic vision for the environment (Bojo and Segnestam 1999).

While essential for highlighting important environmental issues, the strategies and plans are less effective in identifying priorities for action and making explicit the process of policy reform to achieve desirable outcomes. The documentation and dissemination of successful cases and specific experiences in environmental management becomes crucial. The World Bank has been playing an important facilitating role through its efforts at integrating the environment in Bank policy dialog (Warford and others 1994; Warford, Munasinghe, and Cruz 1997).

Source: World Bank (1997d).

other pollutants degrade water quality, the poor often lack access to purified municipal water supplies and the resources to invest in water filters and other purification systems. Air pollution also disproportionately hurts the poor, as they tend to live closer to roads where pollution levels are highest and cannot afford to switch to cleaner fuels for indoor use (UNDP 1998). These distributional impacts aggravate income inequalities and can lead to serious social conflicts. Thus, paying attention to the environment while accelerating growth is fully consistent with a poverty reduction strategy.

The irreversible loss of genetic material and the potential threat of ecosystem collapse provide other compelling reasons for rejecting a grow-now-and-clean-up-later approach. Some damage can never be undone. Habitat

destruction has resulted in the irreversible loss of terrestrial and aquatic biodiversity worldwide. Marine pollution and destructive fishing techniques have damaged a large proportion of coral reefs in East Asia and threaten much of the ocean's animal and plant life (Loh and others 1998).

The experiences of high-income countries show that the health costs of delayed pollution control can exceed the prevention costs, although in comparing them, the difference in the time of their occurrence and resulting uncertainty should ideally be accounted for. For example, the cost of cleanup and compensation to victims of itai-itai disease, caused by cadmium poisoning; Yokkaichi asthma, the result of excessive exposure to sulfur emissions; and Minamata disease, or mercury poisoning, are from 1.4 to 102 times the cost of prevention (Kato 1996). In addition to the impacts on human health, the high cleanup costs of widespread dumping of toxic wastes by U.S. industrial firms illustrate another limitation of the grow-now-and-clean-up-later approach (Harr 1995).

Does Faster or Slower Economic Growth Ensure Protection of Natural Capital?

Both fast- and slow-growing economies have experienced environmental degradation, but to different degrees. Analysis of GDP growth and an index of natural capital quality show a negative correlation coefficient (see figure 1.5). By looking at the link between rapid growth and various components of natural capital degradation at a more disaggregated level, one can get a better idea of the strength and direction of the relationships.

Belying East Asia's phenomenal record of economic growth and poverty reduction is its poor environmental record. In 1995, China was home to 15 of the 20 most polluted cities in the world, as measured by the concentration of total suspended particulates (World Bank 1999e). Air pollution, especially high levels of total suspended particulates, has resulted in premature deaths and severe health damage in urban areas such as Bangkok, Jakarta, Manila, and several cities in China (see table 4.1). Countries that experienced rapid growth in the context of economic reforms in the 1980s—China, Korea, Malaysia, and Thailand—saw carbon dioxide emissions per capita that doubled or tripled after the reforms and growth acceleration (table 4.3).

Natural resources fared poorly as well. Deforestation rates have been high and remain so in most countries (table 4.3). About 20 percent of vegetated land in East Asia suffers soil degradation from waterlogging, erosion, and overgrazing. Severe land degradation in China, Thailand, and Vietnam threatens several ecosystems with irreversible damage

Table 4.3. Trade, Growth, Poverty, and Environmental Degradation, Selected Years
(percent, unless otherwise indicated)

Region and economy	Trade	Growth	Poverty	Indicators of natural capital		
	Annual growth of merchandise export volume, 1980–94	Annual growth of GNP per capita, 1970–95	Percentage of population living on less than US\$1 a day (PPP) various years	Annual deforestation (percent change) 1990–95	Total suspended particulates in capital cities (micrograms per cubic meter)	Percentage increase in carbon dioxide emissions per capita, 1980–96
<i>East Asia</i>						
China	12.2	6.9	29.4 (1993)	0.1	377	86.7
Hong Kong, China	15.4	5.7	< 1	0.0	—	15.6
Indonesia	9.9	4.7	14.5 (1993)	1.0	271	100.0
Korea, Rep. of	11.9	10.0	< 1	0.2	84	172.7
Malaysia	13.3	4.0	5.6 (1989)	2.4	85	180.0
Philippines	5.0	0.6	27.5 (1988)	3.5	200	12.5
Singapore	13.3	5.7	< 1	0.0	—	63.6
Thailand	16.4	5.2	< 1	2.6	223	277.8
<i>Latin America</i>						
Argentina	1.9	-0.4	—	0.3	97 (Cordoba city)	-2.0
Bolivia	-0.3	-0.7	7.1 (1989)	1.2	—	62.5
Brazil	6.2	—	28.7 (1989)	0.5	86 (Rio = 139)	13.3
Chile	7.3	1.8	15.0 (1992)	0.4	—	36.0
Costa Rica	6.6	0.7	18.9 (1989)	3.0	—	27.3
Mexico	13.0	0.9	14.9 (1992)	0.9	279	2.7
Peru	2.4	-1.1	49.4 (1994)	0.3	—	-21.4
Uruguay	0.9	0.2	—	0.0	—	-15.0
Venezuela, RB	1.1	-1.1	11.8 (1991)	1.1	53	10.7

— Not available.

Sources: World Bank (1997a, 1999e); see also annex 4.

(World Bank 1999b). Biodiversity in 50 to 75 percent of coastlines and protected marine areas in East Asia is classified as highly threatened.

Not all indicators show worsening environmental conditions among the fast-growing economies in Asia. Access to clean water and sanitation increased rapidly in China, Korea, Malaysia, and Thailand. In 1995, the share of the population with access to safe water rose from 71 percent in 1982 to 89 percent in Malaysia, from 66 to 89 percent in Thailand, from 39 to 65 percent in Indonesia, and from 65 to 83 percent in the Philippines. Sanitation service availability rose from 46 to 96 percent in Thailand, from 30 to 55 percent in Indonesia, and from 57 to 77 percent in the Philippines (World Bank 1999e). Though still at low levels in Cambodia, the Lao People's Democratic Republic, and Vietnam, access to safe water

and sanitation has been steadily increasing with economic growth (World Bank 1999b,e).

