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Environment, Development, and International Assistance: Crucial Linkages

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Conventionally, the challenge of development has been defined in terms of improving the material conditions of the world's poorer countries. Concepts of development have changed over the past four decades, as have ideas on appropriate strategies, instruments, and expected outcomes. Theories of economic development and theories of political development evolved concurrently, altering and refining concepts of economic change and the views about institutional requisites and organizational imperatives.

Introduction

In the immediate postwar years, the challenge of development was regarded as contingent on foreign aid and assistance. Development, it was recognized, could not take place without financial, material, technical, and other forms of assistance from the more developed economies. In this process the United States took a leading role in helping to design and deliver postwar development strategies. Eventually, other industrial countries moved into the development field and gradually began to mount ambitious aid programs that were delivered by both public and private agencies.

Initially, progress on economic development was measured in terms of increased output (gross domestic product [GDP] and gross national product [GNP]) or increased trade (imports and exports), among others. Distributional concerns gradually emerged, and per capita indicators were thought to provide a better view of material progress. At the same time, efforts to develop institutional capabilities to buttress economic development led to a concerted search for appropriate organizational responses. Throughout the entire postwar period, a material view of welfare and development shaped public policy and economic strategy in developing countries. Assistance efforts by the international community, coupled with a commitment to economic growth and development in the assisted countries, resulted in significant improvements in human conditions. These improvements are reflected in measures of total output, distribution, health, education, and social welfare. But both the level and the rates of improvements were very uneven among the developing countries.

Environment and Development

Economic growth combined with successful strategies for reducing mortality generated a dual challenge, the implications of which are not yet fully understood.

On the one hand, economic development in any form or guise means encroachment on the natural environment and, in all likelihood, environmental degradation. The close positive correlation between GNP per capita and carbon emission per capita carries a compelling message: the higher the level of economic growth, the greater the extent of environmental degradation.

On the other hand, the absence of economic growth—the persistence of poverty—also generates serious environmental degradation. Marginal existence drawing against life-supporting properties creates more marginality and further stress on the support properties. Desertification, deforestation, and polluted water supply, not to mention increasing rates of carbon emission due to human action, are all part of the process of environmental degradation. If there is a simple characterization of this problem, it is that the rich pollute and degrade the environment in some ways and the poor do so in

others. Both affluence and poverty take their toll on natural environments, on local ecosystems and, it is now believed, on the global environment as well.

Defining the Problem

Increasingly, national and international agencies have begun to appreciate the fundamental environmental consequences of growth. The nature of the problem and plausible solutions are beginning to emerge. In 1987 the World Commission on Development and Environment set forth a new development strategy based on the notion of sustainable development. This strategy was presented in three parts: conception, objective, and suggested action. The strategy of sustainable development intends to integrate development and environment, to incorporate environmental factors in development projects and processes, and to respect material improvement and environmental viability.

This new concept of a broad development strategy poses difficulties for program formulation and project development, in part because it challenges conventional national accounting procedures for both national and international transactions. The conceptual foundations of the postwar accounting schemes are now being called into question. This means new foundations must be developed for accounting procedures that accurately represent the environmental dimensions of investment, consumption, demand, and trade. And this process is still in its early stages.

International Assistance

Both the substance and strategy of foreign aid are inevitably affected by prevailing development patterns at any point in time. As a leading donor worldwide, the United States is confronted with new international pressures shaped by the concern for identifying and supporting development strategies that do not threaten environmental balances. The need for innovations in aid-delivery systems, in technical assistance, and in managing every aspect of built social environments strains the more traditional forms of development assistance.

Environmental issues aside, it seems clear that foreign aid will continue to be an important instrument of U.S. foreign policy. Philanthropic and humanitarian considerations have always played a major role in shaping aid delivery programs, particularly relief efforts that follow wars and natural disasters. However, statistics show that foreign policy priorities dictate both the volume and the form of foreign aid.

Environment as a New Factor

This chapter examines the environmental factor in development assistance. We must begin with the inherent logic linking economic development and environment as a dynamic interactive process. Using the carbon budget as an analytical device, we show different ways in which developing countries contribute to carbon emissions. When the carbon budget is decomposed, the individual components driving emission can be isolated. This device is a highly simplified rendition of reality; nonetheless, it points to important targets for foreign aid, constraints on aid, and attendant implications—all tied to the basic logic of development. It is then possible to highlight the foreign aid consequences of linkages between environment and development.

Development and Environment

Imperatives of Growth[1]

Clearly, the greater the number of people and the higher their rate of increase in any environment, the greater will be the demands for such basic resources as food, water, air, and living space. Among nomadic hunters and gatherers of the past, pressures on such resources tended to be localized and limited. Some anthropologists have concluded that prehistoric hunting and gathering bands may have been among the more energy-efficient institutions in the course of human development.

Over time, however, populations increased; through sociocultural change and development, and advances in knowledge and skills—organizational as well as mechanical—they made new resources available and found new applications for old resources.

For all societies, adjustments to population growth often included new technological capabilities and organizational technologies (trading companies, corporations, the state itself), which increased access to resources as well as increasing encroachment on the natural environment.[2]

Dual Dilemma

As a consequence of uneven growth and development of population, technology, and resource-access variables, social change has tended to be erratic in human activities, interests, and organizations. In many ways, social change, economic and political, has also been unpredictable. Such tendencies contribute to a dual dilemma. The first dilemma is that every implementation of knowledge and skills results in a degradation of resources from a more usable to a less usable form, with the consequent production of wastes that are sometimes toxic. The second is that technology use itself requires resources—energy and materials. The more advanced the knowledge and skills, historically, the greater the amount and range of energy and resources required. Also the more advanced the technology, the greater the amount and range of resources people *presume* they need beyond the basic levels to which they have been accustomed.

This dual dilemma means that overall degradation increases with population growth and is exacerbated by technological advancement. But social outcomes and patterns of social change—organizational and mechanical—do vary through time according to the relative (and usually changing) levels and rates of socioeconomic development and of institutional adaptation and innovation. Therefore, each new increment of technological advancement, in conjunction with existing levels and growth rates of population, has tended to expand emissions of carbon and caused further damage to natural environments.

The production of carbon through human action is closely associated with economic development and with other effluents and activity-induced emissions. Carbon is a necessary by-product of energy use given current technology; carbon dioxide is a significant greenhouse gas accounting for roughly 50 percent of total global warming due to human activity; and carbon emission is a direct correlate of economic performance, illustrated by the near-perfect positive correlation between GNP and carbon emission.

Figure 1 summarizes these relationships and shows some revealing cross-national patterns. Underlying these patterns are major differences among states in both levels and rates of growth. At least four messages are clear: (1) near-perfect association of carbon and energy use; (2) near-perfect association of energy use and level of development; (3) distinct contribution of deforestation in association with carbon emission; and (4) developmental trajectory associated with increased levels of energy use and carbon emission, showing that the higher the level of economic development, the greater the emission of carbon into the atmosphere.

