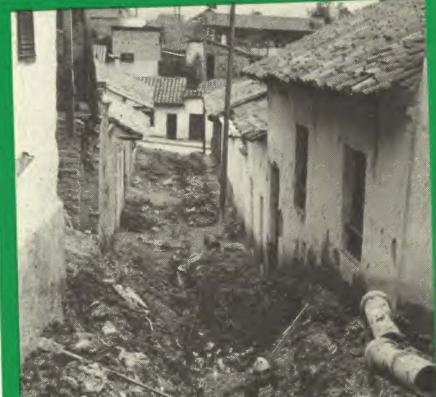
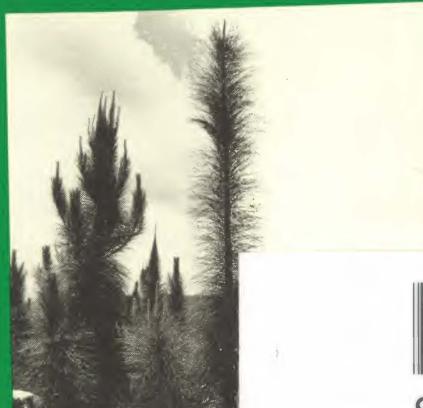
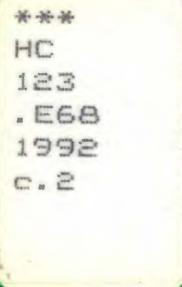


Environment and Development in Latin America and the Caribbean

The Role of the World Bank



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RECONSTRUCTION AND DEVELOPMENT

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*Latin America and Caribbean Region
The World Bank
Washington, D.C.*

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Foreword

Sustainable economic development and management of natural resources are inseparable. In the countries of Latin America and the Caribbean, there is a growing consciousness of the need to adopt policies and programs to preserve the environment.

In its lending and advice, the World Bank places a heavy emphasis on the environmental aspects of economic development. Beyond adopting specific policies on procedures, it has strengthened its organization and staff to address the environmental issues. It is helping borrowing countries in the Region to prepare national environmental action plans. Over the past two years alone, 35 Bank loans approved for Latin America and the Caribbean included significant environmental components totaling nearly \$1.5 billion.

This paper gives an account of the environmental issues faced by the countries of the Region. It also illustrates the World Bank's work with examples of what has been done in specific situations.

The efforts to date are a mere beginning. Much needs to be done. The World Bank expects to be a partner in the effort to attain sustainable economic development in Latin America and the Caribbean.



S. Shahid Husain
Vice President
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Contents

| | |
|---|-----------|
| Introduction | 1 |
| <hr/> | |
| 1. Good Economic Policy Can Be Good Environmental Policy | 6 |
| Poverty and Slow Growth Can Pollute and Degrade | 7 |
| Subsidies Can Be Polluters | 9 |
| Openness Can Reduce Pollution | 12 |
| Better Health Requires Cleaner Water | 13 |
| Saving the Environment Can Help the Economy | 14 |
| Replacing Perverse Incentives with Appropriate Ones | 15 |
| <hr/> | |
| 2. Market-based Incentives and Regulations | 20 |
| Market-based Incentives | 20 |
| Command-and-control Measures | 21 |
| Combining Regulations and Incentives | 22 |
| Harmonizing Regulations with Incentives | 25 |
| Using the Private Sector | 25 |
| <hr/> | |
| 3. Making the Right Choices | 27 |
| Data to Establish Priorities and Raise Political Awareness | 27 |
| Information and Analysis for Improved Environmental Assessment | 28 |
| Analyzing Alternatives | 31 |
| Seeking Cost-effective Interventions | 33 |

| | | |
|-----------|--|-----------|
| 4. | Strengthening Institutional Capacity | 35 |
| | Strengthening Institutions | 36 |
| | Decentralizing and Improving Popular Participation | 38 |
| | New Policies for Forestry | 40 |
| | Minimizing Human Dislocation | 41 |
| | Amerindians | 43 |
| 5. | Global Issues and International Assistance | 44 |
| | Priorities and Funding | 45 |
| | More Data and Studies Are Needed | 49 |
| | Problems and Prospects for Global Cooperation | 51 |
| | Annex. World Bank Funded Projects with Environmental Components and GEF Funded Projects | 53 |

Boxes

| | | |
|-----------|--|-----------|
| 1 | Evolution of an Active Partnership | 4 |
| 2 | Unintended Consequences of Regulations | 17 |
| 3 | Saving Brazil's Rainforests | 18 |
| 4 | Reducing Congestion and Pollution in Santiago | 23 |
| 5 | Cost-effective Air Pollution Control in Mexico | 24 |
| 6 | Carajas—Problems of Unanticipated Consequences | 30 |
| 7 | Getting More Out of Less in Bogotá | 34 |
| 8 | Greening Haiti | 39 |
| 9 | Hard Choices in Yacyretá | 42 |
| 10 | Regional Cooperation for Cleaner Caribbean Waters | 48 |

Introduction

Latin America and the Caribbean face environmental problems that have attracted worldwide attention. Global interest has focused particularly on the loss of tropical rainforests. However, air and water pollution directly affect far more people in the region. Latin America has the largest rainforests and greatest biodiversity. It is also the most urbanized and industrialized part of the developing world. More than 86 percent of people in Argentina and 74 percent in Brazil live in cities and towns, and of the ten largest cities in the world, three—Mexico City, Buenos Aires and São Paulo—are in this region. Latin America has the urban pollution problems common to many OECD countries, as well as the natural resource management problems found in much of Africa and Asia. Finally, the region's extensive marine and coastal areas are threatened by pollution, unplanned coastal development, agricultural run-off and deforestation.

In the past little was known about the value or fragility of ecosystems in the region and the environmental costs of development projects were often unforeseen or simply ignored. There was a false perception that environmental concerns were luxuries for the rich which poor countries could not yet afford. Inadequate policies and ill-designed projects unwittingly inflicted much environmental damage.

Today, the region fully recognizes the urgency of the environmental issues. There are four major reasons for this. First, the knowledge that has emerged from ecological studies and analyses has raised public awareness. Second, it has been widely understood that air and water pollution are not just aesthetic problems but also impair health, productivity and growth. Third, the strengthening of democratic institutions in the region has empowered the people who suffer the consequences of environmental degradation and has forced policymakers to pay attention to their travails. There has been increased participation by local communities in the design and implementation of development

projects. Fourth, the socio-political forces driving the new economic policies are transforming environmental policies. The previous inward-looking policies with their widespread controls and subsidies proved to be a recipe for environmental degradation. Today's democratic regimes are working to integrate economic and environmental policies into the overall management of their resources.

The World Bank has become a major partner of countries in the environmental arena. (For the purposes of this report, reference to the World Bank includes the International Development Association.) For as long as three decades, selected environmental issues have been an integral part of World Bank operations. For example, lending to improve the safety of drinking water started in 1962 with a loan to Nicaragua. Policy and project interventions to enhance energy efficiency have been important since the oil crisis of 1973. The first urban sites and services projects, which assisted in upgrading poor urban neighborhoods, were approved for Jamaica and El Salvador in 1974. The first major resettlement effort was made in 1975 in the lower São Francisco Polders Project in Brazil.

Since the mid 1980s, the environmental agenda of the World Bank's work has been broadened to encompass the full range of resource management, conservation and pollution issues. Overall, the Bank has recruited a strong environmental staff, which is integrating the environmental dimension into Bank activities. The Bank is working with countries to stimulate an integrated approach which incorporates environmental considerations into economic policies, regulations and project design.

The World Bank's program includes analytical work on the environmental issues of countries and of specific economic sectors. Where data or analysis are insufficient, the Bank is mobilizing resources or providing funds to generate the data needed to analyze difficult issues. It provides financial support for policy reform programs, conservation and environmental mitigation measures, and for the management of national parks. The Inter-American Development Bank cofinances some of these programs. This report illustrates through many examples the different ways in which the World Bank collaborates with countries and

supports their programs.

Brazil, the host country for the 1992 United Nations Conference on Environment and Development (UNCED), has made an especially large effort in the environmental area. The World Bank's support for the first comprehensive environmental project loan was extended to Brazil in 1990, and the Bank's environment program in Brazil now covers a broad spectrum (box 1). Partnership with the other countries in the region has also been growing rapidly. Over the past two years alone, 35 Bank loans approved for Latin America and the Caribbean included significant environmental components totaling nearly \$1.5 billion (see annex table 1). (In this report, all dollars are U.S. dollars.) Several of these projects are fully devoted to environmental issues such as environmental institution-building, forestry, and land use rationalization. Of the projects close to final approval, seven are devoted entirely to environmental issues, and another nine contain significant environmental components (see annex table 2). Free-standing loans for environmental studies and the strengthening of environmental institutions are becoming particularly important. All World Bank projects require an assessment of the impact they will have on the environment, and have to incorporate appropriate protective measures.

The World Bank is also helping administer important new international initiatives: the Global Environmental Facility (GEF), the Montreal Protocol Interim Trust Fund, and the Pilot Program to Preserve the Brazilian Rainforest (the G-7 initiative), all of which provide funds to address global ecological concerns. As a consequence, the region now has significant, though by no means adequate, external funding for environmental programs and projects. Nine projects to be financed by the GEF have been approved or are in advanced stages of preparation (see annex table 3), five of which concentrate on the administration of national parks and the conservation of biodiversity, while the others concentrate on issues of global warming.

The UNCED meeting comes two decades after the Stockholm Conference on the Human Environment, which launched the international environmental movement. As an input into the UNCED debate, the World Bank's recently published *World Development Report 1992 (WDR)*

Box 1. Evolution of an Active Partnership

The partnership between the countries of the region and the World Bank is best illustrated in the case of Brazil. Until 1987, World Bank support for environmental programs in Brazil consisted of an industrial air pollution control project and project components for safe drinking water, water pollution control, soil conservation, environmental mitigation in the Carajás iron ore project (see box 6), and resettlement components in dam projects. The first power sector loan, approved in 1986, included preparation of an environmental strategy and master plan for the sector.

Worldwide interest in the preservation of the Amazon rainforest and other resource management issues elicited contradictory reactions in Brazil. Some groups viewed the international interest as an intrusion into the sovereignty of the nation. Other groups saw potential benefits for the Brazilian environmental program. Major policy issues were discussed between the government and the World Bank, such as the subsidization of livestock expansion in the Amazon. Preparation started on a number of environmental projects.

Project preparation provided opportunities to study environmental priorities and issues in industrial pollution, water pollution, land management, and environmental institutions. Discussions involved local governments, NGOs, executing agencies, and state and federal officials. Analytical skills and the international comparative experience of the Bank staff were increasingly appreciated, and agreement was reached to study and analyze dispassionately the development options of the Amazon region, from both environmental and economic perspectives.

The intense national and international debates set the stage for a major shift in the political priority given to environmental issues, which was reflected in Brazil's

focuses on the environment and development. This shorter report draws on the themes of the *WDR* and shows their relevance for the Latin America and Caribbean region. It does not repeat the in-depth analysis of issues which the reader can find in the *WDR*. Instead, this report illustrates the strategies and projects that countries are implementing in partnership with the World Bank.

The first section emphasizes that good economic policy frequently is good environmental policy. While there are sometimes conflicts between economic and environmental objectives, there are a multitude of opportunities to improve economic and environmental management

new Constitution, ratified by the Federal Government in 1988. Yet full commitment to finance and implement the environmental agenda and to collaborate with the international community had to await the government of President Collor, which quickly accorded environmental issues and agencies a high priority.

With the strong commitment of state and local governments, project appraisal and negotiations proceeded on a broad range of programs. Since the mid-1980s, environmental projects and project components totaling nearly \$2 billion have been approved for Brazil or are under preparation. They cover the major resource management and urban environmental issues. They include the first free-standing environmental project in support of the Federal Environmental Protection Agency and the national parks system, resource management projects for the states of Rondônia and Mato Grosso, soil conservation projects for the states of Paraná, Santa Catalina, São Paulo and Mato Grosso do Sul, two multi-state water sector modernization projects, an industrial pollution project in São Paulo, an environmental management project for the Companhia Vale do Rio Doce, a biodiversity project and a biomass gasification project. Many other projects have significant environmental components for resettlement, urban water supply, sewer collection and treatment, industrial discharges and strengthening of the environmental capacity of implementing agencies.

The developing partnership between Brazil and the international community is illustrated in the recent approval of the Pilot Program to Preserve the Brazilian Rainforest to which seven developed nations have pledged \$250 million and which will be managed by the World Bank. A number of individual projects to be supported by this initiative are in preparation.

simultaneously.

Because experience suggests that governments need to use both market-based incentives and regulations, the second section discusses situations where incentives work best, where regulation is essential, and where the two need to be combined.

The third section analyzes how to set the right priorities, and how to choose policies and projects when there is a conflict between economic and environmental goals. In such cases, improved data and knowledge are essential, and benefit-cost analysis can help to assess the trade-offs. Where benefits are difficult to quantify (as with biodiversity), cost-

effectiveness studies can identify the cheapest way of attaining a given goal.