However, it is not just fast growth that leads to problems of natural capital degradation. Like East Asian countries, slow-growing Latin American countries have seen improvements in access to clean water and sanitation (World Bank 1999e), but have also suffered environmental deterioration. Most have experienced extensive deforestation, especially of ecologically sensitive areas and steep slopes; widespread soil degradation; overfishing and water pollution in coastal zones; water contamination from agrochemicals; and pesticide poisoning of people and livestock. While air pollution is not as widespread a problem as in Asia, in part because of the relatively low growth of industrialization (table 4.3), it is a serious concern in Mexico City, Rio de Janeiro, and Santiago. Because of low growth, highly skewed income distributions, inadequate investments in education and health, and political instability, poverty has remained stubbornly high, creating vicious cycles of increasing natural resource degradation and further loss of income (see also box 4.3).

Thus, neither rapid nor slow growth is an automatic ally of natural capital (Thomas and Belt 1997). For example, in the 1980s, differences in air pollution and traffic congestion between slow-growing Manila and fast-growing Bangkok were minimal (Hammer and Shetty 1995). However, fast growth, with increasing urbanization, industrial expansion, and exploitation of renewable and nonrenewable resources, places pressure on the environment such that many indicators show a decline in the quality of natural capital during growth periods.

Yet, growth creates conditions for environmental improvement by creating demand for better environmental quality and making resources available for supplying it. Does this imply the existence of an environmental Kuznets curve? As incomes rise, does environmental quality first deteriorate and then start to improve? If environmental goods are normal consumer goods with positive income elasticity of demand that is greater than unity at certain income levels, then quality will improve beyond the threshold income level. López (1997) suggests that environmental goods, such as clean air and water and sewage treatment, which directly affect health and generate local externalities, are likely to be normal goods with a high income elasticity of demand. Thus, they are likely to improve after a period of decline during a growth period.

Most empirical studies have focused on indicators of the sink function of environmental quality, such as the concentration of suspended particulates in air, the biochemical oxygen demand of water, the level of carbon dioxide and sulfur dioxide emissions, and the prevalence of inorganic industrial pollutants

Box 4.3. Population, Poverty, and the Environment

Analysis of the poverty-population-environment nexus is complex. Population growth has often been blamed for poverty and for environmental degradation (Cropper and Griffiths 1994; Pearce and Warford 1993). However, the converse argument contends that poverty and environmental degradation are the causes of population growth, not the consequences of it. Both views are partial; it needs to be recognized that the three factors are interlinked (Cleaver and Schreiber 1994; Dasgupta 1995; Ekbom and Bojo 1999; Mink 1993). The strength of these linkages will differ from situation to situation, and the policy recommendations will depend on a host of factors, including type of resource, density and rate of growth of population, institutional arrangements, and laws regulating the use of the resource (López 1998b). As a result, no general conclusions about the linkages between population, environment, and poverty are available.

The following example from Dasgupta (1995) gives some insight into the complicated nature of the nexus. In rural settings much labor is needed even for simple tasks, such as collecting clean water

or fuelwood for cooking. In addition, members of rural households devote time to growing food, caring for livestock, and producing simple marketable products. Children are needed as extra workers, even when parents are in their prime. Small households are simply not viable; each one needs many hands. As the community's resources are depleted, more hands are necessary to gather fuel and water for daily use. More children are produced, further damaging the environment and providing an incentive to enlarge the household even more.

Factors that influence the parental demand for children can reverse this destructive spiral. The most potent policy will use many of the factors simultaneously. Good economic policies, secure tenure rights, and political stability can all alleviate the population pressures. Providing cheap fuel and potable water will reduce the need for extra hands and lower the demand for children. Family planning services allied to reproductive health services will help bridge the unmet needs for contraception, and a literacy and employment drive for women that empowers them in decisions of family size becomes crucial.

(Galeotti and Lanza 1999; Grossman and Krueger 1995; Ravallion, Heil, and Jalan 1997; Roberts and Grimes 1997; Selden and Song 1994; Shafik 1994; Stern, Common, and Barbier 1996), finding some support for an environmental Kuznets curve.

Hettige, Mani, and Wheeler (1998), using international data, measured the relationship between water pollution from industrial discharges and per capita income. The study showed that pollution first increases with development, peaking at a per capita income of about US\$12,000, and then levels off for all observable values. The study concluded, "economic development remains far short of a Kuznets-style happy ending in the water sector" (p. 26) and suggests that total emissions will remain constant with income growth unless other factors intervene.⁵

The quality of natural resources is less likely to follow a Kuznets-curve pattern than pollution, because they are typically factors of production rather than consumer goods. Furthermore, the externalities associated with

the destruction of natural resources are mainly global and less likely to be internalized in local demand (López 1997). As a consequence, a growing economy imposes even greater demands on natural resources and makes management interventions crucial.⁶

Countries do not need to wait until incomes reach the Kuznets-curve turning point. São Paulo curbed severe pollution within a generation, even while millions remained poor. Fast-growing Shanghai, the largest industrial base in China, has produced lower sulfur dioxide loads than slow-growing Sichuan (World Bank 2000d). These and other cases illustrate methods—which include characteristics such as appropriate regulatory regimes, centralized and market-based instruments—for environmental conservation, policy and legislative frameworks, institutional capacity, and technological options that help prevent pollution and protect resources (Panayotou 1997).

Evidence suggests that flexing of the Kuznets curve is both possible and necessary.⁷ Whether economies are fast or slow growing, many indicators of natural resources—deforestation, fisheries depletion, soil degradation, coastal zone pollution—have been deteriorating. Because natural resources are important as factors of production, increasing growth tends to put increasing demands on them. Many of the externalities associated with their overexploitation, such as carbon sequestration and biodiversity loss, are global. As a consequence, local governments often do not consider the repercussions of misusing or exhausting their resources.