Development Paths

Historical evidence shows that states grow and develop unevenly in terms of their population, technology, and resources. This unevenness contributes to differences in their capability both to produce and distribute resources and wastes (toxic and otherwise) within

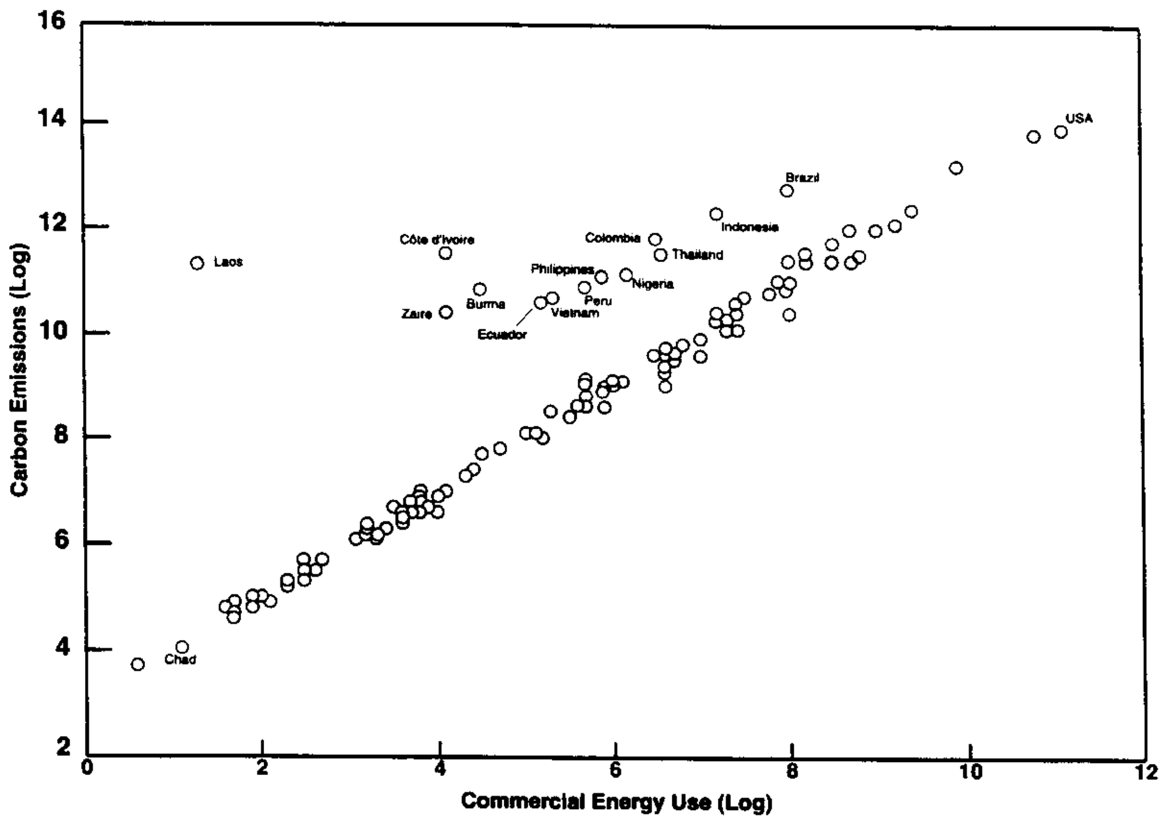

Figure 1. Cross-national Patterns of Carbon Emission and Commercial Energy Use.

Sources: Carbon emission from energy and cement: G. Marland et al., *Estimate of CO_2 Emissions from Fossil Fuel Burning and Cement Manufacturing, Based on the United Nations Energy Statistics and the U.S Bureau of Mines Cement Manufacturing Data*, Environmental Sciences Division Publication No. 3176 (Oak Ridge National Laboratories, 1989).

Carbon emissions from deforestation: R.A. Houghton et al., "The Flux of Carbon from Terrestrial Ecosystems to the Atmosphere in 1980 Due to Changes in Land Use: Geographic Distribution of the Global Flux," *Tellus* 39B (1987), pp. 122–139.

Population, GNP, area, exports, imports, life expectancy, and infant mortality: World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988); for countries with missing data or missing world totals, Central Intelligence Agency, *The World Factbook* (Washington, D.C.: U.S. Government Printing Office, various years).

Commercial energy consumption: World Resources Institute, *World Resources 1988* (New York: Basic Books, 1988); World Resources Institute, *World Resources 1989* (New York: Basic Books, 1989).

Human Development Index: United Nations Development Programme, Human Development Report 1990 (as reported in the *Economist*, May 26, 1990).

and between states, and to develop ways of managing resource use and improving efficiency in use. As a consequence, we can learn a great deal about states—and about differences among them—by comparing their technological and economic levels and rates of development. As recently as 1986, China (with the largest population, the third largest territory, and the ninth largest GNP in the world) had a per capita GNP of only $300—a vivid reminder of how differently aggregate size and its per capita values may affect the environment.

If we look at the experience of developing countries, three general patterns provide us with a means to frame their implications for the environment. These patterns are presented here in terms of the change from *less* development to *more* development.

The first group of countries, the least developed, have little access to natural resources and low levels of technological development. Relatively few developing states are characterized strictly along these lines; but those that are remain among the poorest. Countries in this group tend to be located in physical environments that discourage economic growth, agricultural production, and energy use. Chad, with a population density of four persons per square kilometer and a per capita income of $160 per annum, is typical. Capital accumulation and technological advances in nations that have this profile are severely constrained by the absence of skilled workers, education infrastructure, and attendant institutionalized capabilities.

Environmental degradation in these states begins with the condition of poverty, is continued by practices that erode arable land (e.g., over-grazing) and is aggravated by floods, famine, drought, and other "natural" factors. Included in this syndrome are a decreasing supply of fresh water, environmentally problematic agricultural practices, and excessive biomass burning, among other factors.

In principle, a country with a small population, little technology, or little resource access can change in four ways, each of which has particular outcomes: population increase, technological development, resource acquisition, or any combination of the three. If there is a positive side, it is this: since the physical infrastructures of such states are not yet in place, development investments can be directed away from traditionally high-polluting modes and dependence on fossil fuels toward more environmentally benign forms of industrialization strategies.

Countries in this first group are not immediate threats to the global climate or global environment; however, they may be primarily responsible for local pollution and environmental degradation. By taking early measures, they can avoid some of the more harmful consequences of development and adopt models of less environmentally threatening strategies of development. But every measure entails some cost, and the poorer countries can least afford to incur new costs. This fact places added responsibility on aid and assistance.