The fourth section stresses the urgency of strengthening institutions and improving people's participation in projects, which in the past has often been negligible. Less than one-third of the region's countries has adequate legislation in place, although legislation is currently being prepared in many others. Even where legislation is adequate, it may not have been translated into sector-specific regulations. The institutions for policymaking are relatively developed in countries such as Brazil, Mexico and Venezuela. But even in these countries enforcement capacity is inadequate.

The final section looks at what is being done in the region to address global environmental issues, such as biodiversity and global warming. It highlights the need for global finance to solve global problems.

1. Good Economic Policy Can Be Good Environmental Policy

The earth is endangered as never before by urban pollution, the degradation of forests and soils, and global threats such as the erosion of the ozone layer and the greenhouse effect. Many environmental problems have come in the wake of economic and population growth and are sometimes attributed to them. In fact, the fault often lies with policies that fail to take into account the costs of pollution and degradation and that sometimes provide perverse incentives that unwittingly encourage the destruction of the natural resources on which growth depends.

Great intensity and passion surrounds many environmental debates and policy choices. Sometimes this is because there are conflicts between environmental objectives and narrower economic goals. For example, protecting a forest or coastal area may mean reduced employment and revenue from logging and shrimp aquaculture. In other cases, air or water quality standards may require inefficient firms to close down or may discourage new industries from opening. Priorities must be set and difficult trade-offs considered. There are, however,

many cases in which a policy change yields both economic and environmental benefits. A first objective must be to seize these so-called “win-win” opportunities, and these cases are discussed in this section.

Even where it is possible to improve economic and environmental management at the same time, the nature of environmental effects is such that market forces alone will not produce satisfactory results. For example, a polluting firm imposes an external cost on the population at large without having to bear the cost itself. The market provides no mechanism for those affected to participate in the decisions of the firm and to force it to bear the cost and reduce its emissions. Emission regulations or taxes must therefore be designed that shift the cost of dealing with the pollution back to the firm. Proper design of regulations or taxes requires the ability to measure and quantify the costs of pollution, a difficult task open to dispute. It also requires political agreement on the institutional structure to implement the regulation or tax. Considerable controversy often results. Powerful political and business interests will resist the regulations and taxes and they must be counterbalanced by giving voice to those affected.

Poverty and Slow Growth Can Pollute and Degrade

Environmental pressures are often aggravated by the persistence of poverty. The examples below illustrate that poverty reduction helps alleviate these pressures, although poverty reduction must be combined with more specific environmental interventions to eliminate them.

In urban areas, the poor often settle in unsuitable areas, such as river banks and steep-sloping land where it is very difficult to provide basic infrastructure. Insufficient collection and treatment of wastes often results in serious contamination of water sources used by a much larger population. For example, at the Guarapiranga reservoir, which supplies one-quarter of the water for the 14 million inhabitants of São Paulo, thousands of squatters are causing serious contamination of the water for the entire metropolitan population. To deal with this problem, state governments in Brazil are implementing projects which provide basic

infrastructure in suitable urban areas and resettle people to these areas. The World Bank is supporting these efforts through the financing of four projects which benefit six states.

While the causes of deforestation are complex and many forest areas are cleared by loggers and ranchers, who are not among the poor, poverty has encouraged poor farmers to encroach on the rainforests of the Amazon. Unfortunately, many Amazonian soils cannot sustain intensive agricultural methods. Small farmers and ranchers leave the land after they have "mined" the soil nutrients and when yields have started to decline; they clear yet more forest, only to repeat the extractive cycle through which the poverty problem is never resolved.

This destructive cycle may not be inevitable, however. A project in Yurimaguas, in Peru, shows that with sufficient inputs, a technical solution exists for sustainable farming in this rainforest area. The profitability of the system is not assured unless low-cost supplies of lime and other nutrients are available and products can be sold to nearby markets. Research is required to find out whether there are other solutions based on pasture improvements and tree crops. Only such research can reveal whether agriculture is economically and ecologically sustainable on soils that have failed to sustain it in the past.

In the Central American highlands of Guatemala, Honduras and Nicaragua, population growth and poverty have driven poor farmers to cut forests in search of more land and fuel. In the Caribbean, Haiti is perhaps the most extreme example of this process; its once heavily forested land is virtually denuded today. Such countries need better economic policies to spur the economic growth that will create employment opportunities in non-farm sectors and relieve land pressures. The World Bank is providing financial support to enable governments to undertake such policy reforms and the accompanying public investments.

Even middle-income countries need faster economic growth to finance environmentally-sound investments. Slow growth can actually result in increased pollution. Argentina had a good record in water supply and sanitation in the 1970s when it spent \$7 to \$9 per capita per year on these sectors. When its economy declined rapidly in the 1980s, invest-

ment in these sectors dropped to barely \$1 per capita per year, insufficient to maintain even old systems. As a result, the country suffers from much greater urban water pollution today.

Population growth may not seem as much a problem in land-abundant Latin America as in land-scarce Asia, but experience in the highlands and the Amazon demonstrates that poor people rarely have access to sufficient high-quality soils. Deforestation and soil degradation would be less if population pressure were reduced. In the 1980s, annual population growth was as high as 3.5 percent in Honduras, 3.2 percent in Paraguay, 2.9 percent in Guatemala, and 2.7 percent in both Ecuador and Bolivia. Meanwhile, it was only 1.3 percent in Jamaica and 1.4 percent in Argentina, showing that the problem is not equally severe everywhere. Nevertheless, in a number of countries, reducing population growth must be an integral part of a strategy to tackle environmental problems. To this end, many of the countries in the region are strengthening education and family planning services as part of integrated primary health care programs.

Subsidies Can Be Polluters

While subsidies can sometimes be used to achieve environmental objectives, subsidies for water, power, fertilizers, and pesticides usually constitute poor policies that encourage excessive and inappropriate use. Thus, subsidies frequently turn out to be the cause of much environmental degradation.

For example, in Mexico City water used to be supplied at a price that implied an annual subsidy of \$1 billion. This encouraged excessive pumping, with the result that the water table has fallen by 80 meters, aquifers are being compacted, and many parts of the city are sinking—some places near the historic city center have sunk as much as eight meters over the years. This has damaged the city's underground infrastructure of pipes, cables and sewers, and it increases potential earthquake damage. In effect, cheap water is helping to destroy the city. Mexico, with World Bank finance, is investing in a scheme to bring more water from outside the city and raise municipal water charges. Some

areas have been designated for recharging aquifers and are supposed to be protected from encroachment, but squatters have frequently occupied these grounds. Therefore, enforcement needs to be improved.

By the early 1970s, most private power utilities in the region were nationalized. Many subsidies were introduced by governments. Power tariffs fell by 22 percent between 1972 and 1988 even though operating costs rose 14 percent. Normally, electricity should be priced at the long-run marginal cost, which is estimated to be between seven and nine cents per kilowatt-hour in the region. In fact, between 1972 and 1988, the average tariff dropped sharply from 6.3 cents to 4.9 cents per kilowatt-hour. The lack of self-generated funds for utilities has led to poor maintenance and insufficient investment, which in turn impose further costs. According to a World Bank study, improved maintenance could raise generating capacity by 10 to 20 percent, reducing the need for fresh investment. A power efficiency program to reduce technical losses may save another 10 to 15 percent in new generating capacity. Poor efficiency also leads to higher fuel costs, which are \$360 million a year higher than necessary in the region. Subsidized power encourages excessive energy consumption and diverts scarce resources to fund unnecessary new capacity. It also has adverse environmental consequences in the form of increased emissions of pollutants and greenhouse gases (in the case of thermal generation), and the unwarranted submergence of land and forests, and the displacement of people (in the case of new hydroelectric generation). Argentina, Honduras, Jamaica and Mexico have adopted power sector policies that, among other things, provide for setting power tariffs at the long-run marginal cost and developing energy conservation programs. The World Bank is assisting in the financing and implementation of these programs.

Subsidies for fuels encourage their overuse as well, causing additional pollution. Cheap gasoline and diesel fuel have encouraged excessive vehicular use that pollutes the air in many cities of the region. Emergency restrictions on vehicles are imposed in São Paulo, Santiago, and Mexico City when air pollution reaches critical levels. Countries such as Peru and Argentina are reducing or have abolished fuel

subsidies.

However, such reforms carry political risks. Venezuela once had the cheapest gasoline in the western hemisphere, costing barely 30 cents per gallon, less than one-third the U.S. price. However, an attempt in 1989 by the Venezuelan government to raise fuel prices contributed to riots. Similar riots had occurred in the Dominican Republic after a big rise in fuel prices there. This shows how politically difficult it is to raise prices sharply after having kept them artificially low for long periods. It is better to maintain real prices through frequent adjustments, as is the practice in several countries in the region, or to depoliticize them by leaving them to market forces.

Subsidized electricity has led to excessive pumping of water for irrigation in many parts of Latin America, thereby depleting aquifers. In some coastal areas such as Baja California, it has also led to the intrusion of saline water into freshwater aquifers, spoiling them permanently.

In many countries of the region, irrigation water is priced so low, and the collection of charges is so poor, that revenues do not even cover operating costs. This encourages the overuse of water, which can lead to waterlogging and salinization. Revenue is insufficient to maintain canal systems or provide the drainage that is essential to prevent waterlogged areas from turning saline as the excess water evaporates. In the Rio Fuerte command area in Mexico, 80,000 hectares have turned saline, yields have fallen, and farmers have abandoned large parcels of land. Although all of this land cannot be reclaimed, the Rio Fuerte Irrigation Project supported by the World Bank has helped reduce waterlogging by lining secondary and tertiary canals and rehabilitating around 30,000 hectares of saline area by flushing the salts out of the soil. Under a new country-wide irrigation program, partly financed by the Bank, the construction of main and secondary drainage channels will reduce waterlogging. Mexico is also raising water charges to cover all operating and maintenance costs plus one-third of the capital costs.

Cheap credit is another kind of subsidy. Subsidized credit for ranching has encouraged the conversion of forest areas into cattle ranches on soils that often cannot sustain them. The World Bank has

supported government programs to end subsidies for ranching in Brazil and in the Selva Lacandona, the last remaining rainforest in Mexico. In the past, subsidized agricultural credit has also led to overuse of pesticides and discouraged the adoption of integrated pest management, which emphasizes improved management techniques over pesticide applications. Cheap credit as well as subsidies have encouraged the overuse of fertilizer, resulting in nutrient run-off that can pollute groundwater. Mexico and Venezuela have phased out fertilizer subsidies, and the reduction of credit subsidies by many countries of the region will improve the climate for more rational pesticide use.

Openness Can Reduce Pollution

Promoting sustainable economic growth in the region requires open policies to encourage foreign investment and trade. These are sometimes thought to accelerate the sort of industrial development that leads to pollution. Indeed, there are well-founded fears that polluting industries will shift from rich to poor countries to take advantage of weaker regulations in the latter. However, opposite forces are also at work. A recent World Bank study suggests that openness, on balance, may reduce pollution. An index of the pollution intensity of the industrial mix in 25 Latin American countries was constructed using data on the toxic intensity of U.S. industries. Analysis showed that income growth led to higher pollution intensity but that pollution intensity increased less in more open economies.

Openness may reduce pollution in several ways. For example, export products must comply with the environmental guidelines of the importing countries. The U.S. stations inspectors in both Chile and Mexico to test fruits and vegetables for pesticide residues. German limits on the dioxin content of paper have forced the pulp and paper industry in Chile to change its processes and to treat effluents. Also, foreign firms, under pressure from stockholders, often impose common international standards wherever they invest and bring in new technologies that already include cleaner processes. The foreign firms then press govern-

ments to raise standards for local industries, too, to place all firms on an equal footing.

For years, Argentina aimed at self-sufficiency in petroleum products. Yacimientos Petrolíferos Fiscales (YPF)—a state-owned corporation—refined most of the oil produced. Domestic firms relied almost wholly on YPF for their supply of petroleum products. Regulations and a distorted pricing mechanism meant that the private sector had little incentive to increase oil exploration and production or to develop the country's reserves of natural gas. Argentina has now deregulated the oil and gas sector, and domestic prices have risen to international levels. Industries and utilities will substitute natural gas for fuel oil, reducing particulate and carbon dioxide emissions. Many of YPF's heavily polluting operations are being sold to the private sector, and it is hoped that additional foreign investment will enable construction of more modern facilities with better thermal efficiency and pollution control.

These examples illustrate how open trade and investment policies can help the environment while protection can increase pollution. However, opening up can also encourage additional industry, mining, logging, and other activities that put pressure on natural resources. The answer is not to go to either extreme but to ensure, through a proper mix of incentives and regulations, that any new activity is environmentally sound.

Better Health Requires Cleaner Water

The purpose of development is to improve human welfare, and a vital part of such welfare is improved health. Polluted water and air are major causes of illness and death, imposing welfare costs on Mexico, for instance, of an estimated \$3 billion and \$1 billion a year, respectively. Measures to clean polluted air and water and improve sanitation would help the economy and the environment.

Experience in the region shows that the need for public investment in water and sanitation is great. The World Bank is currently financing water and sanitation projects in many countries in the region, including Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Saint Lucia and

Uruguay. Water charges should be increased to provide the funds for new water supply and sewage treatment plants. Better institutions are needed for metering and collecting water charges. In Caracas and Mexico City, 30 percent of water connections are not even registered.

