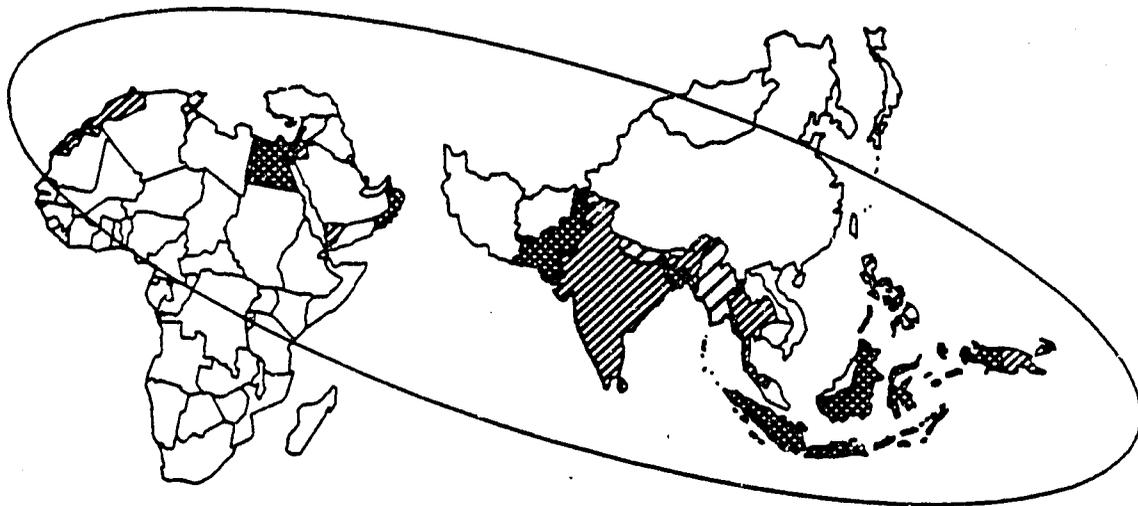


**TOWARD AN ENVIRONMENTAL AND NATURAL
RESOURCES MANAGEMENT STRATEGY FOR
ANE COUNTRIES IN THE 1990s**



**Submitted to
The Asia and Near East Bureau
U.S. Agency for International Development
by the
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PREFACE

Over the past year, the Center for International Development and Environment of the World Resources Institute (WRI) has been cooperating with the Asia and Near East (ANE) Bureau of the U.S. Agency for International Development in developing the analytical basis for a regional environmental and natural resources strategy for the 1990s. The goal is to provide a comprehensive analysis of the major natural resource and environmental problems in the ANE region, to identify their importance for sustainable economic growth, and to suggest possible programming priorities for AID in the 1990s. It also outlines a set of principles and criteria for AID to consider in developing its country and regional priorities.

We hope that "Toward an Environmental and Natural Resources Management Strategy for ANE Countries in the 1990s" will provide a valuable resource for AID and others to use in formulating action priorities for assisting countries in the region. This report should be treated as an initial effort and should be shared with a wide audience both within the ANE region, with other donors, and with NGOs, industry, and others within the U.S.

The report contains five chapters. Chapter I provides the analytic framework that links natural resources, their extent, quality, and management with economic growth in the region. Chapter II contains a more detailed description and analysis of a number of key resource problems that are restricting economic growth and have a severe impact on opportunities to improve the standard of living and quality of life of citizens in the region. Chapters III and IV contain 20 specific opportunities for working toward sustainable economic growth through protection and enhancement of the natural resource base. Opportunities for action were chosen based on the urgency and importance of the problems, the availability of examples and approaches that have proven successful within the region, and the expectation that government, the private sector, NGOs, and donors working together can make a measurable difference. Chapter V presents a set of principles and criteria that we recommend using to help establish priorities for action in individual countries and in the region. Appendix 2 contains a set of statistical indicators for the countries of the ANE region, which were taken from the statistical database developed for this project by WRI.

A key element in the process of developing the Draft Strategy was the preparation of 17 background issue papers, by a number of cooperating organizations and experts. These papers and their authors and reviewers are listed in Appendix 4 and referenced throughout. Copies of the papers will be available from the ANE Bureau and from WRI.

ACKNOWLEDGEMENTS

This report was prepared by the project team at WRI. Dan Tunstall was responsible for overall project management and development of the report. He was assisted in the analysis and writing by Charles Barber and Cynthia Mackie, and in the editing and rewriting by Patricia Blair. The team also included Doug Baker, data analyst, Cathy Olson, administrative secretary, and Ann Gillidette, workshop coordinator.

WRI would like to thank the many individuals and organizations that assisted in the preparation of background issue papers and other materials which provided the basis for our analysis and recommendations. Many of the papers were prepared with financial support provided by other offices and bureaus within AID. Listed are the authors and principal reviewers:

- o Forest resources: Pat Durst (AID Forestry Support Program), George Armstrong (AID/ANE/TR/ENR), and Carl Gallegos (AID/S&T/FENR); Bob Winterbottom and Peter Hazelwood (WRI).
- o Biological resources: Janis Alcorn (AID/ANE/TR/ENR) and Nels Johnson (WRI); Walt Reid (WRI).
- o Economics of sustainable agriculture: Edward Barbier (International Institute for Environment and Development); Paul Faeth (WRI).
- o Global warming: Bob Ichord and Bob Archer (AID/ANE/TR/ENR); Bill Moomaw (WRI).
- o Soil loss and land degradation: Bill Bentley (Winrock International); Mohamed El-Ashry (WRI), Peter Freeman (consultant).
- o Watershed management: Cynthia Mackie (consultant); Ray Meyer (AID/S&T/AGR), Peter Freeman (consultant).
- o Coastal resources: Stephen Olsen, Lynne Zeitlin Hale, Donald Robadue, Jr., and Gordon Foer (The University of Rhode Island, Coastal Resources Center) and Random Dubois (consultant); Nora Berwick (AID/S&T/FENR), Molly Kux (AID/ANE/PD/ENV).
- o Rural water supply: Rick Mattson (V/ASH) and Jahan Tavangar (consultant); Mohamed El-Ashry (WRI).

- o Urbanization and industrial growth: Rick Mattson, David Laredo, and Carol Lurie (WASH); Sue Gibson (AID/ANE/TR/HN), Carl Bartone (World Bank), Sonia Hammam (AID/Office of Housing and Urban Programs).
- o Energy inefficiency: Suzanne Leonard, Alain Streicher, and Chris Hurst (RCG/Hagler, Bailly, Inc.); Jessica Mathews (WRI).
- o Institutional strategies: Charles Barber (consultant); Eric Chetwynd (AID/S&T/RD), Kirk Talbott, Walter Arensberg, Alan Brewster and Paul Hughes (WRI), Lee Kimball (Council on Ocean Law).
- o NGO developments: David Richards (WRI); Tom Fox and Kirk Talbott (WRI).
- o Hazardous wastes: Richard Carpenter (East-West Center) and Anthony Marcil (World Environment Center); Faith Halter (EPA), Mary Lou Higgins (AID/S&T/FENR).
- o Agricultural chemicals: Mary Lou Higgins (AID/S&T/FENR) and William Barclay (WRI); Paul Hughes and Paul Faeth (WRI).
- o Gender issues: Kathy Parker (consultant); Bruce Horwith (AID/PPC/WID), Anamaria Long (AID/ANE/TR/HR).
- o Non-project assistance: Tim Resch (AID Forestry Support Program); Molly Kux (AID/ANE/PD/ENV).
- o Natural resource economics: Theodore Panayotou (Harvard Institute for International Development); Bob Ichord (AID/ANE/TR/ENR).

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Mohamed El-Ashry, Vice President for Research and Policy Affairs at WRI; Tom Fox, Director of the Center; and Walter Arensberg, Director of the Environmental Planning and Management Project, provided valuable policy and administrative guidance throughout. Many other WRI colleagues provided expert comment on sections of the report and were always willing to give advice and encouragement.

EXECUTIVE SUMMARY

The crucial challenge facing the countries of AID's Asia and Near East (ANE) Region in the 1990s is how to grow at rates that will improve living standards and reduce poverty in a manner that is economically and ecologically sustainable. The region -- which encompasses 1.5 billion people and 15 major countries and stretches from Morocco on the Atlantic Ocean to Kiribati in the South Pacific -- has enjoyed more than 20 years of relatively high economic growth. But this growth has been accompanied by increasing destruction and degradation of the region's natural resources, which now threaten to limit productive activity and close off options for growth in the future. Recognition of these important linkages is continuing to grow throughout the region as better information on the economic costs of inaction is obtained.

Growth in GNP over the period 1980-87 has averaged more than 5 percent per year, ranging from - 0.5 percent in the Philippines to 12.7 percent in Oman. Inflation rates in the ANE region have been remarkably low in comparison to the three-digit rates common in Latin America, and external debt has also been kept within manageable proportions. However, the rapid increase in population (despite declining fertility) has meant that per capita incomes have not risen as fast as desired. In India, total GNP grew at more than 4 percent per year over the past 20 years, but per capita incomes increased by only 1.8 percent per year. Indeed, many rural agricultural workers, particularly those without land or other assets, are not participating at all in the economic growth of the ANE countries.

Natural resources have been the source of much of the growth in income and wealth. Relatively abundant water and good soils, biologically rich coastal zones and well-stocked fisheries, extensive natural tropical forests, abundant wildlife, extensive mineral and petroleum deposits, and other natural conditions have provided opportunities for countries to rapidly expand the production of raw and processed materials, generating increased incomes, employment, and trade. The environment has also been used as a place to dispose of growing amounts of wastes -- agricultural, industrial, and household.

As a result of this resource-based economic growth, a number of countries -- Tunisia, Thailand, Jordan, Oman -- are now characterized as middle-income industrializing; others -- India, Sri Lanka, Morocco, Indonesia, Philippines, Egypt, Yemen, Pakistan -- while still low-income are in a transition from agriculture to industrial economies. Burma, Nepal, and Bangladesh remain low-income agricultural economies.

Resource Conditions, Trends, and Their Economic Significance

If properly priced and efficiently used and conserved, natural resources can be both a source of surplus for growth and a direct source of improvements in the quality of life now and in the future. The problem with the policies and practices in many ANE countries is that the revenues generated from resource extraction are not being invested in maintaining and increasing the productivity of the resource sector.

Four trends in resource misuse and mismanagement seriously threaten sustained economic growth:

(1) Soil and water degradation.

Soil erosion is heaviest in the Asian uplands, home to 27 million people in the Himalayas and another 30 million in the uplands of insular Southeast Asia. In Indonesia, 36 of the country's 125 river basins are considered to have critical erosion problems. In India, 38 percent of rural land – about 100 million hectares – is producing well below potential. In the water-short Near East, groundwater is being rapidly exhausted and, in many places, polluted with agrochemicals or affected by salinization.

The World Bank estimates the cost of replacing soil and nutrients in an 8 million hectare area of the Philippines at \$50/per hectare. On the island of Java, the cost of soil erosion is estimated at \$350-410 million per year: \$323 million from on-site losses in agricultural productivity and between \$25-90 million from off-site damages to irrigation schemes, reservoirs, and harbors.

(2) Destruction of natural forests, wetlands, and coastal zones.

Over the past 30 years, more than one-third of Asia's natural tropical forests have been converted to other uses; still more forest have been left in a degraded state. Nepal is losing 4.0 percent per year; Sri Lanka, 3.5 percent; Indonesia, the ANE country with the largest area of remaining tropical forest with species-rich fauna and flora, about 620,000 hectare per year or 0.5 percent. In the Philippines, forests with commercial-grade timber will be completely logged in ten years if current logging rates continue.

Coastal wetlands, mangroves, and coral reefs are also being rapidly converted and degraded. The majority of reefs in the Philippines are in fair to poor condition: two-thirds of the sites sampled have less than 50 percent live coral cover. Indonesia, the country with the world's largest mangrove

habitat, lost about 19 percent of its mangroves between 1969 and 1982.

The cost of forest and coastal decline, though inadequately measured, is having a serious economic impact. Philippine wood product sales declined by half between 1979 and 1987 in volume and in value because of the lack of high-quality commercial timber. Thailand has become a net importer of wood. Deforestation in Nepal has required women and children to spend ever more time gathering fuelwood over greater distances, making boiled water a luxury for many. Tourism, the number one earner of foreign exchange in Thailand and number five in Indonesia, is often dependent on high quality coastal habitats, good water quality, and the protection of nature. Tin mining (in Indonesia and Thailand), coral mining for lime (in the Philippines), industrial and port expansion (planned in most ANE countries), combined with erosion and agricultural runoff, are threatening remaining coastal resources, including some of the world's most productive fisheries.

(3) Inefficient energy use and industrial pollution.

Rapid industrialization and urban growth have required greatly increased energy use. Energy use in ANE countries grew at 6 percent per year between 1973 and 1986, with much of it inefficiently produced and inefficiently consumed. On average in developing countries, each 1 percent increase in GDP requires an increase in energy inputs of 1.3 percent. Rates were much higher in many ANE countries: 2.4 percent in Bangladesh, 1.8 percent in Thailand, and 1.8 percent in Jordan and Tunisia. ANE countries have become increasingly dependent on fossil fuels for commercial energy, much of it imported. Oil accounted for 47 percent of primary energy supply; coal, 30 percent (most of it produced by India); and natural gas and hydropower, 23 percent. Wood and other biomass fuels remain the major source of energy for the poor. At present, the region's share of global CO₂ emissions from fossil fuel combustion is small, but increasing rapidly; levels of SO₂ and particulates already exceed WHO standards in most major cities for which data are available.

Because of government policies and technical problems, Bangladesh, Egypt, India, Pakistan, Indonesia, and the Philippines face severe shortages of energy, especially of electrical power. Industrial energy consumption per unit of output in Egypt averages 60 percent higher than the international average and costs the economy more than \$1 billion per year through lost foreign exchange earnings. Throughout the ANE region, electric power transmission and distribution losses exceed 20 percent.

Inefficient energy use also leads to a rapid increase in pollution. The Asian Development Bank predicts a five- to ten-fold increase in regional air and water pollution over the next 15 years because of expanding industry and mining and increasing numbers of motor vehicles.

(4) Lack of environmental services.