Along a broad development spectrum a second distinctive profile begins to emerge when population growth (hence density) outstrips resource availability and advances in technology (applied knowledge and skills, including economic, mechanical, and institutional capabilities). Demand for food and other subsistence resources increases faster than supply; capital remains scarce; agricultural productivity and industrial prospects are limited. The well-known forms of environmental degradation in demographically dense contexts arise in these situations.

Most developing countries are of this second type—in many different sizes and levels of capability—from Burundi to China. By definition, all are growing, but some, such as India, are much more developed than others, such as Bangladesh. With their larger populations and faster growth, they contribute more to local and global environmental degradation than countries in the first group do.

Largely because of rapid population growth, states with this second development pattern commonly suffer the same deleterious conditions as the less densely populated states, but they suffer more acutely, on a larger scale, and at an accelerating pace. Population density contributes to local degradation and constrains economic development, limiting any gains from technological advance. Deforesting large areas to extend living space and expand exports of timber and wood products (in such countries as Brazil, Indonesia, and the Philippines) has produced distinctive forms of local environmental damage with global consequences.

To the extent that these countries initiate modernization programs, they tend to import or learn to produce products and processes that exact high environmental costs. All conventional accoutrements of development are of this sort, such as internal combustion engines, nitrogenous fertilizers, aerosol sprays, refrigerants, and on and on. With greater modernity and greater access to goods and services come further per capita pressures to the environment, and with larger population comes more profound threats to life-supporting properties.

Overall, however, contributions to environmental damage by such high-population, low-technology countries have been small in terms of global shares. But as more of these countries industrialize, incremental increases in the use of energy, particularly coal and other fossil fuels—combining with the demands and activities of dense and growing populations—will rapidly accelerate carbon emission and other effluents. Already, several medium to large developing countries with active modernization programs—such as India, Mexico, Brazil, and South Korea—produce as much carbon dioxide as many industrialized nations. And China, because of its rapid modernization and immense population (despite draconian efforts to stabilize population growth), is surpassed only by the United States and the former Soviet Union in total carbon emission.

The first and second development patterns are conventional in the sense that there is a gradual progression from poverty to some form of affluence and a progression from poverty-driven environmental degradation to affluence-driven degradation. But some unique cases of development are not conventional. This is the development of countries that are sparsely populated, low-technology, high-resource nations and that have transformed themselves by producing and selling oil and importing a wide range of goods and services. The United Arab Emirates, Libya, Saudi Arabia, and Kuwait and other Gulf states, for example, have small national populations but growing imports of advanced technologies that enable them to expand their country's oil production rapidly, which in turn leads to large-scale imports of foreign labor, an increased standard of living, a developed infrastructure, and a rise in industrial investments. Concurrently, the result is high levels and rates of per capita carbon emission. In the generation of carbon per capita from energy production and use, Oman and Kuwait ranked third and fourth worldwide, the United Arab Emirates eleventh, and Saudi Arabia twentieth. As major producers and exporters of carbon-producing products and processes, countries in this group contribute indirectly to pollution worldwide. It goes without saying that economic growth and environmental practices collide head-on in these countries. And the Iraqi-set fires in Kuwaiti oil fields during the Gulf War created a whole new set of environmental concerns.[3] The ecological dislocations due to that war continue to be extensive.

Research on determining development patterns and national profiles on the basis of cross-national quantitative analysis is discussed elsewhere.[4] Of relevance here is that different patterns of development generate different combinations of effluents and pollutants, reflecting both the rates at which they were discharged and the sources of discharge.

Patterns of Environmental Degradation

Attention to the environment as a global problem has been predominantly a Western concern. Increasingly, developing countries are pressed to make the environment a priority issue, for their own welfare as well as for the global welfare. In many developing areas, environmental problems have become so acute that they present major threats to the health of the population. Many of these countries cannot easily address these developmental challenges and at the same time try to compete effectively in world markets. Consequently, accelerating debt, economic constraints on investment, and chronic limitations on productivity exacerbate "normal" problems of economic growth.

The lethal feedback dynamics between environmental degradation on the one side, and violent conflict on the other, are becoming ominous.[5] This dynamic process is creating new parameters of international politics by presenting unprecedented challenges for an already stressed system of international diplomacy and conflict mediation. Both sides of the process are lethal. Environmental degradation forces people to move, sometimes to cross borders, and most assuredly to impinge on and ultimately challenge host populations; and violent conflict always results in serious strains on natural ecosystems and further threatens life-supporting properties.

By definition, economic development dislocates natural environments. Development can contribute to that lethal feedback, especially if it involves conflict over shared or common resources (such as oil or access to common waterways) or if it involves relocation of populations (due to environmental degradation or violence). Such factors may be among the underlying reasons for declared hostilities, which may be justified publicly on the basis of religious differences or political contentions. But pressures other than economic development can also produce desperate, potentially explosive situations. Desertification of traditionally fertile areas in Africa has led whole villages either to abandon their homelands and seek employment in their country's vastly overpopulated cities or to become economic refugees in neighboring countries.

In cases where multiple sources and consequences of environmental degradation converge, as in the Sudan, untangling the various elements of the lethal feedback is nearly impossible. Desertification, drought, violent conflict, civil war, and famine all interact to produce a spiral of social and environmental deterioration. Furthermore, poor economic management by governments following an ideological agenda (such as in Ethiopia and Mozambique) or by those pursuing policies advantageous to one group at the sacrifice of another (such as in Senegal) tend to generate social inequities that eventually lead to more violence.

Despite vast differences in environmental problems across regions and between the more developed and less developed countries, all countries have in common two basic forms of environmental damage:[6] (1) destruction of natural resources, manifested by deforestation, soil loss, desertification, salinization, and other processes; and (2) destruction of natural environments because of expansion of the built environment (urbanization, expansion of physical infrastructure). Industrialization generally brings air and water pollution and, paradoxically, also the inadequate provision of services associated with expanding built environments (poor waste disposal systems, health hazards resulting from congestion or inadequate sewage systems).[7]

A selective account of some environmental consequences traced back to patterns of human activity is in table 1. Many, if not most, of these problems are a result of population growth, limited resource

Table 1. Patterns of Environmental Degradation

Human Action	Apparent Effects
Fossil fuel combustion	Increased carbon dioxide, leads to increased absorption of infrared radiation, which leads to increased warming; also leads to decreased heat loss from below
Deforestation	Contributes to carbon building and other ecological effects
Increased demand for groundwater (irrigation, domestic use, etc.)	Land subsidence, salt water intrusion into aquifiers, depletion of aquifiers
Filling, draining, or polluting wetlands	Destruction of estuaries as fish habitat
Mismanagement of agriculture or tropical forestry	Deterioration of soil's long-term productivity (e.g., lateralization)
Solid waste disposal	Physical pollution of land, air, and water
Runoff from construction sites	Destruction of coral reef by siltation
Toxins (e.g., pesticides) accumulating in food chain	Diminution of predator populations leading to loss of natural control of prey species
Mining (e.g., of coal)	Acid drainage
Discharge of untreated domestic and industrial wastewater	Unpotability of water polluted with pathogens or industrial chemicals
Exceeding carrying capacity of grazing land or forest	Desertification, flooding

Source: Adapted from Ferenc L. Toth, Eva Hizsnyik, and William C. Clark, eds., *Scenarios of Socioeconomic Development for Studies of Global Environmental Change: A Critical Review* (Laxenburg, Austria: International Institute for Applied Systems Analysis, 1989), pp. 50–51.

access, and rapid technological change. This table shows the pervasiveness of environmental degradation—both in its causes and in its consequences. At the base, this degradation is traced to effluents generated by human actions and discharges into the natural environment.