Cost-effective ways can be found to ease different forms of pollution at a fraction of the cost of providing state-of-the-art treatment. For example, excessive water use can be cut by rehabilitating old, inefficient systems. In Uruguay, the city of Montevideo wanted to build a new pipeline for water supply. Further study showed that the same results could be achieved at less than half the cost by rehabilitating two old water pipelines, a project the World Bank is helping to finance. Argentina is now rehabilitating all its water companies in phases. This will decrease wastage and so release additional supplies for poor slum areas that today depend on polluted supplies.

Effluent charges levied on polluting industries in São Paulo, Brazil, have helped reduce its water demand 40 to 60 percent, releasing more and cleaner water for households. Wastewater can be recycled, sometimes by harnessing private sector expertise and investment. Twenty-six companies in Mexico City have banded together and made a success of such a project. Chile uses private agents for meter reading, pipe maintenance and billing and has been able to trim its workforce to only 3.5 employees per 1,000 connections, one-sixth the average for the region.

People's participation can help devise the most appropriate forms of water supply and sanitation. In many cities in Brazil, households cooperate in running a single sewer line right through a block of houses instead of having separate connections for each house. This saves 20 to 30 percent in capital costs.

Saving the Environment Can Help the Economy

Currently, cholera epidemics are killing people in many countries in the region. Cholera hits agricultural and marine exports, as buyers fear contamination of produce, and it also damages tourism. According to one estimate, a recent epidemic in Peru has cost the economy around \$1

billion, more than three times what Peru invested in water supply and sanitation during the entire 1980s.

Valparaiso, in Chile, has long suffered from poor sanitation. Chile is now investing in improved sewage disposal for the city, with World Bank support. Apart from improving the welfare of hundreds of thousands of urban dwellers, the project will provide insurance against beach pollution, which now threatens the local tourism industry.

Deforestation and intensive cultivation in southern Brazil have led to soil erosion and heavy sedimentation of the Paraná river. Estimates suggest that the life of the Itaipu hydroelectric reservoir, one of the biggest in the world, has been significantly reduced. As one-quarter of Paraguay's entire revenue comes from the Itaipu project, the country will be hurt badly by the reduction in revenues associated with the shortening of the reservoir's life. The Paraguay side of the river is still much better forested, but settlers are moving in from Brazil. The World Bank is supporting a new land-use rationalization project in Paraguay that will help reduce the deforestation and siltation caused by new land settlement.

Replacing Perverse Incentives with Appropriate Ones

Many well-intentioned measures to promote growth, alleviate poverty, or even protect the environment can end up damaging both the economy and the environment. Policymakers often fail to realize that incentives to solve one problem can induce another even worse than the first. In particular, they often fail to anticipate the environmental consequences of economic incentives.

Some countries decree a uniform fuel price in an attempt to be fair to all regions. This has relatively little adverse consequence in small countries. However, in a large country such as Brazil, fuel distribution costs to remote areas are high, especially in the rainforest, and these remote areas should, therefore, pay the highest fuel prices. Brazil had a uniform fuel price at one time, but this resulted in a hidden fuel subsidy that encouraged migration into the very areas where migration needed to be discouraged. Brazil has now given up uniform fuel

pricing.

Mexico used not to levy any taxes at all on cars more than ten years old. The aim was to help the poor who could not afford newer cars. This unwittingly encouraged the increased use of old cars with the lowest fuel-efficiency and highest pollution. The increased air pollution harmed the health of many more poor people than benefited from the tax break. Mexico has now abandoned this policy and instituted a tax. (Box 2 describes similar unanticipated consequences that restricting the use of cars to six days a week might have had.)

Measures intended to protect the environment can end up destroying it if incentives are inappropriate. Nicaragua and Honduras, in their concern about reduction in their forest cover, decreed that all trees on private land belonged to the government. In practice this ended the incentive for any individual to plant trees and so they aggravated the problem. It also encouraged people to fell trees on their land to make a profit at the government's expense.

Free access to forests, pastures, and seas can constitute a perverse incentive to degrade these resources. Every logger, rancher, or fisherman has an incentive to maximize the exploitation of such resources, but none has an incentive to replant trees and pasture or restock depleted fish stocks. This leads to overfelling, overgrazing, and over-fishing, all of which deplete the very natural resources that form the livelihood of those who deplete them.

A clear system of property rights is essential for providing incentives to conserve renewable resources to ensure their sustainable exploitation. If common lands are clearly the property of either individuals or local communities, and if they have the legal right to exclude outsiders, this provides an incentive to nurture these resources instead of "mining" them in unsustainable fashion. This helps avoid the degradation that is common when there is open access for everybody.

In many parts of Latin America and the Caribbean there are no reliable land records, encroachment and land disputes are legion, and enforcement is weak. The World Bank is now financing natural resource management projects in several countries, including Brazil, Bolivia, Costa Rica, and Paraguay, giving priority to the clarification of

Box 2. Unintended Consequences of Regulations

Well-intentioned regulations can have unintended consequences and worsen instead of improving the environment. Air pollution in Mexico City is so serious that since November 1989 the government has prohibited cars and vans from operating one day every week. The measure temporarily reduced traffic congestion as well as pollution. But as the ban became permanent people began to seek ways of circumventing the ban.

According to one survey, 39 percent of vehicle owners have purchased a second vehicle just to overcome the regulation. The number of new cars purchased in the metropolitan region has not accelerated greatly, but as many as 170,000 cheap, old vehicles may have been purchased and brought in from the surrounding regions. Unfortunately, old cars tend to be much more polluting than new ones. Once a family has a second car, it quickly becomes used more than once a week. The mileage of many households has actually gone up after the decree. Could this have more than offset the reduction in traffic congestion and pollution that the decree achieved? The acceleration in gasoline consumption after the decree and the increase in air pollution suggests that this may indeed be the case. It might be better to rescind the ban as a permanent measure and to keep it only as a short-term emergency option.

land titles. Most of these projects include cadastral surveys to update land records and demarcate areas for indigenous peoples.

Public investments, such as roads, can create perverse incentives and have often unwittingly provided access to areas with fragile soils. Controlling road construction in such areas is a prerequisite for conservation, since it is often difficult to control logging, ranching and settlement once access roads have been built. Even where a paved road is built only into areas with good soil, as was the case in parts of the state of Rondônia in Brazil (box 3), local people may build dirt roads branching off into the fragile soils. Controlling road construction by both public and private agencies is essential. The Brazilian states of Rondônia and Mato Grosso have adopted a development strategy that sharply limits infrastructure development to areas with the highest land quality, using agro-ecological zoning as the basis for such deci-

Box 3. Saving Brazil's Rainforests

For two decades, deforestation in Brazil's Amazon region has been driven by inadequate policies and investment programs and by poverty and population growth. Much of the resulting economic activity has not been self-sustaining, based instead on the extraction of trees, nutrients and minerals. Brazil is now adopting a new strategy for managing natural resources, aimed at preserving the remaining rainforest and its biodiversity, preventing encroachment into areas where Amerindians live, and encouraging environmentally sound agriculture.

The Legal Amazon's deforested area increased from 3 million hectares in 1975 to 60 million hectares in 1988. Of the nine Amazonian states, Rondônia in the northwest suffered most. The deforestation began in the 1970s following the building of new dirt roads and the active promotion of immigrants. It gathered pace after the World Bank helped pave the highway to Pôrto Velho as part of a series of projects (POLONOROESTE) to develop the region. There was little knowledge of agricultural conditions, no regulations, and hardly any administration. The settlers logged and cleared the forests, planted crops, and grazed cattle.

By the early 1980s it became clear that much of the agricultural development was on fragile soils. Yields dropped sharply, and small farmers and ranchers cleared yet more forest in a repetition of the cycle. The World Bank stopped lending for several Rondônia settlements, and Brazil and the Bank reviewed the lessons from this experience. They concluded that:

- data collection was vital to establish which parts of the Amazon basin could sustain agriculture and which should be left untouched;
- faulty policies had created perverse economic incentives for people to destroy the forest;
- not enough attention had been paid to preserving the biodiversity of the rainforest or protecting the land rights of the Amerindians living in them;
- institutions to prevent environmental destruction and promote sustainable agriculture were ineffective; and
- centralized decisionmaking meant that projects were divorced from grassroots realities.

Each of these problems was tackled in the preparation of the recently approved Natural Resource Management Project for Rondônia.

Data collection and analysis. The World Bank financed satellite imagery that helped in mapping soils and provided the basis for rational land zoning. It turned out that of Rondônia's total area of 24.3 million hectares, only 2.6 million hectares could sustain annual cropping, while another 6.4 million hectares could sustain perennial tree-crops, such as coffee and fruit. All development and public investment will be

limited to these sustainable regions, so that the remaining 15.3 million hectares can be kept under forest cover. A similar strategy is being prepared for Mato Grosso.

Removing perverse incentives. Previously, the government gave big tax breaks to agricultural enterprises, and this encouraged businessmen to set up ranches simply to save taxes. Subsidized credits for cattle ranching encouraged this activity even when the real returns were negative. Land title for settlers was linked to the area of forest cleared and so encouraged felling. Many roads were built in areas of fragile soil, and immigrants were drawn into such areas simply because access was easier than in undeveloped areas with better soil. In the absence of long-term credit for growing tree crops, farmers planted annual crops that were more damaging to fragile soils.

Brazil has therefore sharply restricted fiscal incentives, subsidized credits, and road building in ecologically sensitive zones. Titles were banned in non-agricultural zones. Plans have been made to help rubber tappers and nut-gatherers market their produce, thus encouraging sustainable forest exploitation. Credit will now be provided for tree-crops. Today, Brazil's economic incentives are more in harmony with the new land zones, and this will reduce unsustainable development.

Protecting Amerindians and biodiversity. The demarcation of Indian reserves has been increased to 9,300 linear kilometers, enclosing 10.3 million hectares. Five state parks, one municipal park and two biological reserves will be created to protect endangered species.

Strengthening institutions. Institutions at the federal, state and local levels are being reinforced to ensure greater awareness of problems, improved technical capacity, and stronger regulatory and participatory mechanisms. Rondônia's new constitution denies legal title to any settlers in prohibited zones.

Decentralizing and improving popular participation. Under the new project, Rondônia aims to decentralize decisionmaking and encourage local participation. A state council reviews the project's progress every month, as do commissions for each component of the project. NGOs are represented in the council as well as on the commissions and participatory forums have been constituted in each locality.

Risks. Although land use zoning is a powerful tool for better planning public investments and for mobilizing public opinion to limit development in fragile zones, without rigorous enforcement private investors will still find it profitable to extract logs, minerals and nutrients from even the marginal zones. However, enforcement at the thinly populated frontier is difficult and costly. If the gains from extractive activity are large, it will be difficult to maintain strong local political support for the required enforcement. Information gathering, dissemination and participation in the decision process of all who are potentially affected will reduce these risks. But, much needs to be learned about the proper role of different government entities and mechanisms to achieve development with ecological balance.

sions. This strategy is supported by World Bank financed projects. Road construction has also been sharply limited in the Selva Lacandona area of Mexico under an action plan agreed with the Bank. In the Mexico Forestry Development Project supported by the Bank, road investment is limited to the rehabilitation of old roads, but even that will not be done if the roads are close to virgin forests or genetically rich habitats.

2. Market-based Incentives and Regulations

Two kinds of policies are needed to curb environmental damage. Market-based policies tax or otherwise raise the cost of harmful activities and reward environmentally sound activities, and command-and-control policies prohibit or limit undesirable activity through regulation. Both shift environmental costs back to the firm or entity that generated them. In some cases incentives work best; in other cases regulatory controls are essential; and in many cases the two need to be used in combination.

Market-based Incentives

Market-based incentives are often a good way to change people's behavior. Taxes on pollution can induce polluters to economize and innovate in ways that benefit the whole economy. For instance, a tax on industrial wastewater in Brazil has induced industries to reduce their demand for water by almost half, thus releasing better water for households. If the industries had been forced to relocate, they would have had no incentive to reduce their water consumption or pollution, while the costs of relocation would have been substantial.

Market-based measures are often much easier to implement than regulatory orders, especially when regulatory administration is weak. Many countries have mandated emission checks to weed out polluting vehicles, but these regulations are easily evaded, as are controls on emissions by industries. However, neither car owners nor industries can evade taxes on fuels, which therefore tend to be more effective in changing undesirable behavior.

Command-and-control Measures

Regulations are essential where proper markets do not exist. This is often the case when property rights are not clarified or enforced. Open, uncontrolled access to air, water, forests and fisheries encourages pollution and overuse. In such cases a regulatory framework is a necessary, though not sufficient, condition for a healthy environment. Many countries of the region are now enacting environmental laws to provide a regulatory framework.

Market-based incentives are inappropriate when the potential risk to public health is severe. Merely taxing industries that dump toxic or nuclear waste is not good enough, since toxic waste can kill human beings and animal life. In such cases command measures accompanied by good enforcement are necessary. Well-educated farmers may be able to read and follow instructions for handling highly toxic pesticides, but not those who are uneducated. Even in a small country like Nicaragua, more than a thousand farmworkers suffer acute pesticide poisoning every year due to improper handling. There is a case for banning highly toxic pesticides in such countries. Better education on the safe use of pesticides and integrated pest management is also needed.