Less than 50 percent of ANE citizens have access to clean water and less than 17 percent to adequate sanitation. In Bangladesh, India, Nepal, and Pakistan, fewer than 6 percent of rural residents have access to proper sanitation. There is also not enough water to meet other domestic needs – for bathing, cleaning, home gardens, and domestic livestock. In Cairo, improvements in water and sewerage have yet to result in a significant decline in infant and child mortality rates, now among the highest in the world. In Manila, 2.5 million people live in slums or squatter areas: drainage is poor and municipal solid waste and disposal is inadequate. Over 35 percent of Jakarta residents live in slums located along drainage canals and less than one-third have public water hookups and sewerage. Karachi contains one of the largest concentrations of squatter settlements in the region. Only one-third of the city has solid waste collection and about the same percentage has sewerage.

The importance of water, for women in particular, cannot be overstated. WHO estimates that three-quarters of all illnesses and 80 percent of child deaths are associated with unsafe excreta disposal, poor hygiene, and inadequate water supplies. Sickness and chronic illnesses limit opportunities for education, reduce worker productivity, and thus reduce the prospects for development.

There are five general constraints on effective natural resources management in the ANE region: market failures, policy distortions, institutional inadequacies, inadequate information and analysis, and lack of popular participation in decision making and management. These factors underlie virtually every worsening environmental trend we have reviewed. They are also problems about which something can be done. Indeed, in this report we identify 20 specific opportunities for addressing them. (See Box 1.)

Responding to the Challenge: Opportunities for Action

What will it take to address the difficult environmental and natural resource problems facing ANE countries? How can policies be reformed and institutions – governmental and non-governmental – be strengthened to deal with the constraints

to wise resource use and management? What kinds of training, research, education, and public outreach are required within a country and in local areas to build support for policy reform, institutional change, and better on-the-ground management? How can these changes be encouraged by the programs and policies of AID and of other donors? These are the kinds of questions we asked and attempted to answer in the process of developing a set of 20 opportunities for AID's ANE Bureau.

Opportunities were chosen based on the urgency and importance of the problem, the availability of models and approaches that have proven successful within the region and have addressed the basic constraints, and the expectation that governments, the private sector, non-governmental organizations, the affected public, and donors working together can make a measurable difference. Most of these activities, and many others, are necessary if substantive and long-term change is to occur. (A detailed checklist of opportunities and activities is included in Appendix 1; a complete discussion with examples is found in Chapters III and IV.)

(1) Market Failures: Markets do not fully reflect the value of forests, water and watersheds, coastal ecosystems, and other natural systems: the products they produce and the environmental services they provide. Neither do they reflect the real and substantial economic costs of environmental degradation and until these externalities are accounted for, the market will not be able to realize its potential as the central mechanism for promoting sustainable use and conservation.

This problem can be addressed in part through economic liberalization and increased private sector participation in the economy. More specifically, by incorporating environmental considerations into economic policy reform, expanding policy research and policy dialogue, and taking advantage of adjustment lending by multilateral financial institutions. Clarifying and expanding ownership rights to resources is also essential to developing more efficient markets.

Strengthening the role of the market is becoming an important objective of national policy in many ANE countries. In the Philippines, a policy of variable irrigation fees based on water-volume use has been adopted that more directly reflects the cost of water development. In Tunisia and Morocco, land policy is being restructured (through both land consolidation and provision of greater tenurial security) to provide better incentives for sustainable investments in land productivity. Both Thailand and Nepal are instituting systems for providing secure tenure on forest lands. In Nepal, recent legal and policy changes mandate a return of many forest areas to legally constituted forest user groups. In Pakistan, the government is encouraging the private sector to develop gas production and power generation at its low-quality natural gas fields near Khaipur in Upper Sind.

**BOX 1. Opportunities for Environment and Natural Resource
Management in the ANE Region**

Cross-Cutting Opportunities

1. Incorporating Environmental Considerations into Economic Policy Reform
2. Strengthening Environmental Policies
3. Integrating Environmental Concerns into Sectoral Programs
4. Clarifying Ownership and Control of Land
5. Mobilizing Private Energies for Environmental and Natural Resources Management
6. Strengthening Public Awareness and Education
7. Training for Natural Resources Management

Environment and Natural Resources Management Opportunities

8. Sustainable and Equitable Management of Tropical Forests
9. Managing Coastal Resources
10. Conserving Biological Diversity
11. Developing Policies and Programs for Sustainable Agriculture
12. Restoring the Productivity of Degraded Agricultural Lands
13. Making Greater Use of Integrated Pest and Soil Fertility Management
14. Sustaining Water Supplies for Multiple Use
15. Improving Rural Peoples' Access to Clean Water
16. Incorporating Environmental Considerations in All Major Energy Decisions
17. Conserving Energy through Greater Efficiency in Production and Use
18. Increasing Production and Use of Cleaner Fuels
19. Providing the Urban Poor with Basic and Affordable Environmental Services
20. Controlling Toxic Chemicals and Hazardous Wastes

The Philippines, Indonesia, and Thailand are initiating resource accounting studies to better measure the value of resources within their national economies, which will strengthen their capacity to analyze economic and environmental policy options.

(2) Policy Distortions: Many ANE government policies seek to increase production of agriculture, forestry, fisheries, and energy and minerals through subsidies, tax credits, concessionaire leases, and price controls. On the whole these policies tend to favor environmentally unsound practices while they discriminate against the poor and waste budgetary resources. Some policies actually promote inefficient use of natural resources, so that the production of crops, timber, and fish does not even meet short-term goals. Policy distortions are caused by faulty assumptions, lack of information on how individuals and institutions respond to incentives, and a lack of accountability.

Activities aimed at reform include: policy research that will more clearly indicate winners and losers, how policies can stimulate private sector conservation and management, and how they can be changed; supporting NGOs that develop independent analyses of environment and resource problems; increasing public environmental education and awareness; strengthening and rationalizing environmental law, regulations, and impact assessment procedures; and increasing public access to information about development decisions.

In many ANE countries policy reform is occurring for economic as well as environmental reasons. Indonesia has reduced pesticide and energy subsidies as a budgetary measure and is considering a restructuring of its timber concession system as a way to generate revenues for reforestation and other management goals. Pakistan is gradually eliminating subsidies on fertilizers, pesticides, and energy and is increasing water charges and other irrigation levies.

Recent studies have examined the linkages between a variety of policy measures and deforestation in Indonesia and the Philippines. Others have analyzed the environmental effects of irrigation and pesticide pricing and subsidy policies in Indonesia, Egypt, and Pakistan.

(3) Institutional Inadequacies: Governments, businesses, schools, cooperatives, religious institutions, and non-governmental organizations as well as households influence the way resources are used and managed. Strategies to promote sustainable development in the ANE region must address the strengths, weaknesses, and potential of these institutions. There are three basic problems that have to be dealt with in strengthening institutions to address environment and resource issues: the laws and regulations that mandate, proscribe, and otherwise direct institutional and individual behavior; the organizational structures and ethics that influence both public and private sector activities; and the capacities and skills

of individuals within institutions.

Opportunities for strengthening institutions include: developing environmental law, establishing effective environmental agencies, improving environmental impact assessment procedures, strengthening the environmental capacities of provincial and local authorities and improving the dissemination of information for natural resource management. Mobilizing the energies of private enterprise and the NGO sector, enhancing the role of women, and making greater investments in training -- professional and on-the-job -- will be needed.

Most ANE countries have passed basic environmental laws in the past decade and are in the process of translating legal mandates into specific criteria, standards, and workable enforcement mechanisms. The Egyptian Environmental Affairs Agency, created in 1982, has a mandate to define priorities, prepare national environmental plans, propose laws, sponsor public awareness activities, and monitor implementation by other government agencies. Like many other countries, enforcement and regulatory power is located elsewhere.

In the Philippines, in an effort to consolidate management of the environment with other natural resources, the Department of Environment and Natural Resources is decentralizing many of its responsibilities to the Regional Environment and Natural Resource Offices; it is too soon, however, to judge the viability of this model.

Developing incentives for private enterprise and strengthening NGO management will directly support resource management. NGOs most need managerial and technical training, and they need to be free of political hindrance. The Bangladesh Rural Advancement Committee, with the support of government, is establishing a Center for Rural Management to train staff in NGOs, rural banks, peoples' organizations, and central and local government officials to help solve local development and environment problems. The Development Innovations and Networks, located in Sri Lanka, is an international network of NGOs rendering support services to local development NGOs. Other more traditional management institutions, such as Indian Institute of Management, are also expanding their assistance to NGOs.

(4) Inadequate Information: Available data clearly indicate that resources are rapidly being used and degraded, but much of this information is incomplete, imprecise, and out-of-date. Three problems are evident. Compared to other sectors, data collection for environment and natural resources management is in its infancy and is not attuned to the needs of policy makers nor to those who are intent on managing resources in a more sustainable manner. (National income accounts, for example, fail to adequately reflect resource depletion and degradation, which means policy makers are not aware of just how important natural resources

and environmental quality are to the economic growth of their countries.) Information is not sufficient to measure performance, and therefore, governments and private enterprises are not easily held accountable for their actions and programs. Third, much information is not made available to the public.

Actions for improving the quality, quantity, and usefulness of information include: strengthening the environmental mandate to require periodic data gathering and public reporting; providing support for environmental research and training; expanding environmental monitoring programs of government and private enterprise; requiring that environmental considerations be routinely addressed in all major sector decisions, particularly in the development of energy; and expanding public education and literacy programs.

Improving the quality of resource and environmental analysis should start now with existing activities. For example, each of Indonesia's 27 provinces already produces an annual statistical report on population and environment. Provincial governments could be encouraged to go beyond the data collection stage and analyze resource problems and their impact on society and report this information to Jakarta.

In recognition of the link between environment and development, ANE countries are engaged in preparing or implementing the recommendations of environmental profiles, conservation strategies, and other resource assessments. In India, the important role of environmental assessment has been taken on by an NGO, the Centre for Science and Environment.

Sri Lanka's Coastal Conservation Department has collected extensive information on coastal ecosystems, analyzed the data, and used the results to promote the formation of "special management zones", which will permit development to proceed in a way that limits damage to natural systems. In Indonesia, five Environmental Study Centers have begun to establish marine science research programs, whose findings will be used to assist coastal resource managers.

The Asian Forum of Environmental Journalists, established in 1988, serves as a network between national groups that sponsor seminars for journalists to improve the quality of investigative reporting and expand the coverage of natural resource and environmental issues.

(5) Lack of Popular Participation: Ultimately, the fate of the region's resource base -- and hence, the prospects for sustainable economic development -- will be determined by the billions of everyday actions taken by individuals responsible for managing public lands, private corporations, or their own lands. The needs and interests of the majority in most ANE countries are not adequately

represented in the policy making and resource allocation processes. Nor do local communities have the tools and incentives to fully participate in the management of local resources.

Actions are needed to make political systems more open and representative; to make courts more accessible, efficient, independent, and responsive to local environmental concerns; to reform economic policy to increase the role of the market, thus increasing free choice; to encourage government to transfer resource ownership to individuals and local communities; and to look on non-governmental organizations as partners rather than as threats to power.

In Indonesia, the 1986 Regulation on Environmental Impacts requires all projects to have a preliminary environmental report to determine whether significant environmental impacts are expected. The existence of the law has recently been utilized by NGOs to bring a lawsuit against a rayon and pulp factory project that did not conduct an environmental analysis. While they lost the case on its merits, the court agreed that NGOs had standing under Indonesian law to sue on behalf of the environment.

For government to transfer property rights to local communities takes a remarkable change in policy and leadership. Thailand, the Philippines, and Indonesia are experimenting with a variety of stewardship contracts for reforestation of degraded lands and for management of buffer zones around protected areas. On Java, the state forestry corporation has launched a social forestry program that incorporates community needs into timber plantation management. The opportunities are numerous, and existing initiatives have only begun to scratch the surface of the problem.

Urban neighborhoods, too, can help to create their own wealth by developing improved water and sanitation systems. In Pakistan, the Orangi Pilot Project, located in a Karachi slum, showed that local groups were able to construct sanitary latrines and underground sewage pipes when provided with useful information and simple plans. Residents paid for the system in the form of labor, management, and organization: the municipal government helped pay for technical expertise. And, because the residents were squatters, it was essential that the local government recognized their property rights.

Priorities for AID

AID cannot possibly address all of the important resource and environment issues in each country, but there is much the Agency can do. By choosing carefully, AID can successfully strengthen ANE institutions capable of analyzing, developing, and reforming policies that affect environmental management, and it

can promote an expanded role for NGOs and the private sector in natural resources management.

Five principles for integrating environmental and natural resource management in economic development need to be applied at the regional and national level.

- (1) Sustainable economic development is based on the wise management and efficient use of natural resources as well as the conservation and restoration of basic environmental systems. Likewise, preservation of the environment is only feasible when accompanied by economic growth and rising standards of living.
- (2) Reconciliation of economic growth and its environmental underpinnings require the merging of environmental management and economics in decision making.
- (3) Environmental and natural resources strategies require action at local, national, and international levels.
- (4) The full range of human and institutional resources must be mobilized to work on environmental issues. This includes the private business sector, NGOs, local communities, and international organizations as well as national governments.
- (5) To achieve sustainable growth, development assistance must place environmental concerns in the mainstream of economic development.

To translate these broad themes into more specific actions in specific countries requires a number of additional steps, most of which will need to be taken by AID missions and headquarters in cooperation with country representatives and with the many groups within the United States that support and have a stake in development. A series of questions should be asked, the answers to which will help target U.S. assistance in the areas it will do the most good.

- (1) Which resources occupy the most direct, strategic position in present and future economic development?
- (2) Which resources and environmental services are most important in their linkages to the growth and sustainability of industrial and service sectors?

- (3) Which resources and environmental systems are most critically and irreversibly threatened in a national or global context?
- (4) What are the most serious environmental threats to human health and other factors that help determine worker productivity and the quality of life?
- (5) How strong is host-country policy commitment and awareness?
- (6) What is the extent of in-country institutional capacities to manage resources and what interventions are most strategic in strengthening that capacity?
- (7) Are there specific current events or circumstances that provide an especially useful window of opportunity?
- (8) How does the proposed initiative fit Bureau and Mission priorities and programs?
- (9) What is the U.S. comparative advantage for addressing this issue?
- (10) Will AID assistance help to implement or leverage other donor support?