Other components of natural capital, such as air and water quality and access to sewage and sanitation services, are typically normal consumer goods. For these goods with an income elasticity greater than unity, income growth is likely to be associated with improvements in quality. Though some empirical evidence suggests the existence of environmental Kuznets curves for a limited set of indicators, the costs of inaction can be extremely high, because many developing countries cannot reach the turnaround income level for decades.

Two indicators, access to clean water and sanitation, appear to improve in both fast- and slow-growth scenarios and testify to the efficacy of interventions, but a careful look at the benefits and costs is required to determine whether the pace of improvements is optimum.

Asset-Income Inequality and the Quality of Natural Capital

A more equitable distribution of income and assets might be associated with improvements in key indicators of environmental quality, such as deforestation and water pollution. For example, if small-scale farmers must use marginal land because large-scale landowners occupy the best

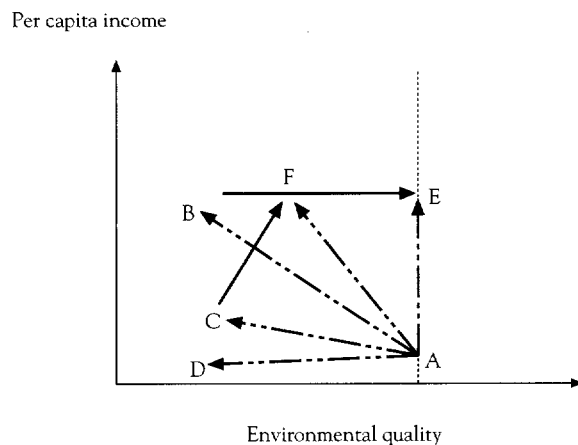
land, the inequitable land distribution may drive deforestation (Ekbon and Bojo 1999). Adoption of clean fuels and more energy efficient technologies implies that the marginal propensity to emit carbon dioxide declines as income rises. Thus income redistribution can speed emissions reduction (Holtz-Eakin and Selden 1995). In a study of 42 countries, Ravallion, Heil, and Jalan (1997) estimated a large positive coefficient between carbon dioxide emissions per capita and the Gini coefficient of income inequality. This study suggests that growth that reduces income inequality and poverty could lead to a decline in emission rates.

Growth Can Complement Protection of Natural Capital

A diagram can help to show that growth and protection of natural capital complement each other (figure 4.1). Consider a preindustrial economy with a low rate of growth and a pristine environment, represented as point A. The country attempts to accelerate economic growth by investing in industry and exploiting the potential of globalization. In an ideal situation, it would seek to balance accelerated growth with high environmental quality, which can be graphically represented as a vertical move toward point E or to one to its right. However, even a well-managed environmental strategy, which could be shown as a move from point A to point F, may not totally

Many combinations of growth and environmental quality are possible

Figure 4.1. Growth Paths and Environmental Quality



Source: Author.

eliminate quality deterioration in both sink and source functions, although the negative impact on natural capital would be relatively small and reversible.⁸ While countries embarking on a path of sustainable development can incorporate environmental policies directly into their economic strategy at any time, most countries have followed the grow-now-and-clean-up-later approach (table 4.4).

The fast growers among developing countries, such as China, Indonesia, Korea, and Thailand, experienced a situation that could be represented by a move from point A to point B, where they paid severely in terms of deteriorating environmental quality. Many of the slower growers, such as Ghana and Nepal, showed a move from point A to point C on figure 4.1 and also suffered considerable environmental damage. Still others in Central and South America and Africa followed policies that failed to stimulate growth while still harming the environment; their actions would be simulated by an arrow from point A to point D.⁹

The economies represented at points B, C, and D have incurred serious losses from ecosystem damage: disease, death, degraded forests and bodies of water, polluted air, and more. Industrial and developing economies that ignored the degradation of their natural capital have learned that the grow-now-and-clean-up later strategy created costs that are difficult or impossible to recoup. For example, the United States will need to spend tens of billions

Table 4.4. Classification of Selected Countries by Growth-Environment Trajectory

<i>A to B: High growth and environmental degradation</i>		<i>A to C: Medium growth and environmental degradation</i>		<i>A to D: Low growth with environmental degradation</i>		<i>A to F: Growth with environmental protection</i>	
<i>Deforestation</i>	<i>Carbon dioxide emissions</i>	<i>Deforestation</i>	<i>Carbon dioxide emissions</i>	<i>Deforestation</i>	<i>Carbon dioxide emissions</i>	<i>Deforestation</i>	<i>Carbon dioxide emissions</i>
Indonesia	China	El Salvador	El Salvador	Algeria	Mexico	Botswana	
Malaysia	India	Ghana	Pakistan	Cameroon			
Sri Lanka	Indonesia	Guatemala	Panama	Haiti			
Thailand	Korea,	Mozambique		Mexico			
	Republic of	Nepal		Nicaragua			
	Malaysia	Pakistan		Zambia			
	Thailand	Panama					

Note: Deforestation rates depicted by annual averages for 1990–95, carbon dioxide emissions are from 1980 through 1996. High growth is defined as per capita income growth of more than 2.3 percent a year in both the 1980s and the 1990s; medium growth includes countries that maintained a positive growth of per capita income in both decades, or improved growth of at least 2 percentage points a year higher in the 1990s than the 1980s; the rest are classified as low-growth countries.

Source: World Bank (2000c).

of dollars to restore the damage caused to the Florida Everglades by the development of irrigation canals for sugarcane cultivation.

Incorporating Environmental Sustainability in Growth Policies

Many countries have integrated environmental concerns and growth policies. The following four cases show how this can be done. The cases were chosen to illustrate success stories in pollution management and natural resource preservation and to highlight the types of interventions required to achieve specific environmental goals. For more case studies of instruments successfully suited to particular settings, see Thomas, Kishor, and Belt (1998), World Bank (1997e, 2000d).