Sources of Effluence

Focusing on carbon emission illustrates both the extent and the diversity of human impacts. In this chapter we use the analytical device of the *carbon budget* to show more precisely some critical environment and development linkages.

The top twenty sovereign emitters of carbon mainly from energy use in 1986 are listed in table 2. Since these estimates reflect the accumulation of both past and present emissions, they obscure the diversity of historical and developmental projections for these countries. Although these figures are compiled by country, we must remember that, in reality, the actions of individuals, groups, institutions, corporations, firms, and so forth generate these effluents. Nonetheless, the figures indicate a compelling dilemma: ten of the top twenty are developing countries. As these states grow and develop, the amount of carbon they send into the atmosphere will also grow. This fact is incontestable, as is the diversity in the sources of growth.[8] Below we show the factors that account for these emissions.

A Simplified Logic

The carbon budget is a useful device for summarizing sources of carbon emission and a nation's total contributions to global emission on a yearly basis.[9] Conceived in terms of *rates of change*, a state's carbon emission (C) is separated into four components, each traced to different underlying sources: *changes* in the carbon content of energy (C/E), *changes* in energy intensity of the gross national product (E/G), *changes* in GNP per capita (G/P), and *changes* in total population (P). Together these elements constitute an identity that can be expressed as follows:

$$C = C/E + E/G + G/P + P$$

Stated thus, the carbon budget is formulated in terms of *change* rather than absolute levels, thereby indicating the dynamic processes leading to carbon emission as well as the relative weight of each

Table 2. The Top Twenty Carbon-Emitting Nations, 1986

	Carbon			Population		
	Thous. mt.[a]	Percent of Total[b]	Percent of Average[c]	Millions	Percent of Total	Carbon per Capita (kg.)
United States	1,201,624	16.65	2,346.81	241.6	4.91	4,973.61
Soviet Union	1,010,804	14.01	1,974.14	281.1	5.72	3,595.89
China	554,349	7.68	1,082.66	1,054.0	21.44	525.95
Brazil	388,521	5.38	758.79	138.4	2.81	2,807.23
Japan	256,084	3.55	500.14	121.5	2.47	2,107.68
Indonesia	220,127	3.05	429.92	166.4	3.38	1,322.88
West Germany	186,269	2.58	363.79	60.9	1.24	3,058.60
India	177,326	2.46	346.32	781.4	15.89	226.93
United Kingdom	166,195	2.30	324.59	56.7	1.15	2,931.13
Colombia	135,831	1.88	265.28	29.0	0.59	4,683.83
Poland	124,477	1.73	243.11	37.5	0.76	3,319.39
Thailand	108,522	1.50	211.95	52.6	1.07	2,063.16
Mexico	106,595	1.48	208.18	80.2	1.63	1,329.12
Canada	105,203	1.46	205.47	25.6	0.52	4,109.50
Côte d'Ivoire	102,319	1.42	199.83	10.7	0.22	9,562.48
France	98,357	1.36	192.09	55.4	1.13	1,775.40
Italy	94,909	1.32	185.36	57.2	1.16	1,659.26
South Africa	92,514	1.28	180.68	32.3	0.66	2,864.21
East Germany	92,315	1.28	180.29	16.6	0.34	5,561.14
Laos	85,056	1.18	166.12	3.7	0.08	22,988.14

[a]Includes deforestation.
[b]Global total.
[c]Global average.
Sources: Carbon emissions from energy and cement: G. Marland et al., *Estimate of CO_2 Emissions from Fossil Fuel Burning and Cement Manufacturing, Based on the United Nations Energy Statistics and the U.S. Bureau of Mines Cement Manufacturing Data*, Environmental Sciences Division Publication No. 3176 (Oak Ridge National Laboratories, 1989). Population: World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988). Carbon emissions from deforestation: R.A. Houghton et al., "The Flux of Carbon from Terrestrial Ecosystems to the Atmosphere in 1980 Due to Changes in Land Use: Geographic Distribution of the Global Flux," *Tellus* 39B (1987), pp. 122–139.

term. This formulation offers a cross-national comparison of countries for the root source of emission and effluence. It is strictly an accounting identity, not a stochastic, probabilistic, or explanatory formulation. Its purpose is to identify (a) changes in the constituent components over time and (b) particular socioeconomic sources of emission for individual countries.

The focus on carbon emission highlights the most obvious and least politically controversial indicators of environmental degradation. However, this logic is applicable to other variables, such as

various greenhouse gases that may contribute to global climate alterations. Uncertainty regarding the underlying physical processes and statistical accounting greatly complicates this type of assessment. Nonetheless, because indicators of environmental degradation reflect human activities that press on natural ecosystem balances and reveal the unintended consequences of growth, the carbon budget helps delineate particular combinations of variables that generate effluents (and pollutants)—for any country at any level of development.

Cross-national Comparisons

Industrial countries are responsible for the greatest volume of carbon emission on both an absolute and a per capita level. By contrast, developing states are responsible for the greatest rates of growth in emission, albeit from markedly lower initial levels. Drawing on the World Bank classification of the world's economies, table 3 ranks the twenty states that had the highest average annual percentage of *change* in carbon emission from 1980 to 1986. All twenty are developing economies; the more developed ones rank much lower in terms of annual change in carbon emission. China ranks twenty-first, just beyond the cut-off point for our purposes here. (Change in the carbon content of energy, C/E, is set at zero cross nationally as a useful simplification, given current energy technology. Over time, however, we can expect a reduction in the carbon content of energy.)

The top-ranking countries for each factor of the carbon budget are shown in tables 4, 5, and 6. These differences are important because they draw attention both to variations in underlying sources of emission and to alternative policy responses most relevant to each case.