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CHAPTER I

THE CHALLENGE OF SUSTAINABLE ECONOMIC DEVELOPMENT

THE CHALLENGE OF SUSTAINABLE ECONOMIC DEVELOPMENT

The crucial challenge facing the countries of AID's Asia and Near East (ANE) Region in the 1990s is how to grow at levels that will improve living standards and reduce poverty in a manner that is economically and ecologically sustainable. The region -- which encompasses 1.5 billion people and 15 major countries stretching from Morocco on the Atlantic Ocean to Kiribati in the South Pacific (See Map 1-1.) -- has enjoyed three decades of relatively high economic growth. But this growth has been accompanied by increasing destruction and degradation of the region's natural resources, which now threaten to limit productive activity and close off options for growth in the future.¹

The challenge for the 1990s is formidable. Populations in the region are expected to increase by 21 percent over the next decade, and by 62 percent by 2025 with an increasing proportion in urban areas. Economic growth will need to be sustained at current rates or higher for continued improvement in human welfare. This demographic, urban, and economic growth will intensify pressures on the natural resource base.

Despite the magnitude of the task, there are a number of positive trends. The region has a labor force that is increasingly well-trained, a growing industrial and service sector, burgeoning infrastructure and communication facilities, economic markets supported by government policies that are becoming more open to competition and more responsive to consumer demands, and a growing awareness of the need for natural resources management. But can these countries -- through government policies, private initiatives, and in some cases with the support of the international donor community -- reorient their policies, institutional arrangements, and educational systems in a way that will reduce the pressures on the natural resource base and lead to sustainable economic growth?

A. SUSTAINABLE ECONOMIC GROWTH

In 1987, GNP per capita in the ANE region ranged from U.S.\$160 in Nepal and Bangladesh to U.S.\$5,810 in Oman. In comparison to other regions in the developing world, economic growth in the ANE region has been relatively high, averaging 4.5 to 5 percent in real GNP during the late 1960s, 1970s, and 1980s. Annual growth rates in 1980-87, as shown in Table 1-1, ranged from -0.5 percent in the Philippines to 12.7 percent in Oman. Furthermore, inflation rates, ranging from a low of 2.1 percent in Burma to a high of 16.7 percent in the Philippines during the 1980s, are remarkably low by comparison to the three-digit rates common in Latin America. External debt has also been kept within manageable proportions,

although it increased dramatically in the 1980s and may pose a problem for the future.

Rapid population growth in the region has meant that per capita incomes have not risen as fast as total GNP. In India, for example, total GNP grew at more than 4 percent per year over 1965-86, but per capita incomes increased by only 1.8 percent per year. In Bangladesh, economic growth averaged 3 percent per annum over the same period, but when adjusted for population, growth was only 0.4 percent. Indeed, many of the rural agricultural workers, particularly those without land or other assets of their own, are not participating in the growth of the ANE economies.

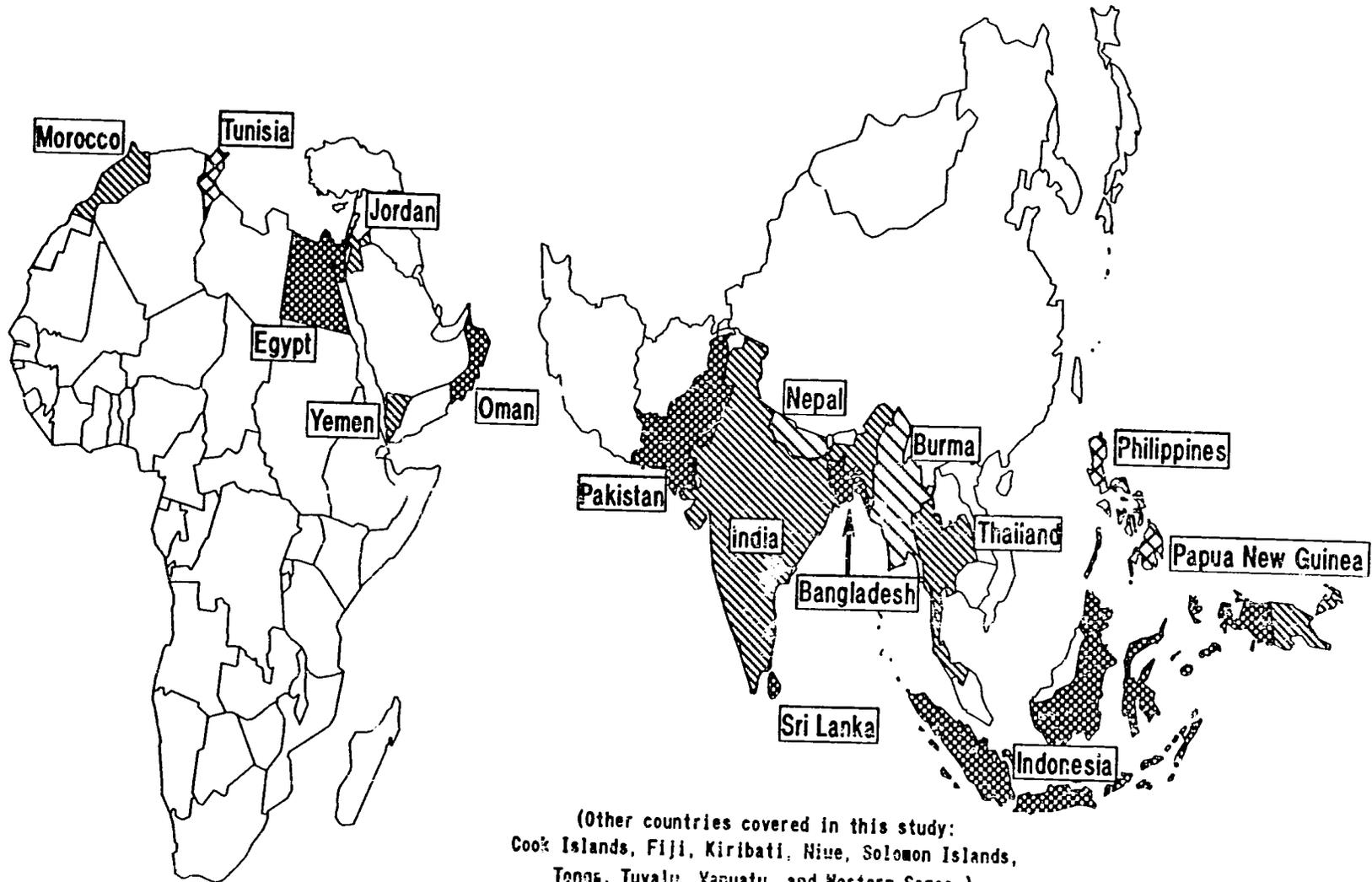
Although annual rates of population growth for the ANE countries as a whole are declining (from a regional peak of 2.4 percent in 1965-70 to 1.9 percent in 1985-90), the very large base means that millions of people are added each year, intensifying pressures on the economy and the natural environment. (See Figure 1-1.) India, for example, has cut its growth rate impressively, from 2.3 percent to 1.7 percent over the past 20 years, but it still adds about 14 million people to its population each year. South Asia as a whole accounts for more than two-thirds of the population of the region, but has only about half the land area. As a result, population densities in this subregion greatly exceed those in other subregions. (See Table 1-2.) Bangladesh, for example, averages 8,400 people per sq. kilometer of land; India, 2,740 people. The Near East has considerably lower population densities, but these figures can be misleading. Virtually all Egyptians, for example, live along the flood plains of the Nile River.

The combination of rapid economic growth, increased population, and inappropriate economic and environmental policies has resulted in growing depletion and degradation of natural resources and a substantial increase in pollution in most ANE countries. Many resources are being used in inefficient and unsustainable ways. Thus, tropical forests have been logged inefficiently and destructively; surface and groundwater supplies have been polluted and overdrawn; wildlife has been consumed without regard to regeneration; habitats have been destroyed; soils degraded; pesticides and fertilizers misused; energy resources have been wasted in inefficient means of production and consumption; cities polluted from uncontrolled sewage and industrial wastes; and coastal areas threatened with development that will destroy the features that make them valuable.

To date, environmental considerations have played little role in the formulation and implementation of economic policies in the region, partly because the full costs and benefits of natural resource and environmental trends have not been understood and partly because policy changes are generally made in response to immediate political and economic pressures, with little regard for the

Map 1.

Countries of the A.I.D. Asia Near East Region



(Other countries covered in this study:
Cook Islands, Fiji, Kiribati, Niue, Solomon Islands,
Tonga, Tuvalu, Vanuatu, and Western Samoa.)

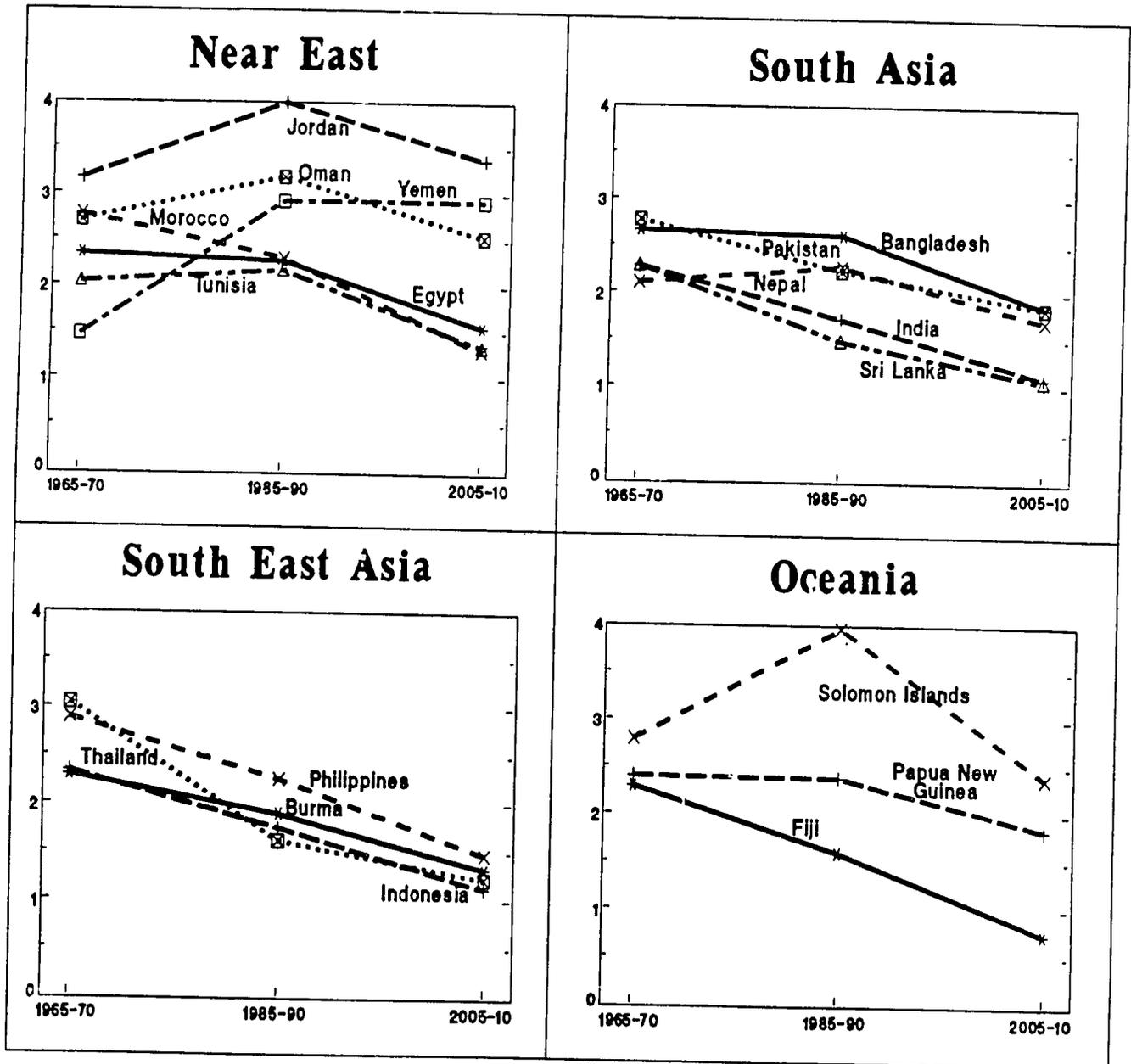
TABLE 1-1

ECONOMIC CONDITIONS

	PRODUCTION			INFLATION			DEBT			
	GNP Total	GDP Growth Rate		GNP per capita	Average Annual (GDP deflator)		Total External Debt (millions \$US)		Service (of long term debt) as % of Exports	
		1987	1965-80		1980-87	1987	1965-80	1980-87	1980	1987	1980	1987
ANE NEAR EAST										
Egypt	34068	6.8	6.3	680	7.3	9.2	17972	40,264	18	22
Jordan	5928	—	4.3	1560	—	2.8	1759	4,564	8	22
Morocco	14213	5.4	3.2	610	6.1	7.3	X	20,706	36	31
Oman	7553	15.2	12.7	5810	17.6	-6.5	603	2,879	5	11
Tunisia	8968	6.6	3.6	1180	6.7	8.2	3684	6,909	13	29
Yemen	5015	—	5.6	590	—	11.4	986	2,389	6	25
ANE SOUTH ASIA										
Bangladesh	16976	2.4	3.8	160	14.9	11.1	4030	9,506	8	24
India	239250	3.7	4.6	300	7.6	7.7	19334	46,370	9	24
Nepal	2816	1.9	4.7	160	7.8	8.8	205	947	2	10
Pakistan	35875	5.1	6.6	350	10.3	7.3	9923	16,299	20	27
Sri Lanka	6560	4.0	4.6	400	9.4	11.8	1923	4,733	6	20
ANE SOUTHEAST ASIA										
Burma	* 7860	—	—	* 200	—	* 2.1	1493	4,348	20	59
Indonesia	77130	8.0	3.6	450	34.2	8.5	20888	52,581	8	33
Philippines	34456	5.9	-0.5	590	11.7	16.7	17387	29,962	7	26
Thailand	45560	7.2	5.6	850	6.3	2.8	8258	20,710	5	21
Source: IBRD WDR 89 Table 1			Source: IBRD WDR 89 Table 1			Source: 1980 = WRI WRR 88-89 Table 14.2 1987 = WDR 89 Table 21				
note: * =1986 figures										