Costa Rica: Conserving Forests and Mitigating Climate Change

The rich biodiversity of Costa Rica attracts wealthy ecotourists from around the world. Yet in the 1980s deforestation rates climbed to more than 3 percent a year. To protect this valuable natural resource, Costa Rica designed one of the most innovative and workable systems of forest protection in the world. It surveyed the marketed and nonmarketed benefits of the environmental services of the forests and identified who bears the costs and who derives the benefits (table 4.5). It calculated annual values per hectare of US\$29 to US\$87 for primary forest and US\$21 to US\$63 for secondary forest. The survey showed that landowners or the government (in the case of national parks) bore the costs of habitat preservation, while

Table 4.5. Environmental Services of Costa Rican Forests and Their Beneficiaries

<i>Type of benefit</i>	<i>Beneficiaries</i>		
	<i>Landowner</i>	<i>Country</i>	<i>World</i>
Sustainable wood production	X		
Hydropower production potential		X	
Water supply purification		X	
Soil stabilization and regulation of hydrologic flow		X	
Scenic beauty, ecotourism uses, and "existence" value		X	X
Carbon sequestration			X
Biodiversity preservation			X

Source: Castro and others (1997).

substantial benefits went to foreign interests. Thus, Costa Rica decided to create markets for some environmental benefits (Castro and others 1997).

Of the several environmental benefits forests provide, Costa Rica has been most successful in capturing carbon sequestration and watershed protection. The government acts as an intermediary in the sale of these services to international and domestic buyers. Funds from the sales (and from an earmarked fuel tax of 5 percent) go to the landowners for preserving the forest cover on their lands. Contracts for more than 50,000 hectares of forest protection were established in 1997. Before that time, cumulative protected areas had encompassed only 79,000 hectares.

Costa Rica has also attracted international investments to compensate landowners who promote carbon sequestration by maintaining forests. Certifiable tradable offsets can be used to sell greenhouse gas offsets in the international marketplace. The first batch was sold in July 1996. Between 1996 and 1998, sales were negotiated bilaterally, but recently Costa Rica started working with brokerage firms in Chicago and New York to establish the certifiable trade offset as a freely tradable commodity, similar to emissions trading in sulfur dioxide in the United States (Chomitz, Constantino, and Brenes 1998).

Costa Rica demonstrates the practical success of creating green markets and implementing green taxes to reduce environmental damage. The potential for replication elsewhere is good, but it depends to a large extent on completion of an international agreement on carbon offsets and acceptance by all parties of the Clean Development Mechanism of the Framework Convention on Climate Change.

China: Controlling Water Pollution with a Levy

The pollution levy, an emissions charge covering thousands of factories in China, is one of the few economic instruments with a long, documented history in a developing country. Although the levy has been used for several decades, serious studies of its efficacy have appeared only recently (Wang and Wheeler 1996).

The system, which has been expanded since 1982, has been implemented in most of China's counties and cities and includes 300,000 factories that are charged for their emissions. The National Environment Protection Agency's regulations specify variations in effluent standards by sector and fees by pollutant. Any enterprise whose effluent discharge exceeds a legal standard must pay a levy. Levies are charged only on the most polluting emission from each source. The levy differs from a tax, which would cover each unit of pollutant, not just those in excess of a certain standard.

Between 1987 and 1993 total organic water pollution fell for the state-regulated industries that reported discharges to the National Environment Protection Agency (Wang and Wheeler 1996). With output growth of 10 percent a year, China experienced an especially impressive decline in pollution per unit of output. While provincial total discharges declined at a median rate of 22 percent, pollution intensities fell at a median rate of 50 percent. Econometric analysis shows that much of the decline was attributable to the levy.

Significant variation in effective levy rates across provinces is explained by local assessments of pollution impacts and local capacities to enforce national standards. Allowing for such regional differences enhanced the feasibility and effectiveness of the pollution levy system.

Since 1991, the authorities have collected more than US\$240 million per year in levies.¹⁰ Approximately 60 percent of the funds finance industrial pollution prevention and control and represent some 15 percent of total investment in these activities, providing an additional incentive for firms to abate. The remainder goes to local agencies for institutional development and administrative costs (Wang and Chen 1999). In addition to helping regulate pollution, the levies help build the monitoring and regulation capacities of local enforcement agencies and reinforce the incentives for effective regulation.

Indonesia: Fighting Pollution with Information

The government can set standards for maximum allowable pollution levels relatively easily, but monitoring and enforcing compliance can be difficult. Indonesia's Environment Impact Management Agency faced compliance challenges in the late 1980s and resorted to voluntary agreements, out-of-court settlements, and other ad hoc approaches that had a limited impact on pollution control.

Seeking a more sustainable approach, the agency developed the Program for Pollution Control, Evaluation, and Rating (PROPER), which receives pollution data from factories, analyzes and rates their environmental performance, and disseminates the ratings to the public (Wheeler and Afsah 1996; World Bank 2000d). The agency hoped that publicizing the performance ratings would encourage local communities to pressure nearby factories that scored poor ratings to clean up their operations. It also hoped to influence polluters through financial markets, which were expected to react to the ratings. To encourage firms to improve their performance, it also established a program for recognizing excellent environmental pollution control practices.

The agency decided to focus on water pollution first. It gathered data on water pollution from factories through questionnaires and rigorous on-site inspections. The government compiled information on 187 highly polluting factories and ranked the companies by level of emissions. The data were combined into a single performance rating keyed to five categories: gold, green, and blue signified compliance; red and black represented noncompliance.

The agency disclosed the results in stages, first publicly recognizing the best performers and giving the others six months to clean up before their bad ratings would be revealed. This phased approach gave factories time to adjust to the program and increased the likelihood of compliance. Between June and September 1995, half the firms that had been rated noncompliant observed the new mandates. This suggests that PROPER created powerful incentives for pollution control. In many instances firms have realized that better environmental management reduces the costs of production, creating additional incentives for them to clean up their production practices. Encouraged by these initial efforts, the agency planned to rate 2,000 plants by 2000.