Environmental Strategies for Development

Of the many considerations that shape development priorities, cross-national patterns in tables 3 to 6 highlight the importance of addressing at least four policy objectives: (1) increasing energy efficiency; (2) managing aggregate economic growth; (3) moderating demographic change; and (4) striking a viable balance.[10]

Measures to enhance efficiency, reduce waste, and rationalize energy use are well recognized. That they can conflict with social priorities, equity concerns, and social contracts is also well recognized. The top twenty states ranked in table 4 according to their average annual change in ratio of energy to GNP are all developing

Table 3. The Top Twenty Nations in Average Annual Percentage of Change in Carbon Emission, 1980–86

	Average Annual Change (%)									Carbon Emission from Energy Use
	C[a]		C/E		E/G		G/P		P	(thous. mt., 1986)
Yemen Arab Republic	13.8	=	0.0	+	9.5	+	1.8	+	2.5	703
Nepal	11.6	=	0.0	+	8.1	+	0.9	+	2.6	249
Burundi	10.4	=	0.0	+	8.1	+	−0.4	+	2.7	44
Oman	10.4	=	0.0	+	4.7	+	1.0	+	4.7	5,498
Jordan	9.2	=	0.0	+	4.1	+	1.4	+	3.7	2,219
Bangladesh	8.8	=	0.0	+	5.1	+	1.1	+	2.6	3,063
Thailand	8.2	=	0.0	+	3.4	+	2.8	+	2.0	12,461
Turkey	7.3	=	0.0	+	2.4	+	2.4	+	2.5	31,620
Egypt	7.3	=	0.0	+	2.6	+	2.0	+	2.7	18,836
Pakistan	6.9	=	0.0	+	0.2	+	3.6	+	3.1	12,338
Algeria	6.8	=	0.0	+	2.4	+	1.3	+	3.1	14,574
Cameroon	6.8	=	0.0	+	−1.4	+	5.0	+	3.2	1,672
Malaysia	6.6	=	0.0	+	1.8	+	2.1	+	2.7	8,773
Nigeria	6.5	=	0.0	+	9.7	+	−6.5	+	3.3	12,137
Tunisia	6.5	=	0.0	+	2.8	+	1.4	+	2.3	2,859
India	6.4	=	0.0	+	1.5	+	2.7	+	2.2	139,971
Korea	6.2	=	0.0	+	−2.0	+	6.8	+	1.4	42,221
Burma	5.8	=	0.0	+	0.9	+	2.9	+	2.0	1,735
United Arab Emirates	5.7	=	0.0	+	9.5	+	−9.4	+	5.6	4,908
Saudi Arabia	5.7	=	0.0	+	9.1	+	−7.5	+	4.1	29,848

C = change in carbon emission; C/E = change in carbon content of energy; E/G = change in ratio of energy to GNP; G/P = change in GNP per capita; P = change in total population.

[a]C is computed as a sum of the other terms, except for C/E which is held at zero.

Source: Based on data reported in World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988); and G. Marland et al., *Estimate of CO_2 Emissions from Fossil Fuel Burning and Cement Manufacturing, Based on the United Nations Energy Statistics and the U.S. Bureau of Mines Cement Manufacturing Data*, Environmental Sciences Division Publication No. 3176 (Oak Ridge National Laboratories, 1989).

states. Therefore, enhancing energy efficiency is obviously an important objective.

The dominance of the developing economies in the growth of carbon emission is also seen in table 5, which ranks states by change in GNP per capita. With the exception of Japan, Denmark, Finland, the United States, and the United Kingdom, changes in economic output per capita increase carbon emission. To the extent that per capita output continues to grow, carbon emission will also grow. In

Table 4. The Top Twenty Nations in Average Annual Percentage of Change in Ratio of Energy to GNP, 1980–86

	Average Annual Change (%)									Carbon Emission from Energy Use
	C[a]		C/E		E/G		G/P		P	(thous. mt., 1986)
Mozambique	1.8	=	0.0	+	10.8	+	−11.7	+	2.7	258
Nigeria	6.5	=	0.0	+	9.7	+	−6.5	+	3.3	12,137
Yemen Arab Republic	13.8	=	0.0	+	9.5	+	1.8	+	2.5	703
United Arab Emirates	5.7	=	0.0	+	9.5	+	−9.4	+	5.6	4,908
Saudi Arabia	5.7	=	0.0	+	9.1	+	−7.5	+	4.1	29,848
Burundi	10.4	=	0.0	+	8.1	+	−0.4	+	2.7	44
Nepal	11.6	=	0.0	+	8.1	+	0.9	+	2.6	249
Niger	3.3	=	0.0	+	5.9	+	−5.6	+	3.0	187
Trinidad and Tobago	−0.8	=	0.0	+	5.5	+	−7.8	+	1.5	4,835
Bangladesh	8.8	=	0.0	+	5.1	+	1.1	+	2.6	3,063
Oman	10.4	=	0.0	+	4.7	+	1.0	+	4.7	5,498
Jordan	9.2	=	0.0	+	4.1	+	1.4	+	3.7	2,219
Paraguay	5.1	=	0.0	+	4.0	+	−2.1	+	3.2	441
Uganda	4.4	=	0.0	+	3.7	+	−2.4	+	3.1	210
Kuwait	2.8	=	0.0	+	3.7	+	−5.3	+	4.4	8,053
Central African Republic	4.6	=	0.0	+	3.5	+	−1.4	+	2.5	43
Thailand	8.2	=	0.0	+	3.4	+	2.8	+	2.0	12,461
Venezuela	2.4	=	0.0	+	3.3	+	−3.8	+	2.9	25,790
Syrian Arab Republic	4.8	=	0.0	+	3.3	+	−2.0	+	3.5	7,934
Rwanda	4.9	=	0.0	+	3.1	+	−1.5	+	3.3	100

C = change in carbon emission; C/E = change in carbon content of energy; E/G = change in ratio of energy to GNP; G/P = change in GNP per capita; P = change in total population.

[a]C is computed as a sum of the other terms, except C/E which is held at zero.

Source: Based on data reported in World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988); and G. Marland et al., *Estimate of CO_2 Emissions from Fossil Fuel Burning and Cement Manufacturing, Based on the United Nations Energy Statistics and the U.S. Bureau of Mines Cement Manufacturing Data*, Environmental Sciences Division Publication No. 3176 (Oak Ridge National Laboratories, 1989).

such cases both the numerator and the denominator are significant contributors of effluence.