Figure 1-1

Population Growth Rates in the ANE Countries (1965-2010)



Source: Prospects of World Urbanization, Revised as of 1984-85

TABLE 1-2

POPULATION IN ANE COUNTRIES

	TOTAL (millions)	GROWTH (percent per year)			DENSITY (Persons/ 1000 ha)	LABOR FORCE Average annual growth (percent)	URBAN POPULATION as Percentage of Total Population				
		Total	Urban	Rural			1989	1985-2000	1960	1990	2020
ANE NEAR EAST											
Egypt	51.4	2.3	5.3	1.4	516	2.7	43	49	68		
Jordan	4.1	4.0	5.1	1.8	424	4.2	43	68	82		
Morocco	24.1	2.3	3.9	0.9	540	3.1	29	49	68		
Oman	1.4	3.2	6.8	2.8	67	2.7	4	11	28		
Tunisia	7.7	2.2	3.6	0.2	497	2.8	36	61	77		
Yemen	7.7	2.9	7.3	1.7	394	3.4	3	25	49		
ANE SOUTH ASIA											
Bangladesh	112.3	2.6	5.4	2.2	8389	3.0	5	14	36		
India	813.4	1.7	3.6	1.0	2736	1.8	18	28	54		
Nepal	18.1	2.3	6.7	1.9	1320	2.3	3	10	23		
Pakistan	109.7	2.2	3.7	1.6	1424	2.8	22	32	57		
Sri Lanka	17.2	1.5	1.7	1.4	2639	1.6	18	21	43		
ANE SOUTHEAST ASIA											
Burma	40.1	1.9	2.5	1.7	610	1.8	19	25	60		
Indonesia	178.5	1.7	4.3	0.8	985	2.2	15	29	56		
Philippines	59.7	2.3	3.6	1.3	2001	2.4	30	42	66		
Thailand	54.8	1.6	4.3	0.9	1071	1.7	13	23	42		
<p>Source: WRI WRR 88-89 Table 15.1</p> <p>Source: Prospects for World Urbanization As Assessed in 1984</p> <p>Source: WRI WRR 88-89 Table 16.2</p> <p>Source: WRI WRR 88-89 Table 16.1</p> <p>Source: IARD WDR 88 Table 31</p> <p>Source: WRI WRR 88-89 Table 16.2</p>											



long-term consequences. Nevertheless, ANE countries are finding that single-minded pursuit of rapid economic growth, without concern for who gets the income and what happens to the environment in the process, is short-sighted and detrimental. Increasingly, they are redefining their goals for development in terms of sustainability.

Just what does sustainable development imply?

First, that there is economic growth to meet human needs and aspirations. People want more goods and services. It takes production growth and open, well-functioning markets to increase the goods and services available to a growing population, to address poverty, and to meet demands for a better life.

Second, that there is a more equitable distribution of the proceeds of growth within and between nations. To ensure social and political stability, poverty must be reduced, and social and gender inequities addressed.

Third, that development support and be supported by open societies and an increase in democratic pluralism -- i.e., that political systems support human rights and alternative ways of thinking, and that citizens have the opportunity to participate in decision making.

Fourth, and not least important, that the natural resource base so necessary to the sustainability of economic growth and quality of life is conserved and enhanced. Natural resources include both the material supplied by nature -- land, water, air, energy, minerals, and living resources -- and the environmental services that are essential for the continued functioning of the biosphere. All are important ecologically, socially, and economically.

B. THE NATURAL RESOURCE BASE

The principal natural resources in the ANE region include the renewable resources of cropland, forests, range, freshwater, fisheries, wildlife, and coastal habitats as well as the non-renewable resources of fossil fuels and minerals. These resource endowments have determined to a considerable extent the path and pattern of economic growth in the ANE countries, especially in the early stages of development.

Croplands, which are the most important in terms of economic production, cover approximately 28 percent of the ANE region. The largest areas are in South Asia, particularly India, which has 168 million hectares or about 57 percent of its territory in crops (See Table 1-3.) Bangladesh, with 6 million hectares, has about 65 percent of its land in crops, though because of the country's large and rapidly growing population, this amounts to less than .1 hectare per person. Irrigated lands are an increasing percentage of cropland in virtually all ANE countries, and on these lands increases in productivity have been greatest.

Forest and woodlands are the major type of land cover in Southeast Asia. Tropical forests – tropical monsoon, tropical deciduous, and equatorial rain forest - are the dominant ecosystems and a major source of forest products. Despite rapid rates of deforestation, Indonesia (117 million hectares) and Burma (32 million ha.) have about one-quarter of the world's remaining tropical forest. Much of India's remaining forest land is subtropical open woodlands and montane forest. Forests in the Near East are limited to woodlands, which are used for grazing, fuelwood, and watershed protection. Forests, particularly tropical moist forests, provide habitat for a substantial and diverse number of biological species.

Pastureland, whose principal use is forage to support livestock and wildlife, is found in all regions. In Morocco, this is the major use of land. The Near East, in particular, contains extensive areas of arid and semi-arid environments in which water deficiency is a critical constraint to vegetative growth for most of the year. Many of these lands are classified as "other," meaning they are of little direct agricultural use.

Statistics on the principal uses of land, compiled by FAO and shown in Figure 1-2, indicate the diversity within the region. They also reveal that in 6 countries – Egypt, Oman, Jordan, Pakistan, Nepal, and Yemen – less than half the land is suitable for agriculture, forestry, or grazing because it is either too dry, barren, or in the case of Nepal, the terrain is too steep, or rugged or the conditions too harsh to be settled.

Although all ANE countries except Nepal have a marine coast, the most extensive coastal resources and fisheries are located in Southeast Asia and the Pacific Islands. Indonesia and the Philippines, with extensive coastline and internal seas, have coral reefs, mangroves, and seagrass beds, which support species-rich fisheries and fish stocks. The isolated, low-lying and land-poor atoll nations of the Pacific – Kiribati, Solomon Islands, Fiji and others – are almost entirely dependent on their coastal and marine resources.

Freshwater resources, measured in cubic kilometers per year, depend on annual precipitation and across-border river flows. The Near East countries have much less water than the other regions, and most of it is developed. Both South

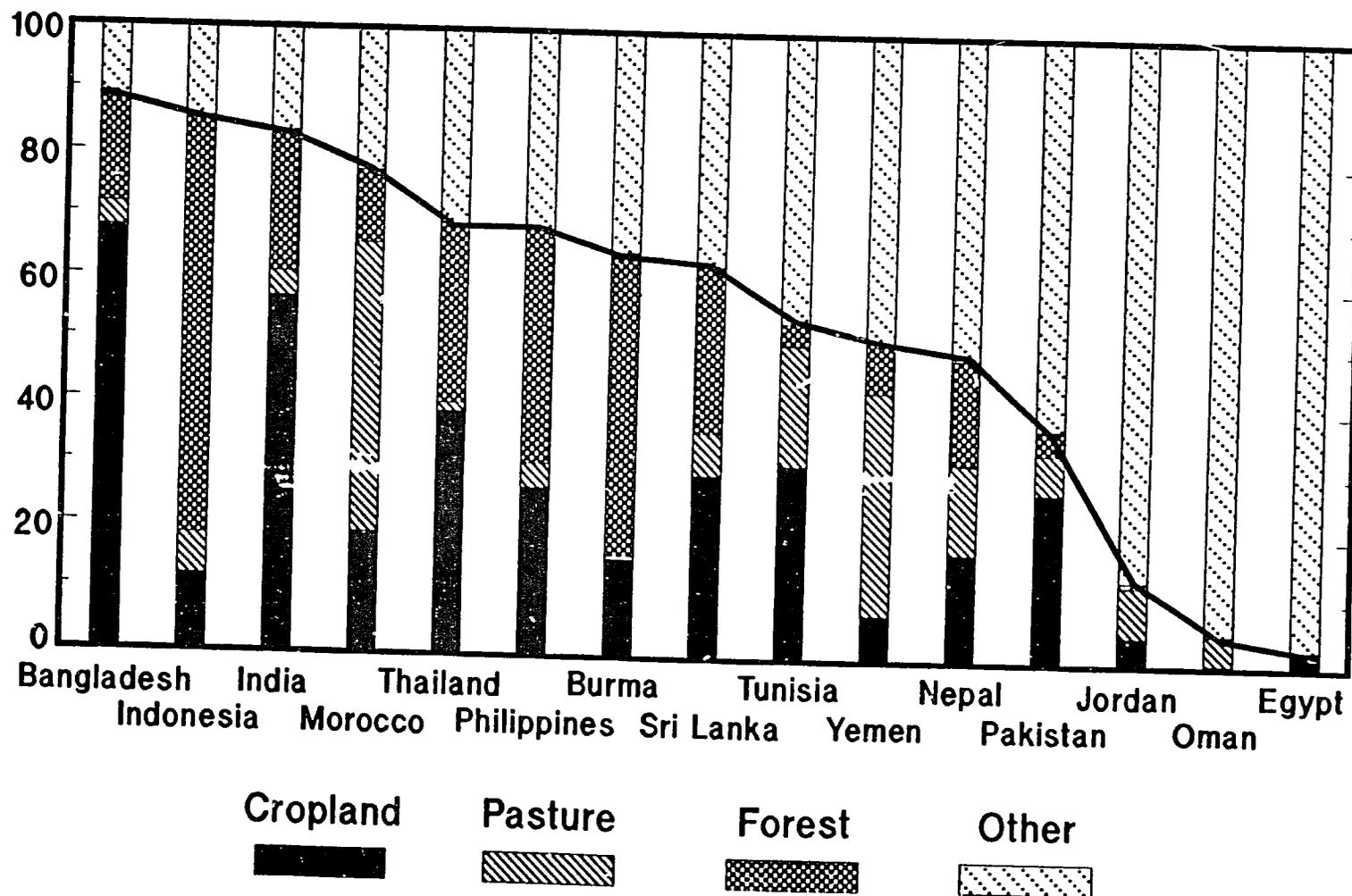
TABLE 1-3

THE RESOURCE BASE IN ANE COUNTRIES

	CROPLAND		PASTURES		FORESTS		FRESHWATER (Internal Renewable plus River Flow)		FISHERIES Avg.		PROTECTED AREAS		ENERGY		
	Total (1000 hectares)	Per Capita (hectares per person)	Total (1000 hectares)	Per Capita (hectares per person)	Total (1000 hectares)	Forest Cover (% of total)	Total (cubic kilometers per year)	per capita 1989 (thousand cubic meters per year)	Length of Marine Coastline (kilometers)	Avg. Annual Marine Fish Catch (1000 mt)	Protected Parks and Coastal Areas (has)	Percentage of National Area Protected	Coal (Lignite, Recoverable and Sub- bituminous) (million mt)	Crude Oil Proved Reserves (million mt) (1984)	Hydro- electric Potential (mega- watts)
ANE NEAR EAST															
Egypt	2,477	0.05	0	0.00	0	0.0%	58.3	1.13	2,450	26	616,100	0.62%	25	400	3210
Jordan	416	0.12	330	0.09	50	0.5%	0.7	0.17	26	0	34,300	0.35%	0	X	12
Morocco	8,375	0.37	15,300	0.68	3236	7.3%	29.7	1.23	1,835	463	294,434	0.66%	178	0	2453
Oman	44	0.03	1,000	0.77	2013	9.5%	2.0	1.42	2,092	105	54,000	0.25%	0	480	X
Tunisia	4,768	0.65	3,020	0.41	297	1.9%	4.4	0.56	1,148	77	56,455	0.36%	0	200	65
Yemen	1,831	0.22	7,000	0.85	10	0.1%	1.0	0.13	523	17	0	0.00%	0	X	X
ANE SOUTH ASIA															
Bangladesh	9,127	0.09	600	0.01	927	6.9%	1357.0	12.08	580	169	94,961	0.71%	1054	X	800
India	168,550	0.22	11,900	0.02	57234	19.3%	1850.0	2.27	7,000	1673	12,910,021	4.34%	27912	471	100000
Nepal	2,323	0.14	1,850	0.11	2121	15.5%	170.0	9.42			964,887	7.05%	0	X	18250
Pakistan	20,423	0.21	5,000	0.05	2480	3.2%	298.0	2.72	1,046	306	7,290,580	9.36%	145	13	19600
Sri Lanka	2,198	0.14	439	0.03	1659	25.6%	43.2	2.51	1,340	155	687,028	10.61%	0	X	715
ANE SOUTHEAST ASIA															
Burma	10,068	0.26	361	0.01	31941	48.6%	1082.0	26.99	3,060	469	3,056	0.00%	5	4	30000
Indonesia	20,680	0.12	11,967	0.07	116895	64.5%	2530.0	14.17	54,716	1732	13,590,792	7.50%	23232	1200	80936
Philippines	10,150	0.18	1,140	0.02	9510	31.9%	323.0	5.41	36,289	1330	498,947	1.67%	170	3	3766
Thailand	19,553	0.37	308	0.01	15675	30.6%	110.0	2.01	3,219	2012	4,015,912	7.85%	15	12	20148
	Source: WRR 88-89 Table 16.1		Source: WRR 88-89 Table 16.1		Source: WRR 88-89 Table 18.1		Source: WRR 88-89 Table 21.1		Source: WRR 88-89 Table 22.1		Source: WRR 88-89 Table 19.1		Source: WRR 88-89 Table 20.2		
1983-85 land use avg / 1986 pop															

Figure 1-2

Land Use in ANE Countries 1985



Source: FAO Production Yearbooks

and Southeast Asia have extensive freshwater resources and considerable irrigation and hydroelectrical potential. In South Asia, excessive water is as much of a problem as inadequate supplies. These countries, particularly Bangladesh and India, have more floods and droughts than countries in Southeast Asia or the Near East.

All three regions have substantial fossil fuel reserves. Indonesia, Egypt, Tunisia, and Yemen export petroleum. Pakistan, India, Bangladesh, Thailand, Burma, and Jordan have natural gas reserves. India has an estimated 27.9 billion metric tons of coal deposits; and Indonesia, Thailand, the Philippines, Bangladesh, and Pakistan also have significant reserves.