Indonesia's PROPER program goes beyond the command-and-control approach traditionally used with limited success to regulate polluters. The rating system is unique in that it allows for multiple outcomes. The final choice lies with the firm and depends on its resources for pollution control, the perceived benefits to cleaning up, and its overall corporate strategy. PROPER relies on public disclosure and public pressure to bring polluting firms in line with environmental regulations. By involving the people affected by pollution, PROPER ensures a bargaining equilibrium between firms and stakeholders. The government's role is to set the rules of the game, monitor the level of discharges, take punitive action when necessary, and act as the final arbiter.

Europe's Blue Flag Campaign: Increasing Awareness of the Coastal Environments

The European Blue Flag Campaign, operating through a network of national organizations, is coordinated by the Foundation for Environmental Education in Europe (Thomas, Kishor, and Belt 1998). It encourages citizen understanding and appreciation of the coastal environment and the incorporation of environmental concerns into the decisionmaking of coastal authorities. The European Commission finances approximately 25 percent of the campaign's budget, which now amounts to more than US\$1 million, and private sponsors finance the remainder.

A beach or marina receives a Blue Flag if it meets three sets of criteria relating to the environmental quality of the locality, management and

safety, and environmental education and information. Recipients must meet mandatory and guideline criteria.

Based on maps, photographs, water samples, and a completed questionnaire, a national jury nominates sites for a European jury, which makes the final selection of Blue Flag recipients by unanimous vote. The results are announced at the beginning of June before the main holiday season commences. The campaign has attracted several commercial sponsors in addition to schoolchildren, who have cleaned local beaches to maintain the high standards required by the Blue Flag judges. Over the years the standards of environmental quality needed to win the award have been successively raised to provide dynamic incentives for better environmental management. More than 1,000 coastal localities, most of them in Denmark, Greece, and Spain, have been awarded the Blue Flag.

Governments see the Blue Flag program as an efficient way to promote environmental awareness and increase tourism revenues. Private sponsors view it as an opportunity to attract more tourists. The initiative brings the government, the private sector, and the public into partnership and generates competition between jurisdictions, which pushes environmental standards higher.

Rethinking the State's Role

Attributing environmental degradation to distorted policies, damaging subsidies, missing markets, externalities, and incomplete public knowledge puts the state in the position of a catalyst for environmental protection and management. However, the mixed record on government interventions has motivated extensive rethinking of the policies the state should foster. To achieve the greatest impact, government should intervene selectively (see box 4.4).

Streamline Subsidies and Implement Environmental Taxes

In principle, subsidies support the incomes of the poor; in practice, they often increase inequalities, drain the public budget, accelerate the depletion of natural resources, and degrade the environment. The global cost of subsidies in agriculture, energy, road transport, and water is estimated at US\$800 billion a year, with about two-thirds of the expenses incurred in OECD countries (de Moor and Calamai 1997). In recent years subsidies have been coming down remarkably rapidly, especially in developing countries. In China, coal subsidies fell from US\$750 million in 1993 to US\$250 million in 1995 (UNDP 1998). Subsidy rates fell from 61 percent in 1984 to 11 percent in 1995 (World Bank 1997e). Removal of perverse

Box 4.4. Development and the Environment

World Development Report 1992 (World Bank 1992, p. 2) addressed the challenge of finding the right balance between development and environment.

The protection of the environment is an essential part of development. Without adequate environmental protection, development is undermined; without development, resources will be inadequate for needed investments, and environmental protection will fail...growth brings with it the risk of appalling environmental damage. Alternatively, it could bring with it better environmental protection, cleaner air and water, and the virtual elimination of acute poverty. Policy choices will make the difference.

The report highlighted two sets of policies for sustainable development. The first builds on positive, win-win links, such as removing environmentally damaging subsidies; clarifying property rights;

accelerating the provision of sanitation; providing clean water; providing education, especially for girls; and empowering local people. The second seeks to break the negative links between environment and development by such means as establishing standards, using market-based instruments such as green taxes, and taking collaborative approaches to pollution management.

The report emphasized that although the costs of adequately protecting the environment were large, the costs of inaction would be monumental. It is rational to act sooner rather than later.

Eight years later, the prescriptions of the report are still valid. Experience in natural resource management and environmental protection shows that finding the right mix of policies for environmentally sustainable development is even more feasible today if it is given a high priority.

subsidies has three benefits: reducing environmental degradation, promoting equality, and conserving budgetary resources.

Not all subsidies result in bad outcomes, and good subsidies should be encouraged. Inaccessibility to water and sanitation services accounts for a significant loss of life, especially among women and children in poor households. Studies show that these households have a high willingness to pay for reliable and adequate supplies of these services. Subsidies targeted to these households to purchase water and sanitation services, perhaps from the private sector, is probably a cost-effective intervention to mitigate negative health impacts and reduce poverty by promoting human capital accumulation.

On the other side of the ledger, green taxes on activities that cause environmental degradation provide a powerful way to fight pollution and resource depletion. Green taxes can be particularly useful in managing emissions that contribute to air and water pollution. Taxing the use of coal by industry or the use of gasoline in motor vehicles will reduce excessive resource use and emissions and raise tax revenues; thus, green taxes can provide a win-win approach to managing environmental quality with growth (World Bank 1997d). Pollution taxes are most effective when a well-established regulatory framework with emissions norms and an efficient system of monitoring and

enforcement are in place. Effective green taxes also encourage the use of cleaner energy sources, such as solar power.

A switch from income to consumption taxes can also benefit the environment and growth. The production and consumption of luxury goods often make heavy demands on environmental and natural resources. Consumption taxes can curb the overexploitation of these goods. Progressive consumption taxes also promote equity, and by encouraging savings, they promote economic growth (Frank 1998).

In addition, green taxes can generate the funds needed to promote environmental management. The public sector needs money for its facilitating role, but funds often fall short of needs. Any strategy for environmental management must identify sources of adequate financing. Many developing countries now rely more on green taxes to create funds for environmental improvements than they have done in the past (World Bank 1999f).

Move from Central Control to Partnerships

In the past, governments relied too much on central control, which required extensive monitoring of compliance, for environmental management. The combination of command-and-control policy and inadequate resources for monitoring and enforcement ensured program failure. Policymakers are learning that community members affected by pollution can complement regulation. The involvement of local communities and civil society has other advantages. In rural areas, especially, they are both the source of key environmental information and the custodians of traditional environmental know-how. Thus, they can identify and implement strategies that balance growth with environmental protection.