It is difficult to envisage either an effective development strategy or a commensurate aid strategy that does not give high priority to population in all its dimensions—size, growth, distribution, composition, skill, and efficacy.[11] However limited, the perspective pro-

Table 5. The Top Twenty Nations in Average Annual Change in GNP Per Capita, 1980–86

	Average Annual Change (%)									Carbon Emission from Energy Use
	C[a]		C/E		E/G		G/P		P	(thous. mt., 1986)
China	5.6	=	0.0	+	−4.9	+	9.3	+	1.2	532,388
Botswana	2.2	=	0.0	+	−9.7	+	8.4	+	3.5	322
Korea	6.2	=	0.0	+	−2.0	+	6.8	+	1.4	42,221
Cameroon	6.8	=	0.0	+	−1.4	+	5.0	+	3.2	1,672
Hong Kong	4.4	=	0.0	+	−1.6	+	4.8	+	1.2	6,609
Singapore	−1.5	=	0.0	+	−6.8	+	4.2	+	1.1	8,655
Pakistan	6.9	=	0.0	+	0.2	+	3.6	+	3.1	12,338
Sri Lanka	4.1	=	0.0	+	−0.8	+	3.4	+	1.5	927
Mauritius	3.0	=	0.0	+	−1.4	+	3.4	+	1.0	265
Norway	2.8	=	0.0	+	−0.7	+	3.2	+	0.3	8,657
Japan	1.5	=	0.0	+	−2.2	+	3.0	+	0.7	246,394
Burma	5.8	=	0.0	+	0.9	+	2.9	+	2.0	1,735
Denmark	1.1	=	0.0	+	−1.7	+	2.8	+	0.0	16,825
Thailand	8.2	=	0.0	+	3.4	+	2.8	+	2.0	12,461
India	6.4	=	0.0	+	1.5	+	2.7	+	2.2	139,971
Turkey	7.3	=	0.0	+	2.4	+	2.4	+	2.5	31,620
Finland	3.6	=	0.0	+	0.9	+	2.2	+	0.5	14,627
United Kingdom	0.8	=	0.0	+	−1.5	+	2.2	+	0.1	164,373
United States	−0.1	=	0.0	+	−3.2	+	2.1	+	1.0	1,191,764
Malaysia	6.6	=	0.0	+	1.8	+	2.1	+	2.7	8,773

C = change in carbon emission; C/E = change in carbon content of energy; E/G = change in ratio of energy to GNP; G/P = change in GNP per capita; P = change in total population.

[a]C is computed as a sum of the other terms, except C/E which is held at zero.

Source: World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988).

vided in table 6 highlights the overall environmental implications of population growth. The top twenty countries ranked by the population factor show growth ranging between 5.6 percent and 3.3 percent (natural increase as well as in-migration). All twenty of these developing states experience high population-driven emissions. (The high rankings for oil-exporting countries in particular reflect both in-migration and natural increase.)

"Success" Cases

Countries with declining rates of change in carbon emission from 1980 to 1986 represent wide ranges of economic and policy experiences as well as diversity in the individual factors of the carbon

Table 6. The Top Twenty Nations in Average Annual Change in Total Population, 1980–86

	Average Annual Change (%)									Carbon Emission from Energy Use
	C[a]		C/E		E/G		G/P		P	(thous. mt., 1986)
United Arab Emirates	5.7	=	0.0	+	9.5	+	−9.4	+	5.6	4,908
Oman	10.4	=	0.0	+	4.7	+	1.0	+	4.7	5,498
Kuwait	2.8	=	0.0	+	3.7	+	−5.3	+	4.4	8,053
Gabon	3.0	=	0.0	+	1.5	+	−2.9	+	4.4	718
Côte d'Ivoire	2.7	=	0.0	+	3.0	+	−4.5	+	4.2	1,213
Saudi Arabia	5.7	=	0.0	+	9.1	+	−7.5	+	4.1	29,848
Kenya	−0.8	=	0.0	+	−4.2	+	−0.7	+	4.1	956
Libya	n.a.	=	0.0	+	n.a	+	n.a	+	3.9	7,465
Zimbabwe	0.4	=	0.0	+	−2.2	+	−1.1	+	3.7	3,530
Jordan	9.2	=	0.0	+	4.1	+	1.4	+	3.7	2,219
Honduras	1.5	=	0.0	+	0.9	+	−3.0	+	3.6	476
Iraq	n.a.	=	0.0	+	n.a.	+	n.a.	+	3.6	n.a.
Syrian Arab Republic	4.8	=	0.0	+	3.3	+	−2.0	+	3.5	7,934
Zambia	−0.4	=	0.0	+	−0.3	+	−3.6	+	3.5	752
Tanzania	2.0	=	0.0	+	1.1	+	−2.6	+	3.5	522
Botswana	2.2	=	0.0	+	−9.7	+	8.4	+	3.5	322
Ghana	−4.9	=	0.0	+	−5.6	+	−2.8	+	3.5	696
Togo	−3.2	=	0.0	+	−2.1	+	−4.5	+	3.4	83
Nicaragua	1.7	=	0.0	+	1.5	+	−3.2	+	3.4	556
Rwanda	4.9	=	0.0	+	3.1	+	−1.5	+	3.3	100
Nigeria	6.5	=	0.0	+	9.7	+	−6.5	+	3.3	12,137
Liberia	−12.4	=	0.0	+	−11.1	+	−4.6	+	3.3	168

C = change in carbon emission; C/E = change in carbon content of energy; E/G = change in ratio of energy to GNP; G/P = change in GNP per capita; P = change in total population.

[a]C is computed as a sum of the other terms, except C/E which is held at zero.

Source: World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988).

budget. Table 7 lists the top twenty states with the highest average annual percentage decreases in carbon emission—from the smallest reduction, 0.1 percent (the former Federal Republic of Germany), to the steepest decline, −12.4 percent (Liberia).

Compared to the experience of developing countries, then West Germany showed an enviable combination: enhanced energy efficiency coupled with increased GNP per capita and a reduction in population growth. The stark contrast is Liberia, which reveals the combined effects of significant declines in economic activity, retrenchment in energy use, and declines in energy-intensive industries. This

Table 7. The Top Twenty Nations in Average Annual Decrease in Carbon Emission, 1980–86

	Average Annual Change (%)									Carbon Emission from Energy Use (thous. mt., 1986)
	C[a]		C/E		E/G		G/P		P	
Germany, Fed. Rep.	−0.1	=	0.0	+	−1.6	+	1.7	+	−0.2	182,666
United States	−0.1	=	0.0	+	−3.2	+	2.1	+	1.0	1,191,764
Mauritania	−0.2	=	0.0	+	−1.2	+	−1.6	+	2.6	160
Peru	−0.3	=	0.0	+	0.1	+	−2.7	+	2.3	5,512
Italy	−0.4	=	0.0	+	−1.7	+	1.0	+	0.3	90,103
Zambia	−0.4	=	0.0	+	−0.3	+	−3.6	+	3.5	752
Malawi	−0.7	=	0.0	+	−3.1	+	−0.8	+	3.2	136
Trinidad and Tobago	−0.8	=	0.0	+	5.5	+	−7.8	+	1.5	4,835
Kenya	−0.8	=	0.0	+	−4.2	+	−0.7	+	4.1	956
Guatemala	−1.3	=	0.0	+	−0.1	+	−4.1	+	2.9	876
Singapore	−1.5	=	0.0	+	−6.8	+	4.2	+	1.1	8,655
Sierra Leone	−1.8	=	0.0	+	−2.2	+	−2.0	+	2.4	150
Philippines	−1.9	=	0.0	+	−0.9	+	−3.5	+	2.5	8,270
Bolivia	−2.0	=	0.0	+	1.0	+	−5.7	+	2.7	1,093
Senegal	−2.3	=	0.0	+	−5.5	+	0.3	+	2.9	526
Uruguay	−2.8	=	0.0	+	−0.2	+	−3.0	+	0.4	810
Togo	−3.2	=	0.0	+	−2.1	+	−4.5	+	3.4	83
Jamaica	−4.5	=	0.0	+	−4.5	+	−1.5	+	1.5	1,597
Ghana	−4.9	=	0.0	+	−5.6	+	−2.8	+	3.5	696
Liberia	−12.4	=	0.0	+	−11.1	+	−4.6	+	3.3	168

C = change in carbon emission; C/E = change in carbon content of energy; E/G = change in ratio of energy to GNP; G/P = change in GNP per capita; P = change in total population.