Table 1-4 offers a typology of ANE countries according to resource endowment. It is based on an analysis of per capita abundance of 15 natural resources, both renewable and non-renewable. (See Appendix 3 for detailed statistics.) Certain resources for which the spatial dimension is important (e.g., forest cover, wildlands, protected areas) are expressed in units of land area rather than in per capita terms. Only forest resources are expressed in both dimensions. Each country in the ANE region received a ranking for each of the 15 resources analyzed in different ways to produce 19 indicators. A rank of 1 indicates that a country is the most richly endowed (or the least threatened) in the region.

The overall resource rank for the major ANE countries is shown in Table 1-4. It was derived by adding the country ranks for the 19 indicators, dividing by 19 to obtain the average rank, and assigning new country values based on average rank. These summary rankings can be used to group ANE countries into one of four categories according to their natural resource endowment:

- o Countries very rich in natural resources: Thailand and Indonesia;
- o Countries rich in natural resources: Burma, Philippines, Morocco, Pakistan, Tunisia, and Oman;
- o Countries poor in natural resources: India, Egypt, Sri Lanka, Yemen, and Nepal; and
- o Countries very poor in natural resources: Jordan and Bangladesh.

This breakdown is more or less what one would expect. Thailand and Indonesia are unquestionably the richest in per capita resource endowment, while Jordan and Bangladesh are the poorest. Moreover, the five countries classified as resource-rich clearly have more resources to work with than the six classified as resource-poor.

C. THE ROLE OF NATURAL RESOURCES IN THE ECONOMIES OF THE ANE REGION

As Table 1-4 shows, the relationship between natural resource endowment and economic growth is neither constant nor always positive. In terms of per capita resource endowment, for example, South Asia emerges as the poorest region. This position corresponds to the relative income position of South Asia in the ANE region. But the resource-poor Near East has by far the highest per capita incomes and some of the fastest growth rates, while resource-rich Burma has one of the lowest levels of income and a low rate of economic growth.

In the presence of international trade, a rich endowment is neither a necessary nor a sufficient condition for economic growth. This can readily be seen by comparing the Philippines with Japan, or Burma with South Korea. In fact, a rich resource base may promote over-reliance on resource extraction, which may lead to inefficient use and degradation of resources and to stagnation or even decline in the non-resource sectors. This was the case in the years after the oil price boom in Mexico, Nigeria, and, to some extent, Indonesia. The Philippines, once a resource-rich country, has squandered much of its natural wealth through mismanagement of both nature and the economy.

Whether a rich resource endowment promotes economic growth depends not so much on the resources themselves, but on how resources are being valued, used, and managed; and that depends principally on the economic policies and institutions of a country. If properly priced and efficiently used, natural resources can be both a source of surplus for growth and a direct source of improvements in the quality of life. The problem with many resource-rich developing countries is that the revenues generated from resource extraction are consumed rather than reinvested, or too little is invested in maintaining and increasing the productivity of the resource sector. Furthermore, the direct contribution of natural resources and the environment to the quality of life is poorly measured or ignored.

The importance of natural resources to the economies of the ANE region is most obvious in the agricultural sector. While the region has moved over the past 20-25 years from a largely agrarian economy to a mixed economy which includes industry and services (See Table 1-5), the contribution of agriculture (including fisheries and forest production) to gross domestic product (GDP) continues to be significant. In the early 1960s, agriculture accounted for between 30 and 60 percent of GDP in South and Southeast Asia and between 20 and 30 percent in the Near East. By 1986, with the exception of Burma and Bangladesh, the share of agriculture was under 35 percent in all three subregions. The most dramatic change took place in Thailand, where the share of agriculture declined from 40 percent to 17 percent of GDP. The contribution of the agricultural sector in

Table 1-4

A TYPOLOGY OF ANE COUNTRIES BASED ON RESOURCE ENDOWMENT AND COMPARISON WITH INCOME PER CAPITA

	RENEWABLE RESOURCE SCORE RANK		NON-RENEWABLE RESOURCE SCORE RANK		TOTAL RESOURCE SCORE RANK		AVERAGE INDICATOR RANK	INCOME PER CAPITA (1987) RANK US\$	
BY ENDOWMENT									
VERY RICH									
Thailand	60	2	28	1	38	1	4.6	4	850
Indonesia	58	1	37	2	95	2	5.0	8	450
RICH									
Burma	65	3	51	6	116	3	6.1	12	200
Philippines	74	4	55	8	129	4	6.8	7	590
Morocco	76	5	56	9	132	5	6.9	6	610
Pakistan	80	7	52	7	132	5	6.9	10	350
Tunisia	86	8	49	5	135	6	7.1	3	1180
Oman	77	6	59	10	136	7	7.2	1	5810
POOR									
India	98	11	48	4	146	8	7.7	11	300
Egypt	111	13	46	3	157	9	8.3	5	680
Sri Lanka	89	10	73	11	162	10	8.5	9	400
Yemen	88	9	85	14	173	11	9.1	7	590
Nepal	103	12	73	11	176	12	9.3	13	160
VERY POOR									
Jordan	119	14	78	12	197	13	10.4	2	1560
Bangladesh	119	14	81	13	200	14	10.5	13	160
BY REGION									
A/NE NEAR EAST									
Egypt	111	13	46	3	157	9	<u>8.2</u>		<u>1738</u>
Jordan	119	14	78	12	197	13	8.3	5	680
Morocco	76	5	56	9	132	5	10.4	2	1560
Oman	77	6	59	10	136	7	6.9	6	610
Tunisia	86	8	49	5	135	6	7.2	1	5810
Yemen	88	9	85	14	173	11	7.1	3	1180
A/NE SOUTH ASIA									
Bangladesh	119	14	81	13	200	14	<u>8.6</u>		<u>274</u>
India	98	11	48	4	146	8	10.5	13	160
Nepal	103	12	73	11	176	12	7.7	11	300
Pakistan	80	7	52	7	132	5	9.3	13	160
Sri Lanka	89	10	73	11	162	10	6.9	10	350
A/NE SOUTHEAST ASIA									
Burma	65	3	51	6	116	3	<u>5.6</u>		<u>523</u>
Indonesia	58	1	37	2	95	2	6.1	12	200
Philippines	74	4	55	3	129	4	5.0	8	450
Thailand	60	2	28	1	88	1	6.8	7	590
							4.6	4	850

Source: Panayotou, T. Natural Resources and the Environment in the Economies of Asia and the Near East: Growth, Structural Change and Policy Reform, 1989.

Note: Regional averages are unweighted means.

For detailed information on the factors included in Renewable and Non-Renewable Resources, see Appendix 3.

TABLE 1-5

THE CHANGING ROLE OF NATURAL RESOURCES IN ANE COUNTRIES

	AGRICULTURE (Includes Fisheries and Forest Production)				INDUSTRY Value Added in Food and Agriculture as a Percentage of Manufacturing Value Added				EXPORTS Primary Resource Exports As a Percentage of Total Country Exports			
	Percentage Share in GDP		Percentage Share Employed in Sector		1970		1986		1960	1965	1986	
	1960	1965	1980	1986	1960	1965	1980	1970	1986	1960	1965	1986
ANE NEAR EAST												
Egypt	30	29	23	20	58	55	46	17	20	08	80	88
Jordan	—	—	8	8	44	37	10	21	27	96	81	41
Morocco	23	23	18	21	62	61	46	—	26	92	95	53
Oman	—	61	* 2	# 3	—	62	50	—	29	—	100	99
Tunisia	24	22	17	16	56	47	35	29	17	90	82	40
Yemen	—	* 52	29	* 34	83	79	69	20	—	—	100	# 4
ANE SOUTH ASIA												
Bangladesh	58	53	54	47	87	84	75	30	26	—	—	26
India	50	47	37	32	74	73	70	13	11	55	51	38
Nepal	—	65	57	—	95	94	93	—	—	—	78	33
Pakistan	46	40	31	24	61	60	55	24	34	73	64	32
Sri Lanka	32	28	28	26	56	56	53	26	—	99	99	59
ANE SOUTHEAST ASIA												
Burma	33	35	46	48	—	64	53	—	—	99	99	87
Indonesia	54	56	26	26	75	71	57	—	23	100	96	79
Philippines	26	26	23	26	61	58	52	39	34	96	95	40
Thailand	40	35	25	17	84	82	71	43	30	98	95	58
Source 1960, 80: Source 1965, 86: Source 1960: Source 1965, 80 IBRD IBRD IBRD IBRD Source: IBRD Source 1960: Source 1965, 86: WDR 82 WDR 88 WDR 82 WDR 88 WDR 88 IBRD WDR 82 IBRD WDR 88 Table 3 Table 3 Table 19 Table 31 Table 8 Table 9 Table 12 (Includes Pearls, Minerals, Metals, and other Primary Commodities)												
note: — = unavailable; * = year other than specified; # = World Tables 4th ed.												

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Indonesia was reduced from 56 percent to 26 percent of GDP, partly because of the escalation of oil prices in the 1970s and early 1980s. The same pattern is evident in India and Pakistan, though structural change in these countries appears to be somewhat more gradual. Of the 15 ANE countries, Burma, Nepal, and Bangladesh derive about half of their national product from agriculture, while Thailand, Tunisia, Jordan, and Oman derive less than 20 percent -- conventionally the sign of having achieved a certain level of sustainable economic growth, though there are clearly many other factors involved. The remaining countries can be called low-income transitional countries, in that agriculture's share of GDP is between 20 and 35 percent.²

The contribution of the agricultural sector to employment in the ANE region is more important than its contribution to GNP. As Table 1-5 shows, in 1980, this sector still accounted for more than 50 percent of total employment (down from 56-95 percent in 1960) in all countries of the region except for Jordan and Tunisia and is likely to do so at least to the end of the century. Even in Thailand, where the share of agriculture in GDP had dropped to 17 percent by 1986, the agricultural share of employment declined only to 76 percent, from 84 percent in 1960. Thai statistics overestimate agricultural employment because they ignore off-farm employment of farmers and seasonal migration. Yet, even with an adjustment for these factors, the figure remains above 60 percent.

The share of resources in total country exports is an additional indicator of the evolving role of natural resources in the economies of ANE countries. While high resource export shares generally reflect the large role of natural resources in the economy in earlier stages of development, they remain important for countries with substantial natural resources. In the 1960s natural resources (including minerals and oil) represented close to 100 percent of exports in all ANE countries except India and Pakistan. By 1986, with the increasing competitiveness of ANE's industrial and service sectors, the share dropped to between 30 and 50 percent, except for Indonesia and Burma in Southeast Asia and Egypt and Oman in the Near East, where it remained as high as 80-90 percent. (See Table 1-5.)

The main resource-based commodities exported from Southeast Asia are oil, tin, copper, rice, maize, rubber, palm oil, coconut, pineapple, coffee, and sugar. The Near East exports principally oil, phosphate rock, cotton, and hides and skins. In South Asia, resource exports account for about one-third of total exports and are mainly jute, hides and skins, and limited quantities of timber, rubber, petroleum, and iron ore.

In world market terms, the significant resource exporters of the ANE region are: Thailand, which accounts for 26 percent of the world rice trade, 16 percent of rubber, and 12 percent of tin; Indonesia, 26 percent of rubber, 15 percent of tin, 40 percent of tropical timber (3.3 percent of all timber), and 4 percent of petroleum;

the Philippines, 53 percent of coconut oil; Bangladesh, 73 percent of jute; Morocco, 9 percent of phosphate rock; Egypt, 7 percent of cotton; and India, 6 percent of iron ore.

Natural resource-based activities are also proving to be major earners of income in the industrial and service sectors. (See Table 1-5.) In seven ANE countries – Jordan, Morocco, Oman, Bangladesh, Pakistan, the Philippines, and Thailand – agroprocessing industries, such as pulp and paper, rubber, coconut and palm oil, and prawns represent more than 25 percent of manufacturing income. These industries, once established, require a steady supply of high-quality raw materials, which must be imported if they cannot be produced within the country.

Furthermore, the energy sector in the ANE region depends heavily on domestic resources. This sector has been growing at over 6 percent a year, and the demand for energy, particularly electricity, is projected to continue to grow at high rates at least through 2000. To meet the demand, most ANE countries plan accelerated development of their indigenous fossil energy resources and hydroelectrical potential.

The linkage of resources to industry extends beyond manufacturing and energy. Resources are an essential component of tourism, which has become the number-one earner of foreign exchange in Thailand and number-three in Indonesia. Natural attractions are important to the large tourism sectors in Nepal, India, and the South Pacific. Biologically diverse ecosystems, found principally in tropical forests and coastal habitats, are a source of genetic material for modern agriculture and biotechnology industries, including pharmaceuticals. In the future, numerous other industries may emerge to take advantage of natural resource endowments.

In addition, the environment provides valuable services that support economic growth and quality of life. Natural ecosystems clean the air, dispose of wastes, regulate and conserve water, recycle nutrients, and control diseases. These services can be valued in billions of dollars, although the profits societies make from investing in their maintenance are poorly measured. An indirect indication of their value is the heavy costs that private and public sectors are forced to bear as these resources are depleted and their capacities for renewal are degraded – costs of cleaning up and regulating pollution and hazardous wastes, of reforestation and managing watersheds to maintain freshwater supplies and control siltation of hydroelectric facilities, and of rebuilding homes, factories, and commercial centers after natural disasters that could have been minimized or prevented by environmental planning and protection.

D. EMERGING TRENDS

To project the role of natural resources in the economies of the ANE countries in the 1990s, it is necessary to examine trends in demographic and economic variables. Changes in population, employment, urbanization, and industrialization are known to affect resource use and environmental quality. Other macroeconomic variables such as foreign debt, balance of payments, inflation rates, interest rates, and investment levels will also be important determinants of how resources will be used and managed.

Continuing high population growth throughout the Near East and in parts of South and Southeast Asia is certain to increase the pressure on resources. This is particularly worrisome for low-income, slow-growth countries such as Bangladesh, Nepal, and the Philippines. Even in Thailand, which has been successful in controlling population growth while growing economically, the pressure on natural resources may actually intensify if the country fails to create enough employment to attract people out of marginal and fragile areas. Studies in Northeast Thailand, for example, show that a 10 percent increase in population results in a 15 percent reduction in forest area.³

The role of employment will be critical, because the labor force is growing much faster than the general population in all ANE countries. (See Table 1-2.) In Pakistan, the labor force is growing at 2.8 percent compared with population growth of 2.2 percent; in Morocco, the equivalent figures are 3.1 percent and 2.3 percent. This rapid increase in the demand for jobs will continue into the next century, because of the high number of births in the 1970s and because more women are entering the labor force.