Although command measures usually fail if they try to change the behavior of a large number of minor polluters, such measures can succeed where the number of polluters is small. In the early 1980s, the states of Cubatão and São Paulo in Brazil used World Bank resources to provide concessional finance to invest in emission control and enforcement. Air quality improved in Cubatão, where the main polluters were a small number of petrochemical and steel companies. However, air quality did not improve in São Paulo, a city of 12 million people, where vehicles are the main source of pollution. Brazil has now decided to limit the use of command-and-control to cities with a handful of polluting industries and resort to other measures where thousands of vehicles are the main problem.

Combining Regulations and Incentives

Regulation alone will often fail, but so too will deregulation alone. Regulations often need to be combined with incentives to produce good results. In the 1970s the Chilean government deregulated public transportation in Santiago, ending the public sector bus monopoly. Deregulation encouraged people to buy cheaper, but more polluting, secondhand buses. Air quality worsened dramatically and improved only after 1991 when the government banned the use of buses with pre-1972 engines (box 4).

Installing sufficient emission-control equipment on vehicles and industrial plants to reduce air pollution substantially can be done, but at a great cost. If fuel consumption is taxed as well, it will discourage vehicular traffic and induce industries to economize on fuel, thereby changing polluting behavior more cheaply than command measures would alone (box 5). Taxes and other charges also yield revenue that is badly needed for a variety of projects to will help both the economy and the environment.

Chile has recently enacted legislation providing for “tradable pollution permits” for larger industries. The law sets a ceiling on the permissible amount of pollution by each company and lets these rights be traded. A company that reduces its emissions to zero can sell its “pollution rights” to a company that may find it more economical to buy these rights than to cut pollution. Tradable permits are a cost-effective solution for reducing pollution in this case.

Mexico is considering adopting a similar strategy for chlorofluorocarbons. These chemicals damage the ozone layer and are being phased out in consonance with the Montreal Protocol. The phase-out program reduces the production rights of each company year by year, and these rights are tradable.

In Costa Rica, both incentives and regulations are used to improve forest management. The country has good forest laws and has designated protected corridors along roads in ecologically-sensitive areas. However, conscious that weak enforcement agencies have been ineffective in the past, Costa Rica’s government also offers farmers a

Box 4. Reducing Congestion and Pollution in Santiago

Chile is strengthening environmental institutions and developing stronger environmental laws. However, air pollution in Santiago needs immediate attention, and so a Special Commission for the Decontamination of the Metropolitan Region has been established. The biggest threat to health comes from the fine particulate matter, called PM10, that damages human lungs. In winter, air quality reaches "critical levels" as often as one day in six, and normal PM10 standards are violated daily.

When Chile deregulated bus transport in the early 1970s, private operators imported thousands of cheap, old buses—major emitters of PM10. They also increased traffic congestion in downtown Santiago since road access was free to all. In early 1991, Chile banned 2,600 buses with pre-1972 engines (constituting one-fifth of the whole bus fleet). This reduced the number of winter days with critical-level pollution from 33 in 1990 to 21 in 1991 (higher rainfall was another contributory factor). An auction-cum-allocation package has been introduced for bus operators. Its main features are:

- more stringent emission standards for new buses and limits on the kinds of buses that operate on downtown routes;
- the allocation of bus-transit rights downtown, on which a ceiling has been placed to check congestion and pollution; and
- the auction of routes based on fares to be charged and the type of buses to be operated.

The reforms, which have been supported by the Inter-American Development Bank, have helped speed up transit time, reduce congestion and pollution, and bring down fares. Although the number of buses has been limited, operators can complete more round trips because of reduced traffic congestion. The auction-cum-allocation system has reduced the average fare by one-tenth. It also yields revenue to finance improvements such as paving roads, which reduces dust pollution.

subsidy of about \$1,000 per hectare to reforest their land. This may be excessive. A World Bank study suggests that the average cost of reforestation is only about \$850 per hectare, and other research suggests that 56 percent of the supposedly reforested land had never been deforested in the first place. The study also estimates that the cost of enforcing good forest management would be a small fraction of refor-

Box 5. Cost-effective Air Pollution Control in Mexico

Mexico City is one of the biggest and most polluted cities in the world. High mountains surrounding the city trap air pollutants, and thermal inversions further concentrate them. Emissions of particulate matter, ozone, and carbon monoxide frequently far exceed health-based norms. According to a World Bank study, air pollution imposes health costs of more than \$1 billion a year on the city.

In 1982, the World Bank approved a \$60 million project for industrial pollution control. However, the debt crisis that hit the country meant there was little political interest or trained staff for enforcing regulations, so the Bank cancelled the loan after disbursing only \$8.1 million. However, what survived was a network of automatic air monitoring stations. These produced devastating data on air quality that eventually led to public outcry.

In Mexico City, vehicles are a major source of air pollution. There are three ways to reduce this pollution:

- reduce the pollution per kilometer from each vehicle;
- shift the passenger load to forms of transportation that pollute less; and
- reduce overall travel.

What is the most cost-effective combination of the three? A World Bank study indicated that cost-effective ways to reduce pollution from each vehicle are to convert high-use vehicles from gasoline to liquified petroleum gas and to recover vapors from gasoline stations. Emission standards have the most impact if initially imposed on high-use vehicles. Taxis drive about 10 times as much as the average car. Requiring old taxis to be replaced reduces emission from a taxi by 80 to 90 percent.

Taxation of gasoline is, however, immensely more effective than regulation for shifting passengers out of cars to less polluting modes, or for reducing overall travel demand. Relying on regulations alone would cost \$560 million to reduce vehicular emission by half. With a well-designed gasoline tax, the costs to achieve this objective could be reduced by nearly \$100 million. The tax would also generate revenue needed to implement some of the regulating measures.

Mexico and the Bank are thus discussing strategies that combine regulations and incentives. Since 1991, all new vehicles have had to be fitted with catalytic converters to cut emissions. However, so long as leaded gasoline remained 40 percent cheaper than the unleaded variety, car-owners tended to use the former. The government has now reduced the price differential to 11 percent, and a further reduction of the differential rate would be desirable. Also, Japanese co-finance is being used to increase capacity for producing unleaded gasoline. Finally, credit is to be given for the replacement of old, polluting taxis by new, less-polluting ones.

estation costs. This suggests that Costa Rica may find it cost-effective to shift some of its emphasis from incentives to stronger enforcement.

Harmonizing Regulations with Incentives

Governments often use several policies to attain different ends. Sometimes regulation aimed at one objective conflicts with incentives provided for another objective. Brazil attempted to reduce overfishing in the coastal waters off Bahia, while the government was subsidizing new nylon nets to encourage fishing, thus resulting in overfishing. The government needs to harmonize these two aims.

At other times, regulations provide unintended incentives which undermine the goal of the regulation. Box 2 shows how prohibiting the use of cars one day every week has reduced air pollution and traffic congestion in Mexico City only in the short run, because many people bought older, more polluting vehicles as a second car.

Many countries in the Amazon basin, notably Brazil, are adopting zoning regulations to keep squatters off land that is unsuitable for sustained agriculture. However, such zoning fails when the government gives fiscal incentives and credit subsidies for farming the same land. One solution is to abolish tax breaks and subsidies in prohibited zones.

Using the Private Sector

Although governments must often take the lead in improving the environment, achievements will be greater with the participation of the private sector. In many cases, private agencies accomplish tasks quicker, cheaper and better than public sector agencies. Buenos Aires, Caracas, São Paulo and Santiago are successfully using private agencies for the collection of solid waste, for example. Some studies suggest that public sector collection costs are 50 to 200 percent higher. Private companies in Mexico City are treating wastewater from sewers and supplying this water to industrial users at 75 percent of the price charged by the public utility.

In many countries, environmental agencies have facilities for testing samples of water, soil and air. In fact, much routine testing could be contracted out to private laboratories that generally do the job more cheaply. Mexico is encouraging the use of private laboratories by both national and state agencies.

Private agents have often proved more effective than the government in afforestation as well. In Haiti, attempts to grow trees on government or common land achieved little because the saplings were neglected. Subsequently, a new approach financed by the U.S. Agency for International Development (USAID) was tried, in which farmers were assisted by NGOs in planting trees on their own land. The results exceeded expectations, with many more families planting greater numbers of seedlings (box 8).

Logging in public forests is often done in ways which impair subsequent regeneration. This is because loggers have little incentive to use techniques that help the natural regeneration of the forest, and weak enforcement means that unscrupulous contractors often cut more than they are permitted. Chile has shown that plantation forests can be grown profitably and in a sustainable manner by the private sector through suitable regulations combined with tenurial security on forest land and stable financial incentives. Industrial roundwood production more than doubled between 1969 and 1989, enabling the country to become a major exporter of industrial wood and paper. The International Finance Corporation (IFC), a World Bank agency that invests in the private sector, is supporting a private company in Chile to grow hardwood for conversion into plywood for export. The radiata pine, an excellent raw material for paper, matures in around 25 years in Chile, while it takes about 40 years in such countries as Sweden. Swedish paper companies have now started investing in Chile, with support from the IFC.

However, although Chile has done well with private plantations of non-native species such as pine and eucalyptus, it still has serious problems with the management of its native forests. Insufficient information about the uses of native species has resulted in a tendency to clearcut these forests for woodchips and for conversion to exotic

species. Private market forces would lead to the rapid loss of much of the native forest and, with it, the potential loss of important genetic material. Recently, the government stopped a major woodchip project in a native forest, and a proposed World Bank loan will support a complete cadastre of existing forest resources.

3. Making the Right Choices

Many environmental problems in Latin America have been due to the absence of environmental assessment (EA) of projects or policies. Decisions were taken with little knowledge or understanding of their environmental impact. The World Bank is now supporting efforts by countries of the region to improve environmental assessment and the analysis of alternative projects and policies.

There are three steps in this process. The first is the collection of data to identify the nature and magnitude of problems and to raise public awareness. The second step is to carry out an overall EA that will help identify potential problems and solutions and lead to better project design and policies. The third step is to use techniques such as benefit-cost and cost-effectiveness analysis to make difficult choices.

Data to Establish Priorities and Raise Political Awareness

Environmental data and scientific research provide the raw material for analysis to help identify important issues and set priorities. Information also helps create public awareness of environmental issues and the political will for action.

In the past, lack of adequate data was responsible for environmentally inappropriate actions. For example, had proper soil surveys been carried out in the Amazon region, they would have informed decisionmakers of the unsuitability of certain soils for settlement and intensive agriculture (box 3). Environmental studies now taking place in Bolivia, Brazil, Colombia, Ecuador and Paraguay are providing information to improve land-use management. Both remote sensing and ground surveys provide information for zoning land according to

its most appropriate use. Such information can be used to plan infrastructure investments and support land registration and titling.

A satellite-based mapping of the reservoir area of the Itaipu dam on the border of Paraguay and Brazil showed different rates of erosion in Paraguay and Brazil—Paraguay, with much better vegetative cover, had much less erosion. This information highlighted the urgency of proper land management in Paraguay to stop erosion from increasing to the levels Brazil was experiencing. A geographical information system identified land suitable for agricultural development and land that should not be disturbed.

Valuable lessons can be learned from analysis carried out in other countries as well. For example, environmental data from Mexico were combined with data on U.S. dose-response relationships to estimate the physical and economic costs of various environmental problems. The study suggests that pollution priorities in Mexico may have been misplaced and finds that polluted water imposes health costs three times as high as polluted air, highlighting the need for much greater priority for sanitation and clean water. It also showed that the health costs of lead in the air were gradually declining relative to the costs from ozone and especially particulate matters, which alone appear to cause about \$800 million in health damage a year.

Information and Analysis for Improved Environmental Assessment

Environmental data are critical for the overall environmental assessment of a project. An EA looks at the direct and indirect environmental effects of a project and helps identify environmentally sound options, which in turn helps avoid costly corrective measures that become necessary in the wake of badly designed projects. Public disclosure of an EA provides a valuable opportunity for public involvement in project design. Ideally, this should involve those who will benefit from, or would suffer from, a project.

EA is a well-accepted practice in most developed countries but is only now being introduced in the region. Many international agencies, including the World Bank and the Inter-American Development Bank,

now insist on EA. Multinational investors are also pressing governments to clarify the "rules of the game" and their potential liability *before* they invest. Although some countries in the region, such as Brazil, have developed their own EA requirements, most still have a long way to go.

EA can be expensive and take a year or more of the time of skilled technicians who are scarce in the region. The lack of legislation and administrative procedures can also be a barrier. These problems are being overcome gradually, and many World Bank loans now have components for strengthening EA capability and providing needed training and technical support. This often means requiring agencies to create, train, and equip in-house environmental management units.

Not all projects need EAs; those aiming to reform financial systems or provide health or education services are obviously exempt. EAs are most commonly required for infrastructure (dams, roads, ports), agriculture (which may involve land clearing or irrigation), and industry projects. (The annex to this report explains the classification of World Bank financed projects for EA purposes.)

Even though the use of EA is still in its infancy in the region and at the World Bank, there have already been some successes. In Bolivia, EA led to design changes and the realignment of a gas pipeline to avoid protected areas and indigenous communities and to limit settlement and agricultural development in a fragile area. The Lower Guayas project in Ecuador, a flood prevention project, was redesigned as a result of the EA and discussions with local beneficiaries, to harmonize the interests of ecology, small farmers, and Amerindians.