[a]C is computed as a sum of the other terms, except C/E which is held at zero. Ranked here from least to most *negative* change.

Source: World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988).

is clearly a case of carbon reduction by necessity, not by policy. On a cross-national basis the case of Belgium is noteworthy; Belgium achieved a carbon emission growth rate of 0.2 percent because of the combination of −0.7 percent for change in ratio of energy to GNP, 0.9 percent for change in GNP per capita, and 0.0 percent for population growth. This case is as far from the "average" developing-country experience as imaginable.

Carbon Emissions of Aid Recipients

Patterns of carbon emission for the top twelve recipients of foreign aid in 1988 illustrate the effluence side of economic development.

Table 8 shows the distribution of total aid and aid per capita along with key indicators of carbon emission. The largest recipient of aid on a per capita basis, Israel, is also the greatest emitter of carbon per capita and ranks highest in terms of *percentage* of the average global carbon emission. China, by contrast, receives the least aid on a per capita basis but emits the highest *volume* of carbon worldwide. Israel and China illustrate key differences in the effects of economic development, population size, and volume of aid received.

Extending this comparison, table 9 shows the carbon budget for each of the twelve top aid recipients and changes in the constituent components. Ranked by volume of aid received, the patterns are revealing: of all aid recipients, Bangladesh ranks highest in carbon emission; China has the highest growth in per capita GNP; Mozambique ranks highest in terms of change in ratio of energy to GNP; and Tanzania has the highest rate of population growth. Each case is different, and each points to the need for a particular assistance strategy to manage sources of environmental degradation.

Conclusion: Implications for Foreign Aid

The issues and linkages discussed in this chapter have implications as much for the theory as for the policy of framing and delivering assistance in the development process. But problems and puzzles—as well as opportunities and constraints—continue to exist, and more challenges for research continue to emerge.

Theory: Problems and Puzzles

Theories of modern economic growth and growth models have provided the foundation for approaches to foreign aid and to strategies of assistance. Not only does growth theory provide a ready answer to the question "Why aid?"; it also provides guidelines for the "how" and "where" of aid. Most growth models derive from, or are variants of, the Cobb-Douglas production function and the Harrod-Domar model. Subsequent contributions to growth theory showed the role of technological change and the complementary relationship between technical change and investment, and they helped focus attention on the technology factor in economic growth. Simultaneously, notions put forth in the other social sciences about stages of growth, cultural factors, and sociological considerations have restrained, but not reshaped, the overwhelming positivism of economic development theories.

Table 8. Carbon Emissions of Top Twelve Recipients of Foreign Aid

	Foreign Aid ($ billion, 1988)	Foreign Aid per Capita ($)	Carbon[a] (thous. mt.)	Carbon (percent of total)	Carbon (percent of average)	Carbon per Capita[a] (kg.)	Carbon per Capita (percent of average)
India	2.4	3	177,326	2.46	346.32	226.93	15.59
China	2.2	2	554,349	7.68	1,082.66	525.95	36.14
Indonesia	1.6	9	220,127	3.05	429.92	1,322.88	90.89
Bangladesh	1.6	15	3,102	0.04	6.06	30.06	2.07
Egypt	1.5	30	19,871	0.28	38.81	399.82	27.47
Pakistan	1.5	14	13,048	0.18	25.48	131.53	9.04
Israel	1.2	280	7,273	0.10	14.20	1,691.28	116.21
Tanzania	1.0	41	563	0.01	1.10	24.48	1.68
Sudan	0.9	39	900	0.01	1.76	39.80	2.73
Ethiopia	0.9	19	571	0.01	1.11	13.12	0.90
Mozambique	0.9	60	320	0.00	0.62	22.51	1.55
Philippines	0.9	15	66,752	0.91	128.42	1,147.51	78.84

Source: See tables 2, 3, and 4 for carbon sources. See also data reported in World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988).

[a]Per capita figures multiplied by World Bank population figures; includes deforestation.

Table 9. Carbon Budgets of Top Twelve Recipients of Foreign Aid, by Amount of Foreign Aid

	Average Annual Change (%)									Carbon Emissions from Energy, 1986	Percent of World Total	Kg. Per Capita
	C[a]		C/E		E/G		G/P		P			
India	6.4	=	0.0	+	1.5	+	2.7	+	2.2	139,971	2.6	179.1
China	5.6	=	0.0	+	−4.9	+	9.3	+	1.2	532,388	9.9	505.1
Indonesia	3.9	=	0.0	+	0.5	+	1.2	+	2.2	26,634	0.5	160.1
Bangladesh	8.8	=	0.0	+	5.1	+	1.1	+	2.6	3,063	0.1	29.7
Egypt	7.3	=	0.0	+	2.6	+	2.0	+	2.7	18,836	0.4	379.0
Pakistan	6.9	=	0.0	+	0.2	+	3.6	+	3.1	12,338	0.2	124.4
Israel	1.3	=	0.0	+	−0.7	+	0.3	+	1.7	6,992	0.1	1,626.1
Tanzania	2.0	=	0.0	+	1.1	+	−2.6	+	3.5	522	0.0	22.7
Sudan	0.3	=	0.0	+	0.0	+	−2.5	+	2.8	872	0.0	38.6
Ethiopia	2.1	=	0.0	+	1.3	+	−1.6	+	2.4	537	0.0	12.3
Mozambique	1.8	=	0.0	+	10.8	+	−11.7	+	2.7	258	0.0	18.2
Philippines	−1.9	=	0.0	+	−0.9	+	−3.5	+	2.5	8,270	0.2	144.3

C = change in carbon emission; C/E = change in carbon content of energy; E/G = change in ratio of energy to GNP; G/P = change in GNP per capita; P = change in total population.

[a]C is computed as a sum of the other terms, except C/E which is held at zero.