In agriculture, still the largest source of employment, there are three key constraints to increasing employment:

- (1) Except in a very few cases, there are no easy and ready sources for further growth; unexploited arable land, freshwater, forests, and fisheries are in increasingly short supply.
- (2) On higher quality lands, economic and environmental constraints are limiting continued growth in productivity; soil erosion, salinization from lack of drainage, loss of vegetation and soil nutrients, pollution of surface and groundwater from pesticides and fertilizers, rapid deforestation, and loss of natural predators are having a clear economic impact.

- (3) On more marginal lands, particularly uplands and those recently settled, "Green Revolution" agriculture -- which depends on high-yielding varieties, synthetic fertilizers and pesticides, subsidized irrigation, and plentiful supplies of fossil fuel energy -- is too costly and in many cases inappropriate.

Without secure tenure, the rural poor, who are increasingly forced onto these marginal lands, tend to "mine" rather than efficiently exploit the land, causing degradation of the uplands as well as of downstream irrigation systems and farmlands. In the absence of adequate employment, the likely result will be increased encroachment of marginal lands, watersheds, and forest reserves, and increased migration to urban areas ill-prepared to receive new job-seekers.

With the exception of Sri Lanka, urban populations are already growing at rates between 2.3 and 7.3 percent a year. The percentage of the region's population living in cities and towns has gone from 18 percent in 1960 to 29 percent in 1990. As the data in Figure 1-3 suggest, urban growth will continue to accelerate, so that by 2020 more than half of the region's population will live in urban centers. In fact, Bangladesh and Nepal, two of the poorest countries in the world, are predicted to show the most rapid rates of urban growth over the next two decades. Increased rates of urbanization too often entail rapid, unplanned growth in residential, commercial, and industrial activities which exacerbate crowding, lack of safe water and sanitation, and water and air pollution. These are already serious problems in Manila, Bangkok, Jakarta, Delhi, Bombay, Cairo, and Casablanca.

The slowing of population growth, the increased participation of women in the labor force, the demographic transition, migration, urbanization, and industrialization will have a profound impact on the type and intensity of environmental problems that ANE countries will face in the next 10 to 20 years.

E. THE IMPORTANCE OF ECONOMIC POLICIES

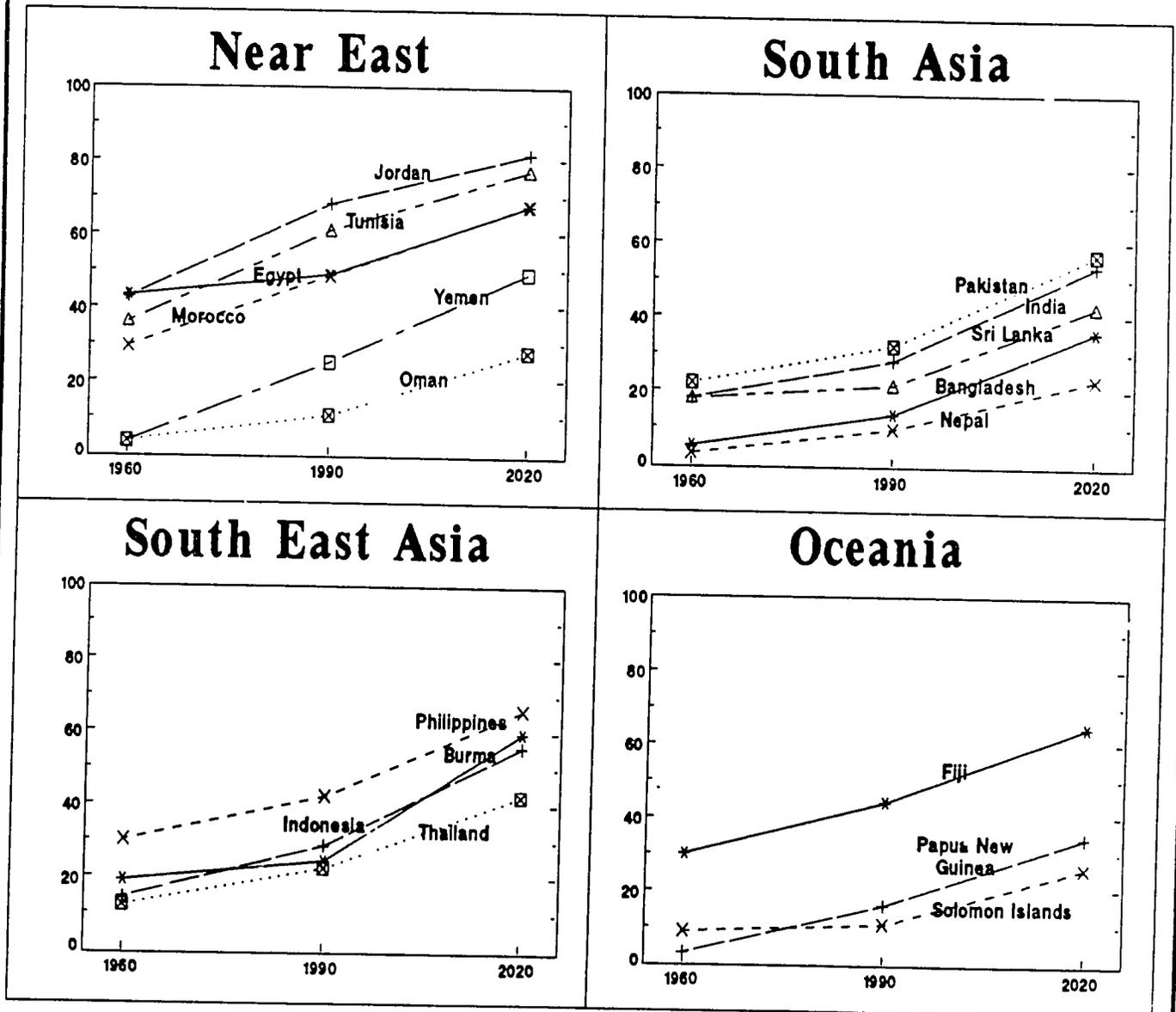
The trends outlined in the previous section strengthen the argument for a major reorientation of investment toward environmental conservation and efficient management of the remaining natural resources.

It is unfortunate that investment is conventionally thought of as the creation of new structures or expansion of industries. Policy changes, institutional reform, management of demand, and conservation of resources are rarely considered investments regardless of the rate of return that they are likely to generate. Yet

Figure 1-3

Urban Population in ANE Countries By Region

1960, 1990, 2020



Source: Estimates and Projections of Urban, Rural and City Populations 1950-2025

they are investments in the sense of making an outlay today for a larger benefit tomorrow. Where the objective is sustainable economic growth, the latter type of investment is often less costly and more productive than the former.

The essence of sustainable economic growth is the recognition of the fundamental interdependence between economic growth and natural resource management. Without natural resource management -- that is, efficient use and conservation of resources -- there can be no sustainable economic growth and poverty alleviation. Efficient resource use and increased productivity, renewability, and conservation of resources are critical factors for the continued generation of economic surplus in all its forms: food, materials, foreign exchange, markets for industrial goods, and labor for the non-resource sectors.

By the same token, without economic growth and poverty alleviation, there can be no efficient use and conservation of natural resources in the long-run. Worsening economic conditions create a situation where investing for the long-term seems to make little sense, where entrepreneurs step up the "mining" of publicly- and privately-owned natural resources, and where the poor are forced to encroach on forests and public lands in order to survive.

Because most environmental degradation is associated with inefficiencies and distortions in the allocation of scarce resources, the most cost-effective and sure way toward conservation is to reestablish the link between efficient use and conservation, between scarcity and price and between choices and consequences. When governments stop subsidizing excessive and wasteful use of resources, when the users of resources are made their secure owners, when uncertainty is reduced, and when external benefits and costs are internalized, it will become profitable for individuals, corporations, and communities to use resources more efficiently and to invest in their renewal and conservation. Then environmental improvement and conservation can be self-financing, at a minimum, and might even generate considerable economic surplus for reinvestment.

The first and foremost investment needed is thus the reform of policy distortions and mitigation of institutional failures in resource-using and -producing sectors. Elimination of Indonesian pesticide subsidies, for example, is doing more to maintain rice productivity on Java than any other investment. More trees are saved by eliminating ranching subsidies in Brazil than could possibly be planted under any grand reforestation scheme. More area can be irrigated in South Asia by reforming water pricing and by better management of existing irrigation systems than by building new dams. More energy can be made available throughout the ANE region, and less pollution generated, by forcing energy efficiency through higher energy prices than through investments in new hydroelectric plants or development of new sources of fossil fuels.

Indeed, the greatest contributions to conservation that governments can make are:

- (1) To reform their macroeconomic and sectoral policies to create a competitive and conducive economic environment and to generate alternative employment opportunities;
- (2) To eliminate all subsidies that encourage wasteful and inefficient use of resources;
- (3) To establish secure property rights over all resources, enforcement of contracts and other legal foundations for maintaining efficient markets; and,
- (4) To provide people with secure entitlements, such as education and employment opportunities, access to capital markets at competitive cost, and/or access to land and other natural resources.

In addition, governments, academia, and donor agencies need to make a greater effort to adjust economic accounting practices to reflect true economic and environmental costs. Because market prices are distorted or absent in many resource-producing and resource-using sectors, their contribution to GDP is often seriously undervalued. As a result, scarce resources are wasted, and degradation of the environment is accelerated.

When growing resource scarcity is allowed to be reflected in higher prices, the result can be both economic growth and better management of natural resources. Investments in irrigation efficiency through improved drainage and reduced water subsidies, for example, would create incentives to use less water, thus reducing waterlogging, minimizing costly maintenance, and relieving demand for clearing new land and building new systems. The result would be increased productivity and growth in income that can be sustained. In the energy sector, reduced subsidies, energy conservation, and improvements in energy efficiency are cheap, quick, and relatively painless ways for high-growth countries to cut energy costs, stretch supplies, save foreign exchange, and provide additional jobs. The same measures can yield reductions in emissions of carbon monoxide, hydrocarbons, and carbon dioxide; reduce demand for water; and by reducing fuelwood demand, limit the pressure on remaining natural forests.

While it is unrealistic to expect economic policies to be tailored to meet all environmental objectives, it can be expected that environmental implications should be taken into account when these policies are being formulated and implemented. For example, environmental costs may tip the scale against marginal policies by raising their social costs above their social benefits; the reverse may happen with

policies that have positive environmental effects; or provisions might be made for cushioning the negative environmental effect of desired policies and projects.

To translate these broad policy priorities into more specific investments in specific countries requires a number of additional steps, most of which are beyond the scope of this strategy and, of course, must be taken by the ANE countries themselves. The critical questions to begin with are:

- (1) What is the country's resource endowment? What resources are available: their extent, condition, and current use?
- (2) What is the country's level of development? That is, how heavy and of what form is the country's dependence on its natural resource endowment; how dependent is the country on resources for inputs to production or for environmental amenities?
- (3) What are the country's policies that impinge on natural resource management? Are there serious market failures in resource allocation?

The answers to these questions can be used to begin to direct investments that will strengthen the role of environment and natural resource management in economic growth that is sustainable.

The following chapters elaborate on the conditions and trends as well as economic significance of issues in the ANE countries and provide detailed guidance on ways to reverse those trends through correcting economic policy distortions, investing in human resources, improving the knowledge base, and many others. These strategies are directed to aid donors and non-governmental organizations as well as to governments in the region. Chapter II highlights selected resource issues – deforestation and forest degradation; coastal degradation; loss of biological diversity; soil loss and watershed degradation; inefficient irrigation; contamination from agricultural chemicals; inefficient energy use; urban pollution and hazardous waste; and lack of clean water and sanitation. Chapter III discusses general opportunities for responding to environmental and resource challenges, and Chapter IV focuses on opportunities in specific resource-producing and resource-using sectors. Chapter V provides a set of principles and criteria for the ANE Bureau to use in the course of developing its own natural environmental quality and natural resource management programs.

ENDNOTES

1. The analysis in this section draws heavily from T. Panayotou, "Natural Resources and the Environment in the Economies of Asia and the Near East: Growth, Structural Change, and Policy Reform" (Paper prepared for the Asia/Near East Bureau, AID, Cambridge, MA, Harvard Institute for International Development, 1989).

Most of the statistics for this section were taken from World Resources published by the World Resources Institute and the World Development Report published by the World Bank. See Appendix 2 for detailed statistics on economics, population, social, and environmental and natural resource issues, and a listing of original sources.

2. This typology of development, based on the criteria of per capita income and economic structure, was developed for the ANE Bureau's Agriculture and Food Strategy. There are three basic groupings: low-income agriculture economies (per capita income of less than \$250 per year, with agriculture producing more than 50 percent of income and industry less than 20 percent); low-income transitional economies (per capita income of \$251 to \$750 per year, with agriculture contributing less than 35 percent and industry more than 25 percent); and middle-income industrializing economies (per capita income of more than \$750 per year, with agriculture providing less than 20 percent of income and industry more than 30 percent).

Using these criteria, the ANE countries fall into the following groups:

I. Low-income Agriculture Economies

Bangladesh
Burma
Nepal

II. Low-income Transitional Economies

Egypt
India
Indonesia
Morocco
Pakistan
Philippines
Sri Lanka
Yemen

III. Middle-income Industrializing Economies

Jordan

Oman

Thailand

Tunisia

3. T. Panayotou, "Natural Resource Management: Strategies for Sustainable Asian Agriculture in the 1990s" (Paper prepared for the AID/Harvard Institute for International Development Workshop, Washington, D.C., September 1988).

CHAPTER II

NATURAL RESOURCE ISSUES IN ANE COUNTRIES

NATURAL RESOURCE ISSUES IN ANE COUNTRIES

A. RESOURCE ISSUES

Chapter I has demonstrated the continuing importance of natural resources and healthy ecological systems as ANE countries industrialize. This chapter examines in more detail the use and importance of individual resources, trends in their condition, causes of degradation, and obstacles to improvement.

Nine issues have been identified: degradation and destruction of forests; misuse and pollution of coastal areas; loss of biological diversity; degradation of watersheds and loss of topsoil; inefficient irrigation systems; contamination of land, water, and wildlife and threats to human health from agricultural chemicals; inefficient energy use; urban pollution and hazardous wastes; and lack of clean water and sanitation.