In the Pehuenche dam project in Chile, the EA showed the need to protect the rare Chilean Conure parrot, which is not found anywhere else. Part of the \$1.1 million environmental program went toward protecting the parrot. Protection measures included a captive breeding program and the fencing of a nesting area near the dam construction site.

An EA may not solve all problems in any case. The initial EA of the Carajas iron ore project in Brazil was competent but narrow (box 6). While accurately assessing and mitigating effects within the narrow corridor of the project area, it failed to consider the indirect effects on

Box 6. Carajas—Problems of Unanticipated Consequences

The multi-billion dollar Carajas iron ore project, for which the World Bank approved a loan of \$304 million in 1982, developed massive iron ore reserves in the Carajas highlands of Brazil, some 550 kilometers south of Belém. It was completed on time, achieved projected iron ore output, and addressed environmental issues successfully within the project area. However, it failed to anticipate important environmental side-effects in surrounding areas and has been subject to considerable criticism.

The Companhia Vale do Rio Doce (CVRD) — the state-owned company managing the project — contracted FUNAI (the Brazilian agency for Indian affairs) to implement the Amerindian component, most of which fell outside the project area. This involved demarcating lands to protect 14,000 Amerindians in an extensive area around the project area and improving living standards through education and health services. Illegal squatters were also to be evicted.

The project railroad provided improved access to the region and intensified the immigration that had begun in the mid-1970s. CVRD managed its own project area well, protecting the forests and Amerindians. But settlers established themselves on the periphery of the project zone, over which CVRD had no direct authority, causing extensive deforestation and encroachment onto Amerindian land. Because of institutional weaknesses, environmental zoning was not completed in the periphery, and the demarcation of Amerindian reserves and the eviction of squatters is only now being completed. Four pig iron smelters were established, causing concern that the charcoal they needed would be produced by felling rainforest trees. So far, however, negligible additional deforestation has taken place because the charcoal is being obtained from sawmill and agricultural crop residues. A recent decree obliges pig iron producers to become self-sufficient in wood supply. Strict enforcement of this decree will be crucial, as three additional pig iron smelters are under construction, and others may be built if pig iron markets improve.

Brazil is preparing a follow-up project, with World Bank support, for preventing further degradation. The Carajas experience shows how countries of the region and the Bank are still learning-by-doing in environmental assessment. They have learned that in preparing a project they must take into account consequences outside the project zone and make sure that the institutions in the region are strong enough to deal with these consequences.

surrounding regions, such as accelerated migration, deforestation and unplanned urbanization.

In Mexico, EAs were done belatedly for 30 irrigation projects already designed and proposed for a joint World Bank-IDB loan. The EAs revealed the need for extensive mitigating measures. In six cases, these measures were so costly that the projects were abandoned. Had the EAs been conducted earlier, improved project designs might have allowed implementation of the abandoned projects.

In a still-evolving project, the EA of the Yacyretá dam project, on the border of Argentina and Paraguay, has shown the need for mitigating measures to establish nature reserves and management systems for local fish species and to reduce water-borne disease. An issue that has been raised, however, is the level to which the reservoir will be filled. By lowering the reservoir level from 83 to 76 meters, the number of additional people needing resettlement falls from 41,000 to about 7,000; it is likely that other environmental impacts could be reduced proportionately. However, energy production would be cut by one half which makes this solution highly uneconomic.

Analyzing Alternatives

When considering the options for improved environmental management, decisionmakers must consider the trade-offs, if any, between the economic and environmental impacts of alternative projects and policies. The best way is to compare the benefits and costs of different measures and choose the one with the largest net social benefit. In the past, environmental costs and benefits were often ignored. It is essential to include both in all benefit-cost analyses from now on.

Although the costs of preventive measures, such as wastewater treatment or alternative project designs, are fairly easy to estimate, placing a monetary value on the benefits from environmental improvements is more difficult. It is often difficult to place monetary values on factors such as human lives, or the value of an endangered species. But recent advances in valuation techniques mean that a wider array of

environmental benefits can now be valued. For example, contingent valuation methods (CVM) can be employed, which rely on direct questioning of individuals to estimate values. These methods provide a way of eliciting the affected people's preferences in the absence of markets.

In a proposed World Bank assisted project to tackle water pollution in São Paulo, beneficiaries were asked what they would be willing to pay for a variety of environmental services such as drainage, sewerage, the creation of a new park, and general environmental protection. Survey results revealed that people were willing to pay most for urban sewerage, three times as much as for the next most important priority—the creation of a park. This is a useful guide for setting priorities.

World Bank studies have confirmed the general view that soil erosion is a major problem in the region, even when only the on-farm productivity losses are considered. But their benefit-cost analyses have shown that many large soil conservation projects and approaches are not worthwhile for the farmers. In countries as diverse as Haiti, Mexico and Brazil, conventional programs to combat erosion have emphasized the construction of terraces and other structures, often carried out as top-down public works programs with additional employment objectives. In country after country, farmers have failed to maintain these works, suggesting that the programs do not yield the on-farm benefits claimed for them. In Haiti, the Bank used benefit-cost analysis to analyze the USAID-funded Maissade Watershed Management Project. The study ranked different conservation techniques and confirmed that only the simplest ones, such as contour ploughing and vegetative barriers, are economic and that these are the only ones farmers will use. Terraces and structures that required large labor inputs produced low returns and were not adopted.

Similar conclusions flow from other benefit-cost studies in Central America and Mexico. The resulting modern approach to soil conservation relies first on increased soil cover, mainly through improved crop vigor, increased cropping intensity, or mulching; second, on alternative cultivation techniques such as contour ploughing, reduced tillage or direct seeding; third, on low-cost vegetative contours; and only as a

final resort does it rely on structural barriers or realignment of rural roads. However, programs based on this approach require a thorough understanding of local agriculture and shared knowledge between farmers and technicians. Two projects supported by the World Bank in Brazil are based on microcatchments, using community initiatives to identify benefits and costs at the local level. The successful World Neighbors' network in Central America similarly relies on strong community involvement.

Seeking Cost-effective Interventions

In many cases it may be very difficult to place a monetary value on an environmental benefit, such as saving lives or protecting biodiversity, and in such cases a traditional benefit-cost analysis may not be the best option. Instead, a cost-effectiveness analysis (CEA) can be used to find the least-cost means of obtaining a chosen level of environmental quality, whether it be hectares of rainforest preserved or improved life expectancy. An increasing number of World Bank projects include this type of analysis.

Two examples of CEA are found in Colombia. The public power utility is using an innovative approach to include environmental costs in its effort to identify the least-cost options for generating electricity. Since a benefit-cost analysis of alternative hydroelectric sites is not possible, due to problems in valuing environmental impacts, the power utility created an index, ranking each project on the basis of many environmental indicators (e.g., forest area flooded, people resettled, water quality, and sedimentation rates). This qualitative assessment of environmental impacts is combined with conventional cost information to eliminate those alternatives with high combined environmental and conventional costs.

Similarly, in the proposed World Bank funded Bogotá Pollution Abatement and Sanitation project, CEA led to the selection of a much cheaper and more effective solution to water pollution than did the original proposal (box 7). In Mexico, the proposed transport air quality management project used CEA to estimate the cost of different mea-

Box 7. Getting More Out of Less in Bogotá

The 6 million people of Bogotá face a serious water pollution problem. They partly depend on the Bogotá River, which flows through the city, for drinking water. But this river is also a disposal site for untreated sewage and industrial and toxic wastes. The river has become the most polluted in Colombia; it spreads disease, contaminates the crops that it irrigates, and damages sensitive wetlands. To correct this, the city first considered treating all sewage going into the river. This would have cost around \$1.5 billion and would not have solved the problems of industrial and toxic waste or agricultural run-off. Nor could the city have afforded such a huge investment.

The Colombian and Bogotá authorities looked at the cost-effectiveness of other options, in consultation with the World Bank. Since their main concern was to protect the city's population from contaminated water, they came up with an alternative scheme using underground pipes to intercept wastes before they entered the river and to carry these to a dumping point 30 kilometers downstream. This form of interception would divert all kinds of waste — sewage, industrial and other toxic effluents — away from populated zones, greatly improving the quality of drinking water. It would also divert waste far away from irrigation canals near the city, thus benefiting local agriculture. There will be no reduction in the waste at the new dumping point 30 kilometers downstream, but this region is thinly populated; waterfalls help aerate and purify the water; and the Bogota River then enters the huge Magdalena River which has a flow 50 times larger, thus diluting pollutants further. Nevertheless, this constitutes an incomplete solution which will need improvements in the future; decisions on the level and location of treatment must be based on an assessment of expected benefits and costs.

The interceptor option selected forms a major part of the Bogotá River Pollution Abatement Project being prepared by the Bank. Other parts of the project include rehabilitating the existing water supply and sewerage infrastructure, and strengthening the institutions in charge of water supplies. Implementing this strategy will eventually cost \$560 million, which is a fraction of the original proposal. It will also permit the treatment of sewage and other wastes — before being discharged into the river — to take place at a later date.

sures (such as gas retrofits, emission standards for different sorts of vehicles, and fuel taxes) to reduce air pollutants by one ton (box 4). This helped suggest an efficient sequencing of air pollution control mea-

sures. Cost-effectiveness was also used to set priorities in wastewater treatment in Mexico.

The region's needs for better environmental data, expanded EAs, and more complete analyses are enormous. Skilled analytic and scientific personnel are in short supply. Many World Bank loans are helping to meet these needs by supporting improved data collection, analysis, training on environmental assessment procedures, and expanded economic analysis for environmental issues.

4. Strengthening Institutional Capacity

Environmental matters have only recently moved to the front of the policy agenda in the region and appropriate institutions are only now being created. An informal survey of World Bank staff who have considerable knowledge of the capabilities of the environmental institutions in the region showed that much remains to be done. Although 30 percent of the 26 countries were felt to have adequate general environmental legislation, and another 50 percent were preparing legislation, only two countries were deemed to have adequate sector-specific regulations. A lack of specific regulations was compounded by generally weak, or inadequate, enforcement capacity and poorly developed policymaking institutions, although over half the countries are developing such institutions. The large number of countries that are preparing laws, regulations and policy frameworks indicate the importance now placed on environmental matters and the rapid pace of change. These changes will not come easily, however, but a number of countries have made promising starts, often with World Bank assistance.

Improved environmental policies often take away the right to pollute or use natural resources from people who are often wealthy or politically powerful. Political will is necessary to combat such interests and can be generated only if public awareness of environmental issues grows and forces changes in the political process. The participation of local communities in projects, the growing influence of NGOs, and the spread of democracy are all important forces for change.

Experience in the region, and elsewhere, suggests that institutions need to be strengthened at several levels. Enacting adequate laws and building strong national institutions is important, but it is just as important to strengthen line agencies that implement policies as well as regional institutions and municipalities. Decentralization of many functions is vital also, and authority often needs to be transferred to the local level to make use of local knowledge. The participation of local committees and NGOs in project preparation and implementation is also essential as they are most familiar with the grassroots realities. In addition, private agents—farmers as well as businessmen—should be relied on more heavily, too. Finally, special arrangements are needed to protect the rights and way of life of Amerindians.

Strengthening Institutions

An essential first step is to enact laws and regulations that provide a framework for environmental protection. Mexico, for example, has the *Ley General del Equilibrio Ecologico y la Protección al Ambiente*, which establishes the broad policy framework. Less than one-third of the countries in the region, however, have adequate legislation, although most are enacting appropriate laws.

Despite establishing new environmental institutions in many countries, it is often necessary to build initially on existing institutional structures. It is usually desirable to separate regulation, including the setting of broad policies, from the implementation of those policies. In Chile, for example, the National Commission for the Environment (CONAMA) is taking the lead in developing the legal policy framework while relying on units in the sectoral ministries, such as mining and forestry, for the implementation of new policies.

Strengthening national institutions has proven to be a slow and difficult process. One of the first World Bank loans to strengthen such institutions, made to Brazil in 1990, has been delayed by fiscal and administrative problems in Brazil, which make it difficult to attract and retain staff and allocate counterpart funds. These problems also exist

in other countries.

Strong institutions require professional environmental managers who must be properly trained and enjoy job security even when governments change. In Bolivia, for example, changes in government used to result in wholesale changes in government staff, breaking continuity and ensuring a weak management structure. Now Bolivia is making major efforts to create a responsive civil service, and an Environmental Technical Assistance project funded by the World Bank will support this effort.

Adequate finance is a continuing problem. Because environmental agencies are new and politically weak, they tend to be underfunded or dependent on foreign resources. This creates uncertainty about long-term programs and, again, difficulty in retaining highly qualified staff. Mexico's official environmental agency—SEDUE—had its budget slashed in the second half of the 1980s, resulting in staff cuts and inadequate resources to meet its legislated responsibilities. Recent World Bank assistance to SEDUE, which is now being incorporated into a new ministry, has helped increase its core budget substantially. The Bank loan supports both national and state level activities, including EA training, regional studies, enhanced monitoring, improved laboratory facilities and economic studies of environmental issues. A separate grant from the Global Environment Facility is supporting improved management for a number of protected areas.