Where undervaluation of a resource can lead to its degradation, proper valuation of its economic and social benefits can ensure that its contribution is fully considered in decisionmaking (Dixon and Sherman 1990; Pearce and Warford 1993; Ruitenbeek 1989). Measurements of "green gross national product" and genuine savings are gaining prominence as a way to incorporate sustainability in traditional economic planning (Hamilton and Lutz 1996; World Bank 1997d). The gap between estimated total economic value and actual private valuation cannot be easily bridged, but evidence suggests that the state can do it by creating markets or by setting up appropriate institutions and legal statutes that create marketlike conditions and by generating adequate financial flows (see the illustrative case of Costa Rica).

Based on data for 77 developing countries, a significant positive association between educational spending and increase in forest cover was found (correlation matrix available upon request). This suggests that added

impetus to environmental sustainability can come from state and private sector cooperation to raise the educational attainment of the population.

Recognizing the limitations of state intervention and the need for active partnerships in environmental management, governments are looking for new ways to promote environmental management. Spreading knowledge about the full consequences of environmental neglect to all stakeholders, together with a clear framework of accountability and environmental liabilities, can have a powerful impact (Thomas, Kishor, and Belt 1998). Alliances between state regulatory agencies and industrial firms are helping to control pollution in many countries (Hanrahan and others 1998; Schmidheiny and Zorraquin 1996). In Zimbabwe, the CAMPFIRE program promotes alliances between provincial governments, the private sector, and local inhabitants in managing wildlife for profit and biodiversity conservation within a legal framework laid down by the central government (Thomas, Kishor, and Belt 1998).

In Africa, East Asia, and Latin America the conventional wisdom that the slash-and-burn agricultural practices of the poor are a cause of large-scale deforestation has given way to a realization that macroeconomic change, commercial enterprises, and infrastructure development often have far greater impacts on deforestation (Chomitz and Gray 1996; Deininger and Minten 1996; Mamingi and others 1996). As unsustainable timber extraction by large commercial logging companies leads to deforestation, poor indigenous communities lose their sources of fuelwood, fodder, medicinal plants, and even their means of livelihood. The poor communities that depend on forests should be the focus of public action that ensures improved and sustainable use of forests. The best chance of a negotiated agreement lies with a three-party partnership of the state, local communities, and the logging companies. The challenge for developing countries is to scale up such partnerships as quickly as possible.

Clarify Property Rights, Resource Ownership, and Environmental Liabilities

The empirical relationship between clear property rights and environmental quality is strong (Dasgupta and others 1995). Farmers with secure title to land are more likely to invest in soil conservation, sustainable cultivation techniques, and other environmental protection practices (Feder 1987). Vested with ownership rights, local communities have reforested degraded lands in India and Nepal (Lynch and Talbott 1995). Establishing use rights for water, fisheries, and logging provides a clear incentive and means for resource management (World Bank 1997e).

Without enforced property rights to natural resources, outside interests take advantage of open access and, with no accountability for their actions, overexploit the natural capital by overfishing, overgrazing, overusing village woodlots, and extracting excessive amounts of groundwater. While experience varies, vesting communal property rights in these resources seems to relieve the pressures for overexploitation. The communal group develops mechanisms for restricting access by outsiders, distributing management responsibilities, allocating use rights among group members, and monitoring and compliance. Examples of communal management systems include those for forests in Japan; fisheries in Turkey; irrigation water in south India; and pastures in the Swiss Alps, the Himalayas, and the Andes (World Bank 1992).¹¹

Security of tenure for urban dwellers can also improve the quality of the environment by simplifying the identification and enforcement of environmental liabilities for air and water pollution and solid, hazardous, and toxic chemical disposal (World Bank 1997e). A study of the relationship between property rights and the urban environment found that when people moved from squatter status to moderate security, the probability of purchasing garbage collection services increased by 32 percent, while moving to high tenure security (high tenure security is characterized by land tenure accompanied by a certificate of legal title) increased the probability of buying trash removal by 44 percent (Hoy and Jimenez 1997). Thus, establishing clear property rights and ownership and identifying environmental liabilities could be the state's most important contributions toward achieving environmental sustainability.

Improve Governance and Reduce Corruption

Rent-seeking and corruption hurt economic efficiency and prevent desirable outcomes even when good policies for environmental management exist on paper (Bhagwati 1982; Krueger 1974; Rose-Ackerman 1997a). Corrupt officials undermine efforts to monitor and enforce environmental measures, from industrial effluent discharges and automobile emissions inspections to allowable cuts for timber (box 4.5). It is found that controlling corruption is significantly associated with, for example, a reduction in water pollution (annex 1, figure A1.1). Collecting knowledge and sharing it widely can combat corruption and foster good governance, with beneficial outcomes for economic growth and environmental management. Specifically, the corruption diagnostics approach has shown promise to reduce corruption and promote integrity in several countries (chapter 6 in this volume; Kaufmann, Pradhan, and Ryterman 1998).

Box 4.5. Private Profit at Public Expense: Corruption in the Forest Sector

Corruption is rampant in the logging and timber trade at all levels of forest-related decision-making. Most damaging to forest resources is the misuse of public resources for private gain by the political elite. In addition to the degradation and misuse of forests, corruption deprives governments and local communities of resources that could be used for development or improved forest management. Corrupt practices include the concealed or secret sale of harvesting permits, illegal underpricing of wood by companies (transfer pricing), false certification of species or volumes cut in public forests, and illegal logging. Examples from around the world are prevalent.

- Transfer pricing was so prevalent in Papua New Guinea that until 1986 not a single company declared a profit despite the booming timber trade.
- In Ghana, 11 foreign companies were implicated in fraud and other malpractices, costing the economy about US\$50 million.