These issues, though in no way unique to ANE countries, all impinge upon economic development and are of critical importance in the region. How the ANE countries deal with them will determine to a large extent how successful they are at achieving continued sustainable economic growth.

1. Deforestation and Forest Degradation

The natural forests of the region contribute to economic well-being and ecological stability in virtually all ANE countries. In addition to providing commercial timber, the forests support biological diversity by providing habitat for plants and wildlife that cannot survive elsewhere; conserve and protect soils and waters; offer areas for recreation and tourism; provide raw materials for an array of industries; and help maintain and protect the global environment.

Forest products are important sources of foreign exchange and employment. Thus, wood and wood products are Indonesia's second leading source of foreign exchange (after petroleum), accounting for more than \$1 billion a year (\$2 billion in 1988).¹ Its plywood industries employ 600,000 people directly, 64,000 in other wood-export industries, and 130,000 in timber harvesting. Timber and timber products account for one-fourth of Burma's export earnings. In the Philippines, too, wood products are a significant export and source of employment.²

Although they are often overlooked, non-timber forest products (NTFP) and other wild products gathered from common lands are also of great economic importance in the ANE countries. A few of these products – rattan, for example, and some medicinal plant extracts – are traded internationally, but most have

large domestic markets or are traded only within the ANE region. Examples include gums, game, essential oils, honey, rope, and medicines. In India alone, it is estimated that economically significant NTFP are harvested from over 3,000 plant species, that half of forest revenues are derived from NTFP, and that 70 percent (by value) of forest product exports are NTFP. Until a recent ban on raw rattan exports, Indonesia earned about \$150 million a year from rattan and other NTFP products and provided 90 percent of the raw rattan traded on the world market.³

Throughout the region, small-scale forest industries provide up to half the cash income for 20-30 percent of the rural labor force. In Nepal, 1.3 million workers depend directly on forest-based activities, mostly fuelwood gathering. In Pakistan, 270,000 people are engaged in harvesting and transporting fuelwood. Furthermore, nature-based tourism, which depends heavily on the aesthetic value of the forest and its wildlife, is a growing sector in many ANE countries.⁴

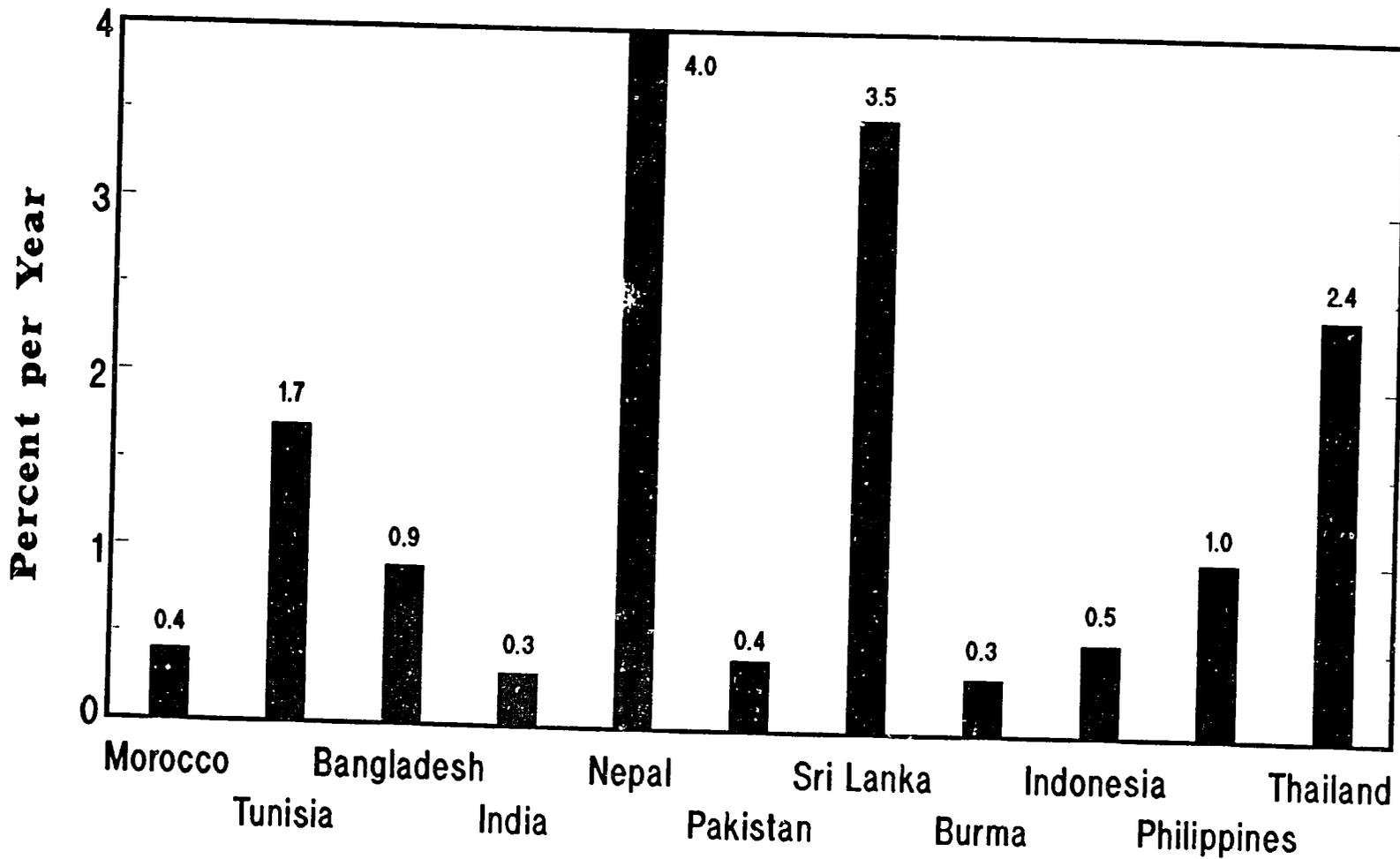
Conditions and Trends. Despite their importance, the remaining natural forests of the ANE region are being cut, burned, and degraded at alarming rates. Over the past 30 years, more than one-third of Asia's natural tropical forests has been converted to other uses by expansion of agriculture, logging, road building, shifting cultivation, livestock operations, and other activities. Still more forest has been left in a degraded state, and the future of the region's once vast forest endowment is increasingly uncertain. The countries of Southeast Asia, which contain some of the most valuable timber stands in the world, are of greatest concern; many regions are already short of wood. In South Asia, population growth, increased demand for wood products, expansion of agricultural production, and resource mismanagement are putting growing pressure on the remaining forests. In North Africa and the Near East, where wood has historically been scarce, residents and their livestock make heavy demands on existing forests for forage, cooking fuel, and water for irrigation and urban use. These forces rarely deforest a site completely, but over time -- especially when working in combination with commercial loggers -- they can seriously degrade a forest's productive potential.⁵

The annual rate of deforestation for the ANE region was estimated at about 0.6 percent for the first half of the 1980s, with the most rapid losses in Nepal (4.0 percent per year), Sri Lanka (3.5 percent), and Thailand (2.4 percent). Indonesia, the ANE country with the largest area of remaining tropical forest, was losing about 620,000 hectares per year, or 0.5 percent. (See Figure 2-1.)⁶

Deforestation rates may even be accelerating. Although not strictly comparable, 1984-87 satellite data on deforestation of closed forests (those with more than 20 percent tree cover) in India, Burma, Philippines, and Indonesia show rates that are higher than those reported by FAO for total deforestation. The more current deforestation rates are: India, 4.1 percent; Burma, 2.1 percent; Philippines,

Figure 2-1

Deforestation Rates in Selected ANE Countries (1981-85)



Source: U.N. Food and Agricultural Organization

1.5 percent; and Indonesia, 0.8 percent.⁷

Even these figures do not provide a comprehensive picture. Data on changes in forest conditions and their economic significance are infrequently gathered; often unreliable; and for internationally comparable data, limited largely to gross estimates of national forest area and large-scale flows of commercial wood products. They almost never include estimates of forest products that do not enter the marketplace, much less the environmental values of forests or the economic and social significance of deforestation. Nor do they cover non-forest trees and shrubs (such as those around farm fields, along roadways, within agroforestry plantings), even though these are the primary sources of fuelwood, fodder, and construction materials in many areas.

Under conditions of multiple-use management, forests can provide a number of benefits simultaneously and perpetually. But intensive forest management and long-term sustainability have not received major political support in most ANE countries, even though government ownership and control of both the lands and forests have been widespread. Rather, forests have served primarily as sources of governmental income, and the agencies assigned to manage them have served principally (and often ineffectively) to police the users.

Less than 15 percent of the region's natural closed forests, (mainly in India) are currently managed for sustained yield of forest products. In most of the region, management is weak because forest departments lack the necessary budgets and trained personnel; corruption is often an accepted though illegal practice; and information on forest ecology and dynamics is scarce.⁸ At the same time, many of these areas are an essential source of livelihood for indigenous forest peoples and adjacent farming communities, and are the last refuge of the landless and otherwise marginalized migrants pushing at the land frontier. Deprived of traditional rights, and excluded from legal definitions of legitimate forest use, these diverse groups treat the forest as an "open access" resource, since they lack incentives to take a long-term view.

Impacts and Economic Significance. The loss of forest potential is having, and will continue to have, severe economic consequences on trade, employment, and income. For example, Philippine wood product sales declined by half between 1979 and 1987 in terms of volume and value due to growing scarcity of quality commercial timber caused by over-exploitation, encroachment into uplands by small-scale farmers, and lack of sound forest management. If current rates of deforestation continue, forests with commercial-grade timber will be completely logged in 10 years in the Philippines and 30 years in Indonesia.⁹ Thailand, once a major exporter of teak and other valuable timber, is already a net importer of wood products.

The living standards of the rural poor are directly affected. Thus, deforestation has required women and children in many areas to spend ever more time gathering fuelwood over ever greater distances. Sometimes, boiled water has become an unaffordable luxury, with the result that family meals are less nutritious than before. Where the absence of fuelwood causes people to turn to dried dung and crop residues for fuel, the result is diminished soil fertility and reduced crop yields. In Nepal, for example, this diversion has been shown to reduce grain yields by 15 percent.¹⁰

In urban areas, prices of fuelwood and derivatives can rise beyond the reach of the poor. In India, for example, a study of wood markets in 41 urban centers found that fuelwood prices increased 14 percent per year in real terms between 1977 and 1984. In Morocco, the price of charcoal has risen almost twice as fast as the average cost of living.¹¹

Forest destruction and degradation also have effects that reach far beyond the forest sector. The combined economic impacts of forest degradation on the rest of society have yet to be quantified but are clearly significant. Thus, removal of trees can lead to severe soil erosion on steeply sloping land, reducing the productivity of upland areas cleared for crops. Deforested areas then often become compacted and lose their ability to absorb rainwater, resulting in irregular stream flows and floods. Where upland deforestation increases the intensity of downstream flooding, the costs of repairing damage to roads, bridges, and other man-made structures rise. Increased sedimentation tends to silt up dams, harbors, and irrigation systems, reducing their value for power production, transportation, and agriculture. Loss of biodiversity from deforestation may have serious long-term implications for both agriculture and medicine. Finally, South and Southeast Asia contribute about 25 percent of the carbon dioxide emissions caused by burning wood, or about 6 percent of total CO₂ emissions.¹² This adds to the concentration of "greenhouse" gases in the atmosphere by releasing the carbon stored in trees, increasing the likelihood of a significant warming of the earth's climate.

2. Coastal Degradation

The coastal zone -- the broad interface between land and sea -- comprises not only shoreline ecosystems but also nearshore waters, small islands and atolls, and upland watersheds that have an impact on coastal habitats and resources. These regions contain some of the earth's most productive ecosystems (estuaries, coral reefs, salt marshes, mangroves, and seagrass beds) as well as significant amounts of prime agricultural and recreational lands. They support unique, diverse, and commercially valuable biota and play a crucial role as habitat for migrating waterfowl. Wetlands, mangroves, and coral reefs also help to mitigate

flooding and coastal erosion.¹³

Conditions and Trends. All ANE countries, except Nepal, border marine waters and therefore, contain coastal zones. In recent years, however, the resources of the region's coastal zones – mangroves, coral reefs, fisheries, and water quality – have deteriorated. The Thailand Development Research Institute, for example, has reported a 7 percent loss of mangroves between 1980 and 1985. In Indonesia, the country with the world's greatest extent of mangrove habitat, about 19 percent was lost between 1969 and 1982.¹⁴ And in Bangladesh, the Sunderbans, an extensive mangrove forest which supports at least 3 percent of the country's labor force by providing fuelwood, timber, fish, shrimp, and other products, is now becoming increasingly degraded as a result of rapid population growth, excessive cutting for fuelwood, increased industrial pollution, and decline in freshwater inflows from upstream.¹⁵

ANE coastal zones contain about 70 percent of the world's coral reefs, a habitat that supports some one-third of all fish species. The opportunity to manage these resources for sustained yields is being threatened. The majority of coral reefs in the Philippines are in fair to poor condition, with two-thirds of the sites sampled in 1982 having less than 50 percent live coral cover. As a result, six of the more commonly collected commercial coral species have declined. Coral mining along the southwest coast of Sri Lanka has caused serious coastal erosion as well as a loss of fish production.¹⁶

The stagnation and decline of fisheries continues. Measured in terms of catch and preferred species, declines have been documented along the Nile Delta, the Negumbo Lagoon in Sri Lanka, and the Gulf of Thailand. The Negumbo Lagoon is an example of a highly productive estuary that has been degraded by a combination of over-fishing, pollution, and destruction of habitat, with the result that it is capable of providing income for only a fraction of the artisanal fishermen that it supported 20 years ago. Discouragingly, restoration of coastal fisheries has not been successful, even when catch has been regulated.¹⁷

Degraded coastal water quality is most apparent in estuaries, lagoons, and coastal embayments where flushing and mixing is restricted. Although water pollution is recognized as a major issue, particularly in the harbors and bays adjacent to the major cities, data are not adequate to carefully document trends. Coastal waters are over-fertilized with nutrients from agricultural practices, contaminated by human sewage and other organic wastes, and degraded by industrial toxic and material wastes.¹⁸

Should predictions of global warming prove accurate, the ensuing rise in sea levels (perhaps by as much as 30 cm by 2025) would cause even more serious problems. Seas would inundate low-lying areas; destroy coastal mangrove forests

and marshes; erode shorelines; exacerbate coastal flooding; increase the salinity of rivers, bays, and aquifers; and destroy the homes of millions of people. These consequences would be most pronounced in countries with population concentrations in low-lying areas. In the Nile Delta, for example, a 50 cm rise in sea level, combined with ongoing land subsidence, would result in the loss of coastal land that is now the home for 16 percent of the nation's population. In low-lying, deltaic Bangladesh, the impacts would be even more severe.¹⁹

Impacts and Economic Significance. Coastal areas are home to an estimated 700 million people in the ANE region and have the greatest concentrations of industry, urban development, and tourism. They are the prime targets for new development in the coming decades. (See Table 2-1.)