Discussions are at an advanced stage on similar loans to other countries, including Bolivia, Chile, and Ecuador. In Chile, the World Bank loan will support the collection of data and environmental assessment training at the national level as well as funds for environmental units in the mining, forestry, and industrial sectors.

Important though such international resources are, domestic resources must be allocated to meet both capital and recurrent costs. Public awareness and the creation of political will are needed to support stable and increased levels of budgetary support. Popular participation in projects can play an important role in increasing public awareness.

Decentralizing and Improving Popular Participation

Although there are certain tasks best handled at the national level—setting broad policy guidelines, for example, or determining norms and standards—it is usually more efficient to decentralize both decision-making, and monitoring and enforcement as much as possible. Decentralization will not happen without planning since it goes against the strong tendency to centralize responsibilities and resources at the national level. Decentralization and popular participation are closely linked. The advantage of decentralization is that it can tap local knowledge and energies. In reforesting Haiti, rapid advances were made only after tree selection and planting were done by farmers (box 8). In designing local irrigation in Mexico and farm credit in Chile, beneficiary participation yielded important improvements. The World Bank is supporting local participation in flood control and agricultural development in Ecuador, rural investment in Colombia, and poverty assistance in Chilean municipalities.

Popular participation serves several functions. It widens the debate over national priorities, serves as a useful check on inappropriate projects, and helps improve project design and implementation. Experience with tree-planting in Haiti and with land management in Rondônia show both the benefits of popular participation and the costs of ignoring it.

In fact, a good example of decentralization and popular participation is the new Rondônia Natural Resource Management project in Brazil. A state council, presided over by the governor, is responsible for the overall guidance of the project as well as the approval of annual budgets. The council includes the state planning secretariat, the implementing state and federal agencies, various local associations, and representatives of NGOs. The NGOs have formed an organization that has participated in project preparation and resolved a number of difficult issues, including the choice of land to be reserved for extractive activities by rubber tappers. Conflicting groups have an incentive to sort out their disputes so that projects go ahead and to make innovative suggestions on how to get the most out of local resources. The annual

Box 8. Greening Haiti

Haiti was once a green and heavily forested country. Today it is denuded, an environmental disaster. Forests have been cleared for cultivation and for making charcoal. Regulations to curb deforestation are non-existent or unenforced.

Many past attempts to rectify the damage have failed because they depended on a weak administration and did not have the appropriate incentives. Attempts to grow trees on government and common land failed because nobody had an incentive to protect the trees and everybody had an incentive to cut them. Starting in 1981, a new approach was tried, supported by the U.S. Agency for International Development. The main strategies of this approach are:

Use private agencies and NGOs. Tree planting on private farmland using NGOs as extension agents was encouraged. Local people were allowed to choose local fast-growing species and were directly involved in the project. By 1989, about 50 million tree seedlings had been distributed to more than 200,000 families, and tree survival rates of 45 percent were achieved. This far exceeded the original project targets.

In parallel, a project supported by the World Bank and other international agencies supported a new forestry service and the protection and management of the largest remaining forest reserve in Haiti. A recently approved second project extends these approaches and also uses NGOs for soil conservation and extension.

Reduce the demand for wood. It is not enough to grow more trees; excessive demand for wood needs to be curbed. Charcoal is underpriced since there are hardly any enforceable curbs on felling, and it is overused because charcoal-burning stoves are thermally inefficient. The new project, which is being financed by the World Bank, aims to popularize efficient charcoal stoves, to be manufactured and sold by private agencies and NGOs; these should cut consumption by 10 percent. In addition, research is being done to identify the best way of curbing free access to trees.

Independent Evaluation Committee includes members from the NGOs, and it will analyze the progress of the project. The very act of participation has now strengthened local NGOs, which have a much better feel for local issues than do international NGOs. This suggests that democracy and the empowerment of people are good for the environment.

However, efficient decentralization is not easy. Where national institutions are weak and lack people with skills, local institutions may be even weaker and need considerable upgrading. Besides, environmental regulations, which are designed to curb pollution or access to resources by people who may be powerful locally, may induce such powerful interests to evade laws or to exert more control over local institutions. Popular participation can diminish such problems. In any case, NGOs, farmers and other beneficiary groups need training and skill upgrading, and provisions for this are beginning to be made in areas such as Rondônia.

These lessons have led to changes in the way the World Bank develops and implements projects. Three examples—forestry projects, the resettlement of displaced people and Amerindian issues—illustrate the challenges and complexities of melding environmental, social, and economic concerns.

New Policies for Forestry

Many forestry projects have fared poorly in the past. A review of World Bank experience suggests that this was due mainly to inadequate policies that created perverse incentives and to weak institutional capacity. The on-going Mexico Forestry Development project highlights the need for institutional strengthening and coordination. It aims to improve the management of the temperate oak and pine forests in the Sierra Madre, which have been degraded by improper logging over the past 100 years, and has components to improve forest management and promote social development of the indigenous people. Although approved more than two years ago, disbursements are virtually at a standstill, awaiting completion of the comprehensive environmental information that is a prerequisite for disbursement.

The World Bank's recently published *Forest Sector Policy Paper* suggests that future strategy should not focus just on specific reforestation, forest management, and utilization projects but should help countries adopt appropriate policies and build a strong institutional framework for policy analysis, project design, and implementation. The Bank will

promote the participation of local people and the private sector in long-term forest management and will rely on environmentally-sound forestry conservation and development plans. It will call for social, economic and environmental assessments of the forests being considered for commercial utilization and will support the major conservation schemes to protect biodiversity and the livelihood of forest dwellers. Finally, under no circumstances will the World Bank Group finance logging in primary rainforests.

The World Bank is currently supporting studies and project preparation in Argentina, Colombia and Costa Rica, to prepare broad-based forestry projects with strong institutions and good policy frameworks.

Minimizing Human Dislocation

The process of development sometimes displaces people. The numbers may range from a handful, in the case of highway expansion, to thousands, in the case of dam construction. Governments and lending institutions must ensure that the economic and social condition of displaced persons is as good as or better than before they were moved. World Bank policy requires that resettlement details be worked out before any investments are made.

Large dams in the region have received worldwide attention because of their environmental and social impacts. These include the flooding of rainforests (in the Amazon), the loss of habitat for endangered species (in Brazil and Chile), and the flooding of white-water rapids (in Chile). How these issues affect project design and implementation in the specific case of the Yacyretá project is discussed in box 9. From the early 1970s onwards, up to 300,000 people affected by World Bank financed projects in Latin America have had to be moved. The largest resettlement efforts have been in Brazil.

Resettlement and other environmental problems can be handled properly. In Mexico, for example, the resettlement of people displaced by the Aguamilpa and Zimapán dams, about 1,000 and 2,500 people respectively, is going well. Resettled families are receiving a minimum of two hectares of irrigated land for each hectare lost as well as

replacement housing and infrastructure, which they did not have before, including electricity, potable water, schools, clinics, and com-

Box 9. Hard Choices in Yacyretá

The Yacyretá Project is already at an advanced stage of construction, with works about 80 percent completed. Nine thousand people have already been resettled, and fish passage facilities and navigation locks have begun operating. Because of relatively flat terrain, the Yacyretá Project has a low ratio of hydropower generated per land area flooded. The reservoir created by the dam causes the partial flooding of two large towns in an otherwise sparsely populated region.

Today, the only option to reduce flooding would be to lower the operating level of the reservoir. The original design calls for operation at 83 meters (above mean sea level). Lowering the operating level by seven meters would reduce the number of additional people that could be resettled from 41,000 to 7,000, cut the flooding area in half, and sharply reduce potential water quality problems.

However, this would also cut the energy production by one-half. A benefit-cost analysis showed that operating at full capacity is justified economically because the extra power can easily pay for all of the extra costs (over \$500 million) of infrastructure, relocation, resettlement, land acquisition, and environmental protection and mitigating measures. This option is also much more cost-effective than any alternative source of electricity, such as the Atucha II nuclear power plant, which is to be completed after Yacyretá's commissioning.

Current plans, therefore, call for a phased program in which the reservoir will operate at 76 meters initially, and the level will be gradually increased to 83 meters as revenues from the sale of electricity to Argentina permit the execution of the resettlement program.

This scheduling also allows for careful planning and implementation of the project's resettlement program, which at its completion will have involved the relocation of 50,000 people to new neighborhoods or to farmlands nearby. It also facilitates the implementation of an array of environmental mitigating measures, the most important of which are the setting aside of compensatory protected areas of about 800 square kilometers; providing potable water and sewerage systems for the two affected cities; cleaning up urban refuse dumps before flooding; monitoring and treating water-related diseases; building a barrage on the Arroyo Aguapey to avoid the flooding of about 400 square kilometers; saving cultural property; and protecting fish. The timing and amounts of water releases from the dam will take public health and other important environmental objectives into account.

munity meeting halls. In other places, resettlement has not gone as well. In Brazil the Itaparica Resettlement and Irrigation project is the World Bank's first stand-alone resettlement project, aiming to resettle 5,300 rural families and 2,800 urban families. Although urban resettlement appears to be progressing as planned, construction of the irrigation system for the displaced rural people is behind schedule because of serious institutional weaknesses and shortfalls in budget allocations. The irrigation system has a long gestation period, is costly, and may not have been the best rehabilitation option. In this case, final rehabilitation costs may reach \$80,000 per family.

Amerindians

Amerindian populations are found in almost all countries in Central and South America, and are threatened by the movement of settlers into their habitat. They are losing the hundreds of hectares per head they need for their livelihood as mixed hunter-gatherers and horticulturalists. Furthermore, they have little immunity to the diseases introduced by the settlers. The problem is particularly acute in the greater Amazon where roads, mines, and agriculture have opened areas that were traditionally inaccessible. The unique problems of Amerindian populations are the focus of a World Bank policy document. The policy requires all Bank projects that affect Amerindians to include an indigenous development plan to address specific Amerindian issues, including the protection of land rights. The countries of the region now recognize the need to create large indigenous areas and, with Bank support, are beginning to codify the legal rights of Amerindians to prevent others from usurping their traditional lands. Special social services are being introduced to counteract health or social problems arising from contact with settlers.

Brazil has a large and scattered Amerindian population and has increased its attention to Amerindian issues. It has altered its controversial POLONOROESTE program to regularize and demarcate 9.9 million hectares of Amerindian reserves and has done the same with another 3.2 million hectares in the Carajas region. Large areas have also

been demarcated in Bolivia, Colombia, Ecuador, Paraguay, and Peru. A recent World Bank review of these projects had three major findings. First, much progress has been made in securing Amerindian land rights. Second, the primary obstacles to successful land regularization have been an inadequate legal framework and institutional weaknesses, including poor preparation of Amerindian components in Bank projects. Third, land regularization must be linked through research, technical assistance and training programs to the promotion of sustainable development activities that build on indigenous knowledge and practices.

The three issues—forestry, resettlement and Amerindian issues—are particularly complicated and difficult. It is no accident that World Bank staff spend more than the usual amount of time and resources to design and supervise these projects. Although progress has been made, the remaining challenge is large. Continued attention to developing, understanding and institutionally strengthening both the countries and the Bank is, therefore, essential.

5. Global Issues and International Assistance

Most environmental problems arise within individual countries and have to be solved there. But some problems, such as acid rain and the pollution and sedimentation of international rivers, spill across borders. Other problems are global in their dimensions, affecting all countries. As discussed more fully in the *WDR 1992*, the four major global issues that have received the most international attention are: loss of biodiversity, global warming, pollution of international waters, and the emission of chlorofluorocarbons (CFCs).

Biodiversity is being lost through the extinction of species as their natural habitat shrinks as a consequence of logging, mining and the advancement of agriculture. The interest in biodiversity in Latin America is especially great because of the large areas of rainforest that remain but are under pressure.

The global climate may be changed in catastrophic ways by the accumulation in the atmosphere of gases that act as a heat trap. This so-

called greenhouse effect could lead to global climatic warming and an increase in the sea level, which could inundate large coastal areas. The main greenhouse gas is carbon dioxide, generated by burning carbon-rich fuels and clearing forests that otherwise lock up carbon in the form of wood. The OECD countries, because of the size of their economies have, of course, higher emissions of greenhouse gases than countries of the developing world.

International waters, marine life and coral reefs become polluted by oil spills, the dumping of wastes, and other undesirable activities.

The emission of CFCs is eroding the ozone layer in the upper atmosphere which blocks harmful ultra-violet rays from the sun. The continued erosion of the layer will mean increased ultra-violet radiation and hence an increase in skin cancer.

Priorities and Funding

While global issues are near the top of the agenda for some international NGOs, other issues such as access to clean water and air are often considered more important by national governments. Given the budget constraints of most governments of the Latin America and Caribbean region, there are simply no resources for conservation projects that have more global than local significance. It is more appropriate for national issues to be financed by local resources and for global issues to be financed mainly, but not exclusively, through international support. However, in many cases, projects that tackle local environmental problems also have a significant effect on global issues. By improving their energy efficiency, for example, countries of the region will reduce emissions of greenhouse gas, thereby improving both the local economy and the global environment.