- In the 1980s, the Philippines lost about US\$1.8 billion a year from illegal logging.
- In 1994 the Indonesian Department of Forestry admitted that the country was losing about US\$3.5 billion a year, or a third of its potential revenues, because of illegal logging.
- In 1994, the Russian government collected only 3–20 percent of the estimated potential revenues from logging fees; that is, US\$184 million instead of US\$900 million to US\$5.5 billion.

The World Commission on Forestry and Sustainable Development emphasized the need for mechanisms for public participation and conflict resolution to expose cases of corruption and penalize offending corporations and individuals. Acting on this recommendation, the World Bank started a forest law enforcement program, focused mainly on Southeast Asia, to address corruption.

Source: World Commission on Forestry and Sustainable Development (1999).

Thus, developing countries should give high priority to stamping out corruption and improving governance.

Global Environmental Issues Must Be Confronted

Many environmental management issues are global in scale, though local in cause.¹² The greenhouse effect and global climate change are clearly connected to human activities (see box 4.6). Fossil fuel combustion is the biggest source of greenhouse gases. Deforestation contributes to the problem because of the loss of forest sink functions, which transform gaseous carbon dioxide into biomass. Farm activities, coal mining, and leakages from natural gas transmission pipes also add to greenhouse gases by releasing methane.

Because the problem originates with a large number of economic activities considered essential to growth, controlling them raises difficulties. Most developing nations depend on fossil fuel combustion for economic production and are unlikely to switch to cleaner, but more expensive, fuels.

Box 4.6. International Cooperation to Mitigate Global Climate Change

The first World Climate Conference, held in 1979, recognized climate change as a serious problem and explored how it might affect human activities. The conference declaration called on the world's governments to predict and prevent potential man-made changes in climate that might have adverse impacts on the well-being of humanity. The Intergovernmental Panel on Climate Change, established by the World Meteorological Organization and United Nations Environment Programme, released its first assessment report in 1990 and confirmed the scientific evidence for climate change. The Second World Climate Conference in 1990 called for a framework treaty on climate change. The United Nations Framework Convention on Climate Change, which was opened for signature at the Rio Earth Summit in June 1992 and entered into force in March 1994, provides the context for a concerted international effort to respond to climate change. There are 166 signatories and 167 parties to the convention.

The Conference of Parties, which replaced the Intergovernmental Negotiating Committee for the Framework Convention, became the convention's

ultimate authority. It held its first session in Berlin in 1995. The second, held in Geneva in 1996, took stock of progress and other issues. Participating officials stressed the need to accelerate talks on how to strengthen the Climate Change Convention. The Geneva Declaration endorsed the second assessment report of the Intergovernmental Panel on Climate Change as the most comprehensive and authoritative assessment of the science of climate change, of its impacts, and of the response options available.

The Kyoto protocol adopted at the Third Conference of Parties in December 1997 is acknowledged as a historic step toward binding emissions limitations in 39 industrial and transition economies. These parties agreed to ensure that their greenhouse gas emissions are reduced by at least 5.2 percent below 1990 levels in the commitment period 2008–12. This is a significant development, because projections for the United States, for example, indicate that without such binding commitments its emissions could be 30 percent above 1990 levels by 2010.

Despite the significant progress, the details of joint implementation, emissions trading, and developing country obligations still remain to be resolved.

Yet, switching to cleaner fuels can lead to better health outcomes, which is good for national economic objectives. As a consequence, a natural tension exists between the two goals, and many countries opt for more growth over better health (Munasinghe 2000). Financial and technical assistance from the international community, in return for reaping the benefits of switching to cleaner fuels, can enable the joint realization of both national and global interests.

Cooperation between rich and poor countries can also help control deforestation. Despite the externalities that it generates, developing countries see deforestation as an unavoidable consequence of their economic development. As with clean fuels, the international community needs to deal with the threat of global climate change by transferring resources, including technology, to control deforestation (Kishor and Constantino 1994; López 1997). Under the Joint Implementation Initiative of the

United Nations Framework Convention on Climate Change, several bilateral schemes of forest conservation are being tested in different parts of the world. Successful pilots will be replicated on a larger scale.

The Global Environment Facility is the main institution addressing global environmental concerns. As the interim financial mechanism of the Convention on Biological Diversity and Climate Change, it addresses global environmental problems through collaboration between industrial and developing countries that benefit both parties. For example, industrial countries can mitigate greenhouse gas emissions cheaply, and developing countries can benefit from financial and technological transfers in protecting their resource base and promoting economic development.

Preventing global climate change and managing its consequences will be one of the biggest challenges of the 21st century. Global conventions, treaties, and agreements have been important in identifying common problems, developing solutions, and allocating responsibilities. National awareness and commitment are increasing, and implementation must be encouraged to secure national and global objectives. Successful examples of this marriage of national and global objectives need to be replicated widely (Castro and others 1997; Watson and others 1998).

Conclusions

For the developing world, depletion of natural capital (forest, energy, and minerals) and damage from carbon dioxide emissions is estimated to be 5.8 percent of GDP. Environmental health risks account for 20 percent of the total global burden of disease. In addition, the huge costs of global environmental problems need to be factored into domestic development policies. The poor, especially women and young children, often bear much of the burden of environmental degradation. Thus, natural capital is crucial for sustained growth, and its conservation and augmentation are crucial to national and international development strategies.

Three key findings emerge from the evidence presented in the chapter, namely:

- Several indicators of the quality of natural capital, with the notable exception of access to clean water and sanitation facilities in some countries, tend to worsen in both slow- and fast-growth economies, imposing heavy costs and diminished prospects for future growth. However, faster growth makes more resources available to invest in the improvement of natural capital. Thus, the

grow-now-and-clean-up-later approach espoused by many industrial and developing countries needs to give way to one of growth with sustainability of natural capital.

- The state performs a crucial role in environmental management, but it needs to be selective and efficient in its interventions. It should focus on collaborative approaches with local communities and the private sector.
- Global environmental problems are huge, but they offer opportunities to simultaneously address national problems if international cooperation can be secured. The development of transfer mechanisms for resources to pay for global externalities is key.