Source: See tables 2, 3, and 4 for carbon sources. See also data reported in World Bank, *World Development Report 1988* (New York: Oxford University Press, 1988).

Without exception the environment was ignored in all theories of growth. For example, conventional views of economic development evolved to reflect a wide range of concerns—the importance of a critical rate of growth, "balanced" growth, external trade, absorption of labor, investment and investment criteria, among other issues—but the issue of environment was not raised at all.[12]

This intellectual context provided the theoretical framework for assistance programs. Throughout the past four decades, foreign aid was directed to closing one of three dominant gaps: (1) the savings-investment gap; (2) the foreign exchange earnings-expenditures gap; and (3) the capital-absorption gap. In theory at least, aid was directed to the gap that was considered most severe or problematic at any one time.[13]

In this process, environmental factors were conventionally relegated to the status of "externalities" of growth. Not a single study of development economics in the sixties, seventies, or eighties directly addressed the environmental dimensions of development. Recently, concern for sustainable development shifted the theoretical discourse by defining development in terms of a symbiotic relationship to environment. The dual challenges noted in the beginning of this chapter have direct implications for economic theory. Environment is now recognized as an important factor with potentially serious constraints on growth. Therefore, the theoretical implications of environmental factors for foreign aid can no longer be ignored.

Three theoretical questions are important: First: What is the accurate valuation of national assets? Second: What is the valuation of environmental by-products of investment? Third, and by far most problematic: How can the environment be consistently internalized both in models of growth and in guidelines for aid? Already some steps have been taken in these directions.[14]

Policy: Opportunities and Constraints

Theoretical and analytical issues notwithstanding, in practice the imperatives of foreign policy and policy priorities always dominate. Recognizing the strategic determinants of foreign policy and the use of aid as an instrument of policy, it seems clear that all donor countries, including the United States, face both constraints and opportunities in pursuing their assistance policies and conducting their aid programs.

The constraints on foreign aid can be summarized as follows: resource constraints, in terms of budgetary allocations; policy constraints, in terms of foreign policy priorities; program constraints, in terms of adjusting existing programs to address environmental issues; and political constraints, in terms of assuring the compatibility of national goals at each end of the aid relationship.

The opportunities can be summarized as follows: By improving the sensitivity of conventional aid approaches to the environment, donor countries and agencies can help develop more viable concepts of development. As a major donor, the United States in particular could assume an important role in framing new strategies for development and new policies for protecting the environment. The dominant role of the United States in foreign assistance during the immediate postwar period eroded as the donor community expanded and concepts of development changed. Today, both government and business find a common interest in devising approaches, strategies, and technologies for improving environmental responsiveness.

Business opportunities cannot be underestimated. Pollution control technologies—and products and processes for combating, abating, or mitigating environmental degradation—may create new market opportunities of significant proportions. U.S. firms have already moved ahead in this area. To the extent that aid policy reinforces the demand for improving environmental conditions in developing countries, important commercial opportunities could be realized.

By far more important are the opportunities for positive diplomacy. A posture of environmental protection can have important global payoffs. Projecting U.S. interests beyond strategic and military terms to encourage and facilitate support for life-enhancing properties—for both the global and local environment—can be regarded, in itself, as a supportive political move. In other words, environmental sensitivity could provide not only goodwill but, more important, improved strategies for development buttressed by expanded technological and commercial opportunities.

Notes

1. This section is based on Nazli Choucri and Robert C. North, "Global Environmental Change: State Profiles and Policy Imperatives" (unpublished manuscript, Massachusetts Institute of Technology, 1990).

2. See Robert C. North, *War, Peace, Survival* (Boulder, Colo.: Westview Press, 1990) for a detailed discussion of this process.

3. Nazli Choucri, "Managing Environmental Damage in the Gulf" (Cambridge, Mass.: MIT Department of Political Science, 1991).

4. Nazli Choucri and Robert C. North, "Growth, Development, and Environmental Sustainability: Profile and Paradox," chapter 3 in Nazli Choucri, ed., *Global Accord: Environmental Challenges and International Responses* (Cambridge, Mass.: MIT Press, in press).

5. Nazli Choucri, "Resource Constraints as Causes of Conflict," *Ecodecision* (September 1991), pp. 52–55.

6. See especially Organization for Economic Cooperation and Development (OECD), *Strengthening Environmental Co-operation with Developing Countries* (Paris: OECD, 1989), Part IV.

7. A more specific accounting of the impacts of human activity on the environment, distinguishing between "action" and "effect," is presented in Ferenc L. Toth, Eva Hizsnyik, and William C. Clark, eds., *Scenarios of Socioeconomic Development for Studies of Global Environmental Change: A Critical Review* (Laxenburg, Austria: International Institute for Applied Systems Analysis [IIASA], 1989), pp. 50–51.

8. A slightly different and more general formulation is presented by John H. Gibbons, "The Interface of Environmental Science and Policy," *Energy and the Environment in the 21st Century*, MIT Energy Laboratory preprint (Cambridge, Mass.: MIT, March 1990).

9. I am grateful to the MIT Committee on Global Environmental Change (1990–91) and particularly to James Wei, then committee chairman, for formulation and analysis of the structure and implications of the carbon budget. The assistance of Jan Sundgren in the cross-national comparative analysis is appreciated.

10. The concept of "sustainable development," initially put forth by the World Commission on Environment and Development in 1987, is becoming a central focus of international deliberations on global environmental change. There are numerous efforts designed to develop operational definitions of this concept.

11. Nazli Choucri, "Population and the Global Environment," in *Energy and the Environment in the 21st Century*, MIT Energy Laboratory preprint (Cambridge, Mass.: MIT, March 1990).

12. See Partha Dasgupta and Karl-Goran Maler, "The Environment and Emerging Development Issues" (paper presented at the World Bank Annual Bank Conference on Development Economics, April 26–27, 1990) for a review of the relevant literature on the issue of silence on environment; references illustrate the near-total absence of concern. See H. Chenery and T. N. Srinivasan, eds., *Handbook of Development Economics*, Vols. 1 and 2 (Amsterdam: North Holland, 1988); J. Dreze and N. H. Stern, "The Theory of Cost Benefit Analysis," in A. J. Auerbach and M. Feldstein, eds., *Handbook of Public Economics*, Vol. 2 (Amsterdam: North Holland, 1987); N. H. Stern, "The Economics of Development: A Survey," *Economic Journal*, Vol. 99, No. 3, pp. 391–416 for environmental factors in development processes.

13. For a review of intellectual context, see Raymond F. Miksell, *The Economics of Foreign Aid* (Chicago, Ill.: Aldine Publishing, 1968).

14. The inherent logic of environment and development, presented earlier in this chapter, suggests some theoretical directives for guiding aid strategy. See also World Resources Institute, *World Resources 1990–91* (New York: Oxford University Press, 1990) for a discussion of the accounting issue.