The Global Environment Facility (GEF) is a three-year experiment that provides grants for projects dealing with the four key global issues identified above. Set up in 1991, the GEF receives funds from three sources. First is a core fund of \$800 million pledged by 24 countries (nine of them in the developing world). Second are several concessional cofinancing arrangements totaling \$300 million. Third, around \$200

million is also available from the Interim Trust Fund of the Montreal Protocol on phasing out CFCs. The United Nations Development Programme provides technical assistance for the GEF and implements some of its projects; the United Nations Environment Programme provides the secretariat and other expertise; and the World Bank is responsible for overall administration and project implementation. (Annex table 3 lists GEF projects being implemented in the region with World Bank staff support.)

Another new experiment is the Pilot Program to Conserve the Brazilian Rainforest, set up with financing from the seven richest industrialized countries (G-7). This fund will have about \$250 million to finance conservation projects and special studies in the Amazon basin, including demarcation of indigenous reserves and demonstration projects of grassroots organizations to provide sustainable development. For example, most countries of the region are increasing the number of natural protected areas, national parks, and indigenous areas, using both national and international financial resources. Brazil, the country with the greatest level of biodiversity in the world, established 123 conservation areas in 1989 but lacked sufficient legal protection against encroachment or the funds to police the protected areas. The GEF is now proposing to fund 50 of these high-priority areas and aims to convert them into model conservation units.

Another new approach is to exchange foreign debt for improved local resource management. The first debt-for-nature swap took place in 1987, when \$650,000 of Bolivian debt was written-off and diverted to finance the management and protection of the Beni Biological Reserve and Chimanés Forest Reserve. Bolivia is a country of unusually high biodiversity, with 18,000 plant species and over 1,200 bird species. Forests and grasslands in neighboring countries have been greatly reduced, thus increasing the importance of biodiversity in Bolivia.

Permitting unsustainable farming in fragile soils in humid rainforests is poor economic policy. Conserving such areas automatically conserves biodiversity, too, and reduces the greenhouse effect by keeping carbon locked up in forests. It also helps protect the culture and way of life of Amerindians in the forest, and stems soil erosion and river

sedimentation. Zoning regulations and economic incentives that keep settlers off ecologically sensitive areas help the local economy, the local environment and the global environment simultaneously. Because settlers will lose in the short-run, even though they will be better off in the long-run, incentives or other short-term measures are needed to implement these policies.

The blue, sparkling waters of the Caribbean have made tourism the economic mainstay of many islands. But the solid waste generated by local populations and by tourists threatens the very beaches and waters that tourism thrives on. Box 10 outlines a project that the GEF is helping to finance that will help stem this pollution. It will also help to develop tourism.

National parks that contain endangered species have considerable potential for "ecotourism," which has long been neglected. Ecotourism helps provide income opportunities for local people, gives them a stake in ensuring the survival of fragile areas, and raises revenue, thus providing badly-needed finance for conservation. However, poorly managed ecotourism can endanger natural wonders as well. An example concerns the world famous Galapagos National Park in Ecuador. In terms of species diversity, the inner seas of the Galapagos islands constitute the world's second biggest marine reserve. Tourism has encouraged an influx of immigrants into the Galapagos Islands, and the local population is growing at an unsustainable 8.5 percent annually. The consequent pollution threatens the ecosystem. The greater the number of people entering the park, the higher is the danger they will accidentally bring in organisms that damage the fragile ecosystem. Institutions for conserving the area are weak. Tourist fees are well below what the market will bear, and only 20 percent of such revenue is retained for the operation and maintenance of the park.

The GEF is now funding a project to help the Galapagos National Park plus six others in Ecuador that are regarded by experts as "parks in peril." The project will help strengthen institutions, delimit sensitive areas, train conservationists and tour operators, and design a new system for collecting fees and controlling the influx of tourists and immigrants. The new system will be designed to maximize revenue

Box 10. Regional Cooperation for Cleaner Caribbean Waters

Tourism is the lifeblood of the small islands constituting the Organization of Eastern Caribbean States (OECS). Cruise ships carry vacationers from island to island in the course of their week-long cruises. The island stops are brief, allowing for the loading of supplies and the removal of garbage, and giving passengers a day in port. Although the passengers leave behind some money, they also leave behind large quantities of waste, which, along with locally generated waste, now threatens both the land and sea environment.

The inadequate public infrastructure of the small island nations is not equipped to handle domestic and ship-borne wastes properly. The appropriate policy response would be to raise port fees for ships, thus raising enough money to handle wastes. But each country is afraid that if it increases its fees unilaterally, cruise ships will switch to other islands with lower fees. Clearly, joint action is needed, without which the problem will get worse and the beaches and clear waters will suffer.

The OECS nations, working with the World Bank, have developed a Regional Environmental Project to tackle both ship-borne and local wastes. The total project could cost as much as \$60 million, of which about one-third will be sought from the Global Environment Facility under its protection-of-international-waters component. A similar project is being developed for the wider Caribbean, which focuses on wastes from ships. Since the costs of cleaning up are being assisted by the world community, these island nations do not have to fear losing their competitive advantage to other ports. The islands, oceans and tourists will all emerge as winners.

from a safe tourist volume that will not threaten the environment and will ensure that enough of these fees are retained for conservation and maintenance.

Other ways also need to be found of using wildlife resources to generate income and revenue. A World Bank assisted project for national parks in Mexico will help build nesting shelters for endangered turtles and examine whether commercial turtle breeding is feasible.

While most of the GEF funding is used to protect biodiversity, the

GEF is also funding the development of technologies that will curb the demand for fossil fuels. One project in Brazil will establish facilities for biomass gasification and power production from sugarcane waste and woodchips. The use of sugarcane waste to generate electricity is already well established in Hawaii. This could reduce the use of fossil fuels in other cane-growing countries of the region. Another GEF project under preparation in Mexico proposes the mass replacement of standard incandescent bulbs with power-saving fluorescent ones. In Jamaica, GEF support is also proposed for an energy-efficiency demonstration project.

More Data and Studies Are Needed

Current knowledge of the extent of and dangers to biodiversity is limited and needs enhancement. The same is true of our knowledge of global warming and depletion of the ozone layer. Several conservation projects, including those funded by the GEF and proposed by the G-7, have components for the collection of baseline data to monitor how the environmental situation is evolving and for research to help establish the most effective forms of intervention.

Improved knowledge is vital for getting priorities right and diverting scarce funds from low-priority to high-priority projects. Improved data and analysis have enabled Bolivia to switch resources from areas of lesser biodiversity to the most biodiverse and fragile ones. Studies have revealed that the Alto Madidi and El Chaco regions of Bolivia have extraordinary biodiversity, and these will now be designated protected areas. In Ecuador, too, a close look has led to the inclusion of several important but neglected areas in the GEF conservation project. For example, few administrators or tour operators knew about the tremendous diversity of fish species in the Yasumi region in Ecuador, or that the Cotachi-Cayapas reserve, also in Ecuador, has 40-60 percent of plant species endemic, making it one of the most important areas for biodiversity in the world. The GEF is funding studies in the six national parks of Ecuador to find the best ways to harmonize conservation with

the interests of small farmers and Amerindians, and with tourism. Similar studies are being funded by the GEF along the Patagonian coast in Argentina. This area has a unique ecosystem boasting the world's largest population of Patagonian sea lions, the only growing population of southern elephant seals, the largest population of endangered right whales, and Magellanic penguins. This ecosystem is in danger because it borders on one of the finest and fastest-growing fishing zones in the world. In consequence, the population in coastal towns is doubling every few years; Puerto Madryn, for instance, has grown from 9,000 to 46,000 inhabitants in 20 years. These towns are polluting the seas with untreated sewage, and coastal oil wells are aggravating the damage. Meanwhile, tourists flock to see the spectacular breeding grounds of elephant seals and sea lions and to catch a glimpse of endangered right whales and killer whales. The new GEF studies will help design policies and institutions that enable fishing, mineral extraction, and ecotourism to take place in harmony with environmental conservation. Without urgent action on this front, ecological damage could be enormous.

The longest barrier reef in the western hemisphere lies along the eastern coast of Belize and Mexico. In Belize it forms a complex of coastal lagoons, extensive seagrass beds, over 400 sand and mangrove cays, and three coral atolls. The reef is essential for the survival of a host of local fish and plant species, endangered animals such as manatees and marine turtles, and several bird and crocodile species. It is one of the most biodiverse marine systems in the world and attracts many immigrants and tourists, who now endanger the ecosystem. Mangrove forests are disappearing, reefs are suffering damage by divers, fragile cays are suffering from the dumping of wastes, and fishing has exceeded sustainable limits. The GEF is funding a project to increase understanding of the ecosystems of the Belize reef and suggest the best ways to protect it; investigate the pharmaceutical potential of its many species; help zone the reef so that economic development can take place without killing the ecosystem; and promote participation by local communities in future development to forge a consensus on sustainable activities.

Problems and Prospects for Global Cooperation

Troublesome issues can come up when the volume of foreign assistance for environmental projects is much larger than local funding. When the execution of such projects is entrusted to foreign NGOs who command more resources than the country's own officials, questions arise about priorities, sovereignty and accountability. Some developing countries resent being told what to do to solve problems such as global warming that have been caused largely by the huge energy consumption of OECD countries. They prefer to use their scarce public funds to address pressing domestic environmental issues.

There are no easy answers to such questions, although there are some general principles regarding global aid. First, financing for solving local problems must generally come from national sources. Solving local problems, such as increasing energy efficiency, will also contribute to solving global problems, such as the greenhouse effect. But in some cases—biodiversity being a case in point—a large part of the benefits of developing country actions will go to the developed countries, which therefore should be expected to contribute financially to their solution. Such financing for global issues needs to be viewed as a transfer from developed countries for the export of global services provided by the developing countries. This implies that such financing should come as grants or highly concessional loans, as in the case of the GEF. It should not be confused with economic aid and should thus constitute extra money separate from the budgetary accounts of donor countries.

Second, the financing needs in terms of global environmental concerns are enormous. Donors have tended to finance projects here and there rather than commit themselves to long-term programs, nor have they paid attention to the maintenance needs of conservation projects. Since the cost of conservation is perennial, financial support must be perennial, too. This calls for a new strategy on the part of donors. They must work out and implement long-term plans, which would provide financing on a continuing basis for programs that include maintenance, and they

must also improve aid coordination among themselves to reduce duplication and waste. This would make better use of funds, which may never be enough to cope fully with the immensity of the challenge in any case.

Finally, the developed countries must do more to reduce threats to the global environment that result from their own prodigious use of energy. They need to encourage the invention and use of new technologies that conserve energy and look for viable ways to replace fossil fuels with renewable energy, such as solar energy. They need to develop cheaper and more efficient forms of pollution control. The development of economic substitutes for the CFCs used in aerosol cans (banned in 1977) shows that a cleaner world need not cost more money, but certainly needs more well-directed effort.

Annex.

**World Bank Funded Projects
with Environmental Components ,
and GEF Funded Projects**

The World Bank finances a wide range of development projects, often with significant environmental components. The three tables in this Annex show World Bank projects in the region that are either totally devoted to environmental issues or have environmental components within them. Also included are GEF-funded projects and programs being carried out under the Montreal Protocol.

A 1989 World Bank policy document on environmental assessment delineates four categories of projects for the purposes of environmental assessment (EA). Not all projects need an EA. They are most commonly required for major infrastructure projects such as dams, roads, or ports. Such projects are generally classified as A projects and require a full EA. Category B projects, which include projects with significant on-lending components or small-scale agricultural development projects, have some environmental impact, and although a full EA is not required, some environmental analysis is. Category C projects include many education, health, or research sector projects and require neither an EA nor environmental analysis. A fourth category (D) was initially established for environmental projects. In the 1991 revision of the Bank's EA policy, this category was abolished and environmental projects are now classified according to one of the three other categories.