Countries need to focus on strategies to achieve high-quality growth that is sustainable and compatible with domestic and external financial stability, that is, growth that supports the poor and vulnerable and does not excessively degrade the atmosphere, rivers, forests, oceans, or any other part of humanity's common heritage. Cost-benefit estimates support a strategy of growing clean, and the examples in this chapter show that such a strategy is feasible.

Notes

1. Some World Bank studies attributed 100 percent of all waterborne illnesses to the lack of piped water connections and sanitation facilities. However, epidemiological studies rarely showed declines of more than 40 percent in sickness due to water access interventions (Esrey and others 1990). Thus, health benefits related to a cleaned up water supply and improved sanitation services may be overstated in table 4.2.
2. Work done under the Global Burden of Disease Initiative uses a standardized measure of health outcomes, DALYs, across various causes of illness and death, giving a standard way to quantify some of the losses described here (Murray and López 1996).
3. Most estimates use discount rates in the range of 6–10 percent to calculate the present value of benefits. If actual discount rates are higher, say 20–25 percent, as evidence from some developing countries suggests, then the present value of benefits will be much lower. Similarly, the opportunity cost of capital available to finance environmental improvements is assumed to be much lower than that developing countries actually face. The net result of applying the “true” values would be to reduce the gap of benefits over costs, thereby reducing the investment required for optimal environmental management, or even reduce benefits below costs, making such investments unprofitable. This points to the need to carry out a sensitivity analysis with respect to discount rate changes to reliably identify the priority areas for intervention (Kishor and Constantino 1994).

4. Protecting the environment while accelerating growth can also have beneficial impacts on the accumulation of physical capital. If the authorities announce more stringent environmental standards in advance of the date when they become binding, investments embodying the improved standards can be made over a period of time, thereby reducing capital obsolescence or the need for costly retrofitting to meet environmental standards, for example, the experience with emissions standards and catalytic converters for cars.
5. Even where an environmental Kuznets curve seems to be supported, this does not imply that environmental management is unnecessary. Take the case of sulfur dioxide emissions, where Grossman and Krueger (1995) estimated the turning point for emissions to decline at a per capita income level of US\$4,053. Even with a high growth rate of 5 percent a year, India, for example, will take several decades to reach this income level. India and much of the rest of the developing world cannot continue to suffer the consequences of this type of pollution while hoping to “grow out of the problem.”
6. Deforestation appears to follow a Kuznets curve path (Cropper and Griffiths 1994), but with a turning point of US\$5,420 per capita income for Latin America, proactive policies are absolutely necessary.
7. Clearly, the links between pollution and growth depend on many factors, and a case-by-case analysis is necessary. In China, for example, the development of private town and village industrial enterprises was the prime engine of growth in the 1990s, lifting more than a 100 million people out of poverty. These enterprises are often more efficient, with better pollution control technologies, than state-owned enterprises. Therefore, as a result of the expansion of private enterprises, accelerated growth is likely to be associated with declining pollution intensities.
8. Moving from A to F implies that environmental quality deteriorated from its pristine state. This corresponds to the optimal rate of environmental protection referred to earlier. For the sink function of environment, this may be justified on the ground that “small” amounts of air pollution, water pollution, and so forth neither pose health risks nor impair the ability of the resource to “renew” itself; and the economic gains resulting from the pollution-generating activities are large. For the source function, a certain amount of forest clearing, for example, is justified as long as the alternative use of land provides greater social returns and forest clearing does not occur in the “wrong” places, such as steep slopes, along river basins, and so forth.
9. East Asia provides an interesting case. The recent economic crisis has plunged Thailand and Indonesia from B to C. As a consequence, they have the tough task of implementing policies to clean up the environment as they raise economic growth, that is, move from C to F.
10. Some Y 2 billion, converted at the rate of Y 8.3 to the dollar. China unified its dual exchange rate regime in 1994; hence, this amount should be viewed as approximate.

11. Protected areas, national parks, and other public lands that provide critical environmental services typically do not enjoy the advantages of community management. As a result, migration, encroachment, illegal extraction, and other forces continue to degrade government-managed lands in many areas.
12. Watson and others (1998) classify global environmental issues into two categories: those involving the global commons (atmosphere, water, and so on) and those of worldwide importance, but not directly involving the global commons (biodiversity, land degradation, and so forth). On the basis of current scientific assessment, the most important global environmental issues for this century requiring urgent action are global climate change, stratospheric ozone depletion, loss of biological diversity, deforestation and unsustainable use of forests, desertification and land degradation, freshwater degradation, marine environment and resource degradation, and persistent organic pollutants. The interlinkages among these issues and the need to address them simultaneously is also emphasized. Without downplaying the importance of other global environmental issues, this section focuses on global climate change mitigation and forest management to illustrate the challenges that we face in this area.

DEALING WITH GLOBAL FINANCIAL RISKS

Times of trouble prompt us to recall the ideals by which we live.

—Michael J. Sandel, *Democracy's Discontent: America in Search of a Public Philosophy*

The financial crisis of 1997–99 that affected most severely Brazil, the Russian Federation, and several countries in East Asia underscored the importance of financial stability as a contributor to the quality of growth. As with environmental sustainability, education, and good governance, managing the risks of financial instability, especially those of cross-country capital flows, can stimulate sustainable growth by reducing economic inequality, enhancing social stability, and strengthening democratic trends and institutions. Without social and political stability, “no amount of money put together in financial packages will give us financial stability” (Wolfensohn 1998).

Global financial integration has undeniable benefits for developing and industrial countries, but it also exposes countries to the vicissitudes of international capital markets, such as volatility in currency values, interest rates, liquidity, and volumes of capital flows, with important macroeconomic and growth consequences. These risks are pronounced and costly, as demonstrated recently by lost output and jobs, corporate and banking distress, and increased poverty in crisis-hit countries, especially in countries where the institutional and regulatory frameworks for open capital markets are not fully in place.

The high social and economic costs associated with financial instability are unacceptable and make a strong case for devising better ways to deal with financial risks and to ensure stable growth. Chapter 2 shows how policy distortions, subsidies, and unnumbered guarantees can cause