Annex table 1. World Bank Financed Projects with Environmental

| <i>Country</i> | <i>Project name</i> | <i>Environmental assessment category</i> |
|----------------|---|--|
| Argentina | Agricultural Services and Institutional Development Project | C |
| Argentina | Hydrocarbon Sector Engineering Loan | B |
| Argentina | Water Supply and Sewerage Sector Project | B |
| Bolivia | Eastern Lowlands: Natural Resource Management and Agricultural Production Project | D |
| Bolivia | Major Cities Water and Sewerage Rehabilitation Project | B |
| Brazil | Electricity Transmission and Conservation Project | B |
| Brazil | Itaparica Resettlement and Irrigation Project, Supplemental Loan | D |
| Brazil | National Environment Project | D |
| Brazil | National Irrigation Program: Northeast Irrigation I Project | C |
| Brazil | Rondônia Natural Resource Management Project | D |
| Brazil | São Paulo Metropolitan Transport Decentralization Project | B |
| Brazil | Water Sector Modernization Project | B |
| Chile | Second Valparaiso Water and Sewerage Project | B |
| Chile | Transport Infrastructure Project | B |
| Colombia | Industrial Restructuring and Development Project | B |
| Colombia | Rural Development Investment Program | B |
| Colombia | Third National Roads Project | B |
| Costa Rica | Agricultural Sector Investment and Institutional Development Project | B |
| Ecuador | Lower Guyas Flood Control Project | A |
| Ecuador | Rural Development Project | B |
| Haiti | Forestry and Environmental Protection Project | D |

*Components Approved during 1990-92 **

| Total project costs (\$ million) | Value of environmental component (\$ million) | Environmental aspects covered under project (value of World Bank loan, \$ million) |
|----------------------------------|---|---|
| 82.7 | 9.5 | Fisheries resource evaluation; fisheries institutional development (33.0) |
| 40.1 | 0.8 | Environmental studies (28.0) |
| 141.3 | 16.8 | Institutional development; studies (70.6) |
| 54.6 | 8.0 | Natural resource planning and management; research; support to indigenous people (35.0) |
| 57.0 | 1.3 | National component for institutional development (35.0) |
| 3,851.9 | 4.2 | Energy conservation studies (385.0) |
| 649.7 | 649.7 | All project costs are resettlement costs associated with construction of Itaparica dam, but include infrastructure and agricultural development (100.0) |
| 166.4 | 146.3 | Institutional development; ecosystem protection (117.0) |
| 465.0 | 1.4 | Environmental protection measures (210.0) |
| 228.9 | 57.3 | Zoning; extractive reserves; Amerindians; institutional strengthening (167.0) |
| 281.0 | .. | No specific environmental component, but project report estimates environmental impact of project in terms of environmental costs avoided (125.6) |
| 500.0 | 8.0 | Institutional strengthening (250.0) |
| 141.5 | 44.8 | Infrastructure for pollution control; institutional improvements (50.0) |
| 134.8 | 1.1 | Monitoring and control; standards (71.0) |
| 500.0 | 2.0 | Environmental pollution control (200.0) |
| 100.0 | 13.2 | Watershed management and environmental protection; training and community organization; institutional strengthening (30.0) |
| 414.0 | 6.0 | Road safety (266.0) |
| 70.0 | 27.2 | Institutional development; land titling (41.0) |
| 97.5 | 3.6 | Institutional strengthening; studies (59.0) |
| 112.7 | 0.9 | Institutional development (84.0) |
| 29.0 | 29.0 | Total project costs (26.1) |

Annex table 1 (con't)

| <i>Country</i> | <i>Project name</i> | <i>Environmental assessment category</i> |
|-----------------------|---|--|
| Honduras | Energy Sector Adjustment Program | B |
| Jamaica | Agricultural Sector Adjustment Loan | C |
| Mexico | Agricultural Technology Project | C |
| Mexico | Decentralization and Regional Development Project for the Disadvantaged States | B |
| Mexico | Environmental Project | C |
| Mexico | Irrigation and Drainage Sector Project | B |
| Mexico | Mining Sector Restructuring Project | B |
| Mexico | Transmission and Distribution Project | C |
| Mexico | Water Supply and Sanitation Sector Project | D |
| Paraguay | Land Use Rationalization Project | C |
| Saint Kitts and Nevis | Agricultural Development Support Project | .. |
| Saint Lucia | Water Supply Project | .. |
| Trinidad and Tobago | Business Expansion and Industrial Restructuring Project | B |
| Venezuela | Agricultural Sector Investment Project | B |
| TOTAL | | |

a. The Inter-American Development Bank participates in some of these loans by providing co-finance or funding pilot projects.

.. = Not available.

| Total project costs (\$ million) | Value of environmental component (\$ million) | Environmental aspects covered under project (value of World Bank loan, \$ million) |
|----------------------------------|---|--|
| 310.6 | 0.1 | Environmental protection regulations (50.6) |
| 55.0 | 0.1 | Pesticide use study (25.0) |
| 300.0 | 11.7 | Institutional development (150.0) |
| 1,362.7 | 61.1 | Environment and cultural patrimony; Action Plan for Selva Lacandona; institutional development (350.0) |
| 126.6 | 126.6 | Protected areas program; Air and water pollution control; institutional development; regulatory framework (50.0) |
| 1,245.0 | 49.0 | Measures for mitigation of pollution; institutional development; studies (400.0) |
| 436.5 | 0.4 | Training (200) |
| 7,127.4 | 3.0 | Studies (450.0) |
| 650.9 | 29.0 | Studies; pilot pollution control (300.0) |
| 41.1 | 41.1 | Total project costs (29.0) |
| 4.3 | 0.9 | Land cadastre; institutional development (1.5) |
| 40.5 | 2.0 | Environmental programs; land purchase (7.7) |
| 49.5 | 0.7 | Institutional development; pollution standards (27.0) |
| 900.0 | 88.2 | Land cadastre; institutional strengthening (300.0) |
| 20,768.2 | 1,445.0 | |

Annex table 2. Projects with Environmental Components in Preparation

| <i>Country</i> | <i>Project name</i> | <i>Main focus</i> |
|----------------|---|-------------------------------|
| Bolivia | Environmental Technical Assistance | Technical assistance |
| Bolivia | Power/Gas Pipeline | Investment project |
| Brazil | Environmental Conservation and Rehabilitation | Investment project |
| Brazil | Mato Grosso Natural Resource Management | Natural resource management |
| Brazil | National Industrial Pollution Control | Pollution control investments |
| Brazil | Water Quality and Pollution Control (Paraná and São Paulo) | Pollution control |
| Brazil | Water Quality and Pollution Control (Minas Gerais) | Pollution control |
| Chile | Environmental Institutions Development | Institutional development |
| Chile | Irrigation Development | Rehabilitation & development |
| Chile | Small Farmer Services | Technology development |
| Colombia | Bogotá Pollution Abatement and Sanitation | Pollution control |
| Colombia | Forestry and Environmental Protection | Investments |
| Ecuador | Environmental Technical Assistance | Technical assistance |
| Honduras | Agricultural Sector Loan | Sector reform |
| Mexico | Mexico City Transport Air Quality Management | Pollution reform |
| Venezuela | Low-income Barrios Improvement | Infrastructure |

a. The Inter-American Development Bank participates in some of these loans by providing co-finance or funding pilot projects

tbd: To be decided

*Proposed for World Bank Funding **

| <i>Environmental assessment category</i> | <i>Environmental aspects covered under project</i> |
|--|---|
| C | Institutional development. |
| A | Institutional development; studies; infrastructure |
| B | Pollution control; reforestation; studies |
| B | Forestry conservation; zoning and land tenure; institutional development |
| D | Pollution control equipment; technical assistance |
| A | Institutional development; studies; infrastructure |
| A | Institutional development; studies; infrastructure |
| C | Institutional development |
| A | Institutional development; water rights |
| B | Land titling; institutional development |
| A | Infrastructure; institutional development |
| tbd | Watershed protection; biodiversity; reforestation |
| C | Institutional development |
| B | Land tenure. |
| C | Institutional development; studies; technical assistance |
| B | Institutional development; studies. |

*Annex table 3. Global Environment Facility^a and Montreal Protocol Projects**Global Environment Facility Projects Implemented by the World Bank*

| <i>Country</i> | <i>Project name</i> | <i>Type of project^b</i> |
|-----------------------------------|---|------------------------------------|
| <i>Projects approved</i> | | |
| Brazil | National Conservation Units | BIO |
| Mexico | Biodiversity Conservation | BIO |
| Mexico | Ozone Pilot Recycling Project | GW |
| Peru | Trust Fund for Conservation Units | BIO |
| <i>Projects under preparation</i> | | |
| Bolivia | Biodiversity Conservation Project | BIO |
| Ecuador [funded] | ENDESA/BOTROSA Afforestation Project | GW |
| Ecuador | Biodiversity Protection | BIO |
| Mexico | High Efficiency Lighting Pilot Project | GW |
| Mexico | Ozone Protection Policy | GW |
| <i>Projects in the pipeline</i> | | |
| Brazil | Biomass Gasification and Gas Turbine Power Generation | GW |
| Jamaica | Demand-Side Management | GW |
| Paraguay | Biodiversity Protection | BIO |
| Caribbean Basin | OECS | IW |
| Caribbean Basin | Wider Caribbean Ports Waste Disposal | IW |

Montreal Protocol Projects

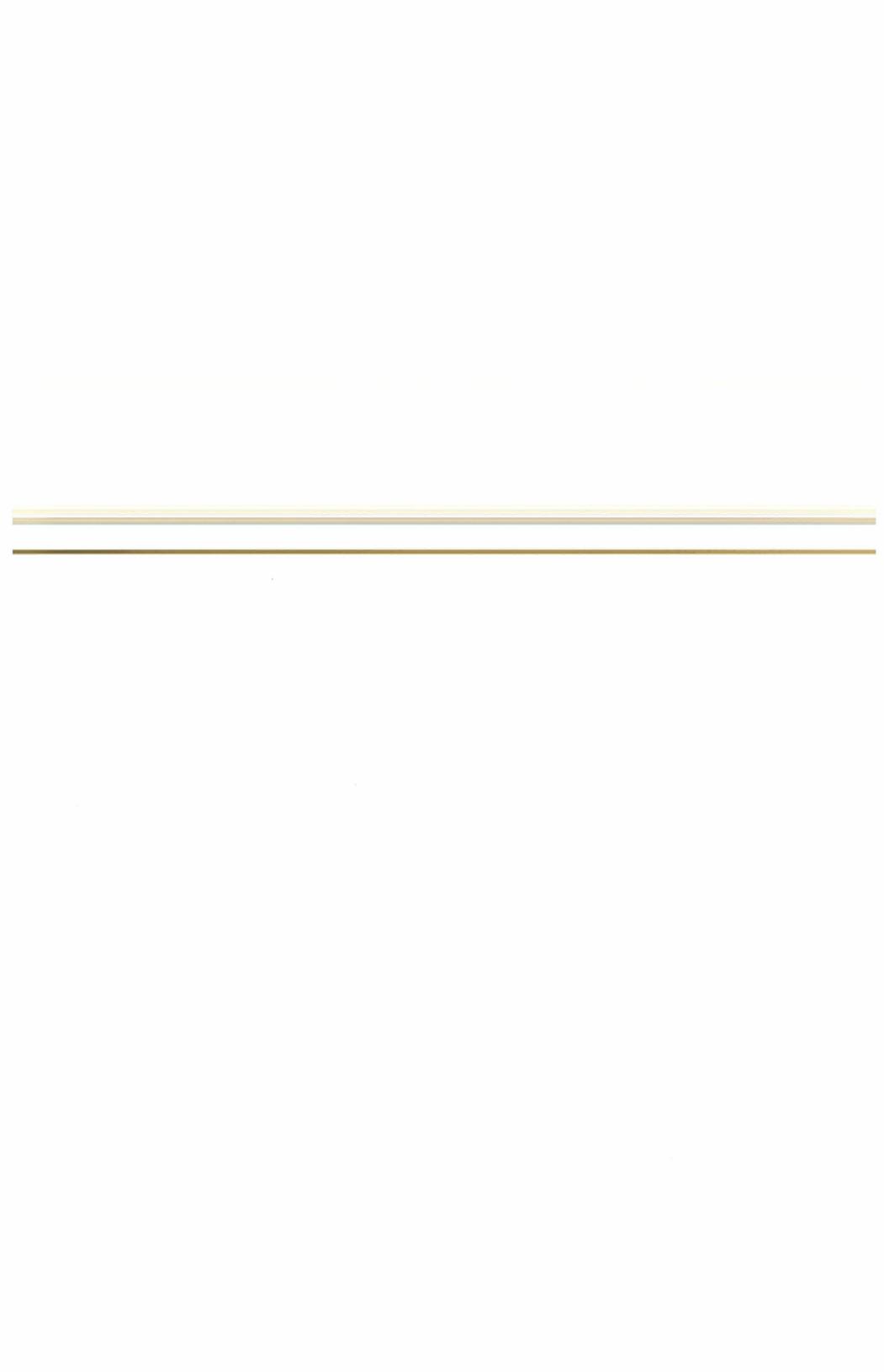
| <i>Country of operation</i> | <i>Project size (\$ million)</i> |
|-----------------------------|----------------------------------|
| Brazil | 15 |
| Chile | 1 |
| Ecuador | 4 |
| Mexico | 4 |
| Venezuela | 10 |

a. The UN Development Program is also implementing a number of GEF projects, which are not included here.

| <i>Total project costs (\$ million)</i> | <i>Financed by GEF (\$ million)</i> | <i>Associated World Bank project</i> |
|---|---|---|
| 30.0 | 30.0 | National Environment Project |
| 30.0 | 30.0 | Mexico Environment Project |
| 0.2 | 0.2 | Free-standing |
| 8.5 | 4.0 | Free-standing |
| <hr/> | | |
| 12.0 | 4.5 | Environmental Technical Assistance Project |
| 12.0 | 2.0 | ENDESA/BOTROSA Aforestation Project [IFC] |
| <hr/> | | |
| 12.0 | 4.5 | Technical Assistance for Environmental Management |
| 10.0 | 10.0 | Power Sector Loan |
| .. | 4.0 | Free-standing |
| <hr/> | | |
| 70.0 | 23.0 | To be determined |
| .. | 3.8 | Free-standing |
| 2.0 | 2.0 | Free-standing |
| 26.6 | 19.5 | Infrastructure project |
| 5.0 | 5.0 | Free-standing |

b. Projects are classified according to three main areas: biodiversity (BIO), global warming (GW), and international waters (IW).

.. = Not available.



4

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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