The following are among the sectors that are most dependent on coastal resources and therefore, most likely to feel the impact of degradation in these resources:

- o Tourism -- which is already the number one earner of foreign exchange in Thailand, number five in Indonesia, and high on the list in many other countries -- is enhanced by, if not dependent on, high-quality habitats, good water quality, and the protection of scenic and cultural resources.
- o Shrimp mariculture, a rapidly growing industry in nine ANE countries, requires the construction of freshwater ponds, which are created by draining wetlands, further reducing habitat for marine fish. This characteristic has led to direct conflicts with other sectors including fishing and tourism, in the Philippines, Thailand, Indonesia, Sri Lanka, and India.
- o Marine Fisheries. While most marine fisheries in the region are fully utilized or over-fished, half of the ANE countries have plans to increase marine fish production, principally through a shift in catch rather than net increase from stocks. In Indonesia and Morocco, gains are expected through the exploitation of under-utilized stocks.
- o Nearshore and Offshore Oil and Gas Development. As proven land-based reserves are depleted in countries such as Indonesia, Thailand, Egypt, and Tunisia, new oil and gas exploration is focusing on coastal environments. Substantial reserves have already been found in the Gulf of Thailand/Eastern Seaboard Development Region.
- o Coastal Mining. Indonesia and Thailand are expanding nearshore tin mining, with attendant pollution from processing and mine tailings.

Table 2-1

SIGNIFICANCE OF COASTAL RESOURCES
IN SELECTED ANE COUNTRIES

	ANE NEAR EAST			ANE SOUTH ASIA		ANE SOUTH EAST ASIA			ANE OCEANIA	
	Egypt	Morocco	Tunisia	Bangladesh	Sri Lanka	Indonesia	Philippines	Thailand	Kiribati	Solomon I.
DEVELOPMENT OPPORTUNITIES										
Offshore Oil and Gas	+		+			+		+		
Industrial Complexes	+	+	+	+		+	+	+		
Mining (coastal, offshore)										
New/Expanded Ports	+	+	+							P
Fisheries		+		+		+		+		
Mariculture	+	+		+	+	+	+	+	+	+
Tourism (coastal)	+	+	+		+	+	+	+	P	P
Intensified Agriculture (coastal)	+	+	+			+	+	+		
Human Settlements	+					+		+		
SOCIO-CULTURAL										
Food				+	+	+	+	+	+	+
Fuel (Mangrove Wood)	-	-	-	+	X	+	+	+	NA	+
Cultural Association					+(P)	+	+	+(P)	+	+
ECOLOGICAL										
Biodiversity	NA	NA	NA	NA	+	+	+	+	NA	NA
Migratory Species	+(B)	+(B)	+(B)	NA	NA	NA	NA	NA	+(F)	+(F)
Unique habitats/species	+	+	+	+	+	+	+	+	+	+

Notes:

- +: priority for future development. P: potential but cautious approach to be taken.
Source: The "Economist" Country Report; these reports are based on a review of the country's most recent development plan. The authors offer no comment as to whether this activity will occur.
- +: >50% of animal protein consumed in the country is from fish or shellfish. Source: WRI '87, Table 9.4
- +: Widespread, a major use (firewood and charcoal). X: localized, a minor use (firewood).
-: not utilized. NA: data not available.
Source: IUCN, 1983: Global Status of Mangrove Ecosystems. Commission on Ecology Papers No. 3
- +: Important. +(P): important for parts of the country.
Source: Authors' interpretation based on country specific documents cited in Appendix I.
- (B): Birds
(F): Fish

SOURCE: University of Rhode Island, Coastal Resource Center.

Coral mining for lime production and sand is a significant but localized problem, with implications for erosion, tourism, and fisheries, particularly in Sri Lanka and Indonesia.

- o Port expansion is planned in half of the ANE nations. These developments will have considerable impact on natural habitats as well as water quality and will influence tourism and other industries that depend upon a high-quality resource.
- o Industrial development is concentrated along the coasts because a coastal location provides access to labor and transportation and because waste disposal into estuaries and coastal waters is easy. However, existing and projected development is producing conflicts with other sectors over the need to protect the coastal zones from industrial pollution.
- o Agricultural Production. The Near East countries and Indonesia are already planning agricultural expansion through impoundments, increased irrigation, and the conversion of coastal wetlands. Some coastal reserves are already affected by runoff of agricultural chemicals.

This rich and often conflicting mix of human activities, natural resources, and tightly linked ecological processes creates a situation where integrated, cross-sectoral management becomes a necessity.²⁰ Coastal resources will not generate the economic returns that are expected of them unless they are seen in all their various aspects. For example, coral reefs can be mined for construction material and fished intensively with measurable economic benefit. But when harvesting overwhelms regeneration and when reefs are threatened by extensive siltation and pollution, the economic value of the resource to local and regional economies is reduced. Since reefs and mangroves dissipate the destructive energy of typhoons, when these resources are degraded, their value is reduced even further.

Few environmental initiatives in the ANE region focus directly on the special problems of coastal areas. Pollution may be prohibited, but large segments of the population living in the coastal cities are not served by sewers, and where sewage is collected it is rarely treated. Fishing laws and stock assessments are not translated into effective programs to control the rapid depletion of coastal fish resources. Marine parks, when designated, are not provided with staff and money to develop and implement park management plans. Tourist and recreation sites are developed without regard to the sustained use of the beaches and fishing sites they depend on. Upstream erosion and pollution from agriculture, forestry, mining and industrial development continue to destroy coral reefs and lagoons, sea grass beds, beaches, and other sensitive coastal resources.

3. Loss of Biological Diversity

Biological diversity – often shortened to biodiversity – refers to the variety of plant and animal species, the different genetic makeup of individuals belonging to a species, and the range of natural habitats in which they live. This diversity of life constitutes the basic biological capital on which human and planetary livelihood depend. It would be difficult to find any collection of countries with life forms and ecosystems as diverse as those in the ANE region. Between Morocco and Fiji, wide variations in habitats – from desert to alpine to tropical rainforests and coral reefs – have given rise to an extraordinary diversity of life. Some tropical forests in Southeast Asia, for example, have as many as 570 woody species in one hectare, more than can be found in all of the continental United States.²¹

At the same time, the economies of the region are highly dependent on agriculture and other activities whose productivity is intimately bound to the health of the basic biological capital. These resources provide products that are consumed directly or marketed informally – firewood, fodder, game meat, medicinal herbs, and many others. They provide commodities and services that are commercially marketed, including timber, fish, skins, new crops developed from traditional varieties and wild crop relatives, and nature tourism. And, they perform ecosystem functions, including watershed protection, photosynthesis, climate regulation, crop pollination, and breeding and nursery habitat for fish.

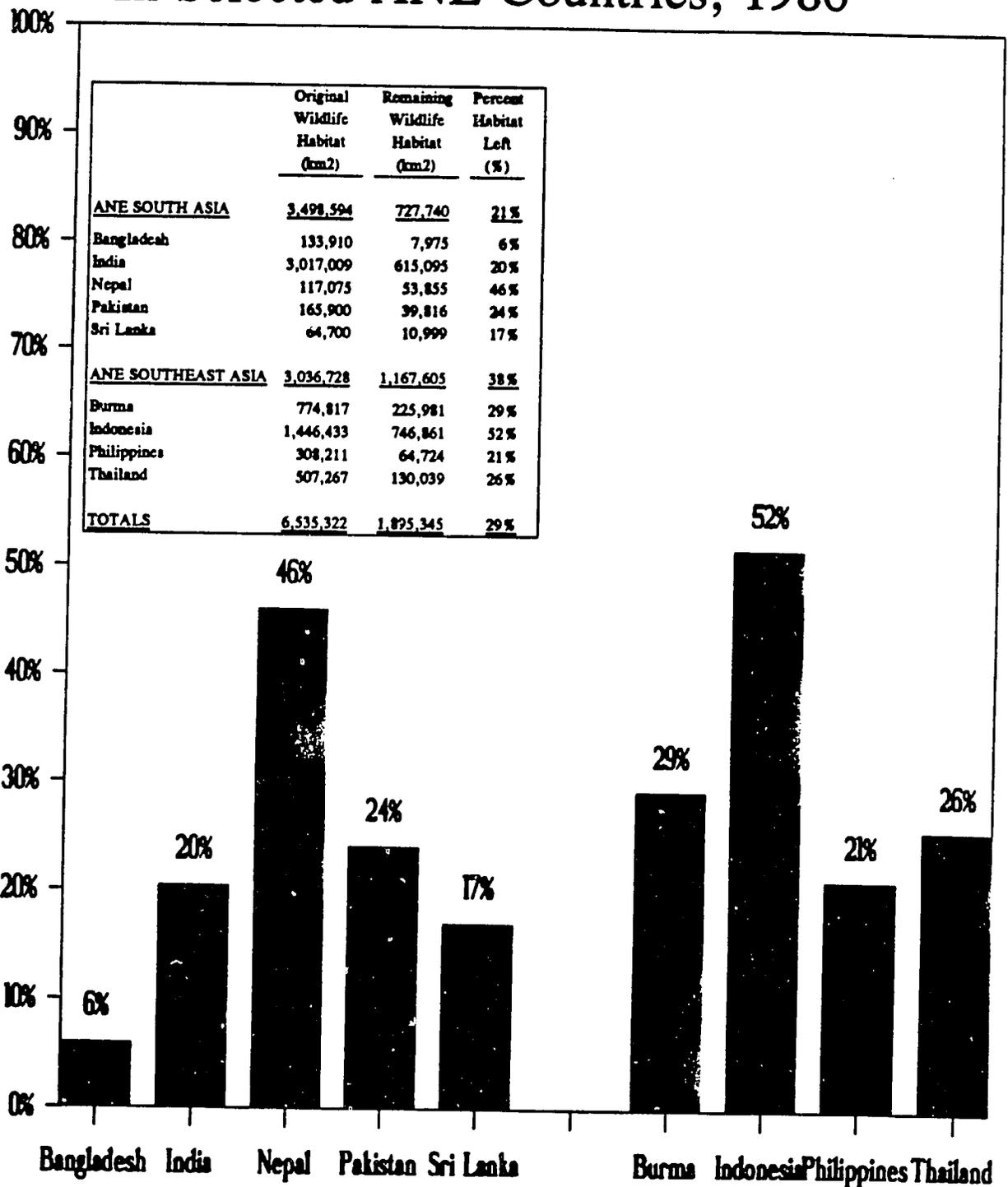
Conditions and Trends. It is likely, however, that the number of species vulnerable to extinction in the ANE region is growing steadily, and even accelerating in some areas because of growing human populations, declining natural habitats, and unusually high rates of endemism (species limited to a single area and found nowhere else in the world). Indeed, some areas of Southeast Asia may soon have the highest rates of species extinction in the world.

Maintaining relatively unmodified natural habitat is the best option available for conserving the diversity of flora and fauna. Yet, as Figure 2-2 shows, only 21 percent of the original wildlife habitat in South Asia (Bangladesh, India, Pakistan, and Nepal) remains, and 38 percent in Southeast Asia (Burma, Indonesia, Philippines and Thailand). These remaining natural habitats are increasingly fragmented by human uses of land, and contiguous habitats of a substantial size are disappearing even more rapidly than the overall figures indicate. Habitat loss is probably lower in the countries of the Near East, except in the wetland or riparian habitats where human activities tend to be focused.²²

The list of factors causing loss of biodiversity is lengthy and varied. Among those often cited are the clearing and burning of forests, the draining and filling of

Figure 2-2

Remaining Wildlife Habitat In Selected ANE Countries, 1986



Source: MacKinnon and MacKinnon 1986.

wetlands, coral reefs smothered by sedimentation and pollution, shifting cultivation, introduction of monoculture forestry and agricultural systems, over-harvesting of plants and animals, introduction of exotic species, the indiscriminate use of pesticides, and illegal trade in wildlife. Underlying many of these causes are national and international policies that encourage the depletion of biological resources -- exploitation of the raw materials base to generate foreign exchange; resettlement of unemployed and landless populations onto marginal frontier lands; clearing of public lands and forests by squatters who have been forced off more productive land by lack of tenure; and so on. Whether such policies under-cut biodiversity because it is thought there is no choice, or because the deleterious consequences were overlooked, the insufficient value attached to biodiversity is invariably part of the problem.²³

Impacts and Economic Significance. Biological diversity is essential to sustaining currently important economic activities and to preserving future development opportunities for three major reasons: (a) to sustain and improve agriculture, forestry, and fisheries; (b) to provide opportunities for medical discoveries and industrial innovations based on natural organisms; and (c) to preserve choices for addressing problems and opportunities in the future.²⁴

Information on the economic values of biodiversity is in very short supply in most ANE countries, as is information on the relative contributions of various factors to the impoverishment of biodiversity. Nevertheless, the rapid rates of growth and change in many parts of the region lend a particular urgency to the problem. Over-exploitation of biological resources, particularly of the tropical forests and coastal habitats, is evident in each of the ANE countries to one degree or another, and has been accelerating since 1945.

Some ANE countries have responded to the threatened loss of habitat on which biodiversity depends by establishing legally designated protected areas. Areas under some protected status range from less than 1 percent of total land area in Burma and the Near East to more than 8 percent in Sri Lanka, Thailand, Pakistan, and Indonesia, for an overall regional average of a little more than 4 percent. (See Appendix Table 20.) These areas differ vastly in size, habitat quality, adequacy of management, and suitability of location. Often, the designation of protection means little in terms of actual protection from unauthorized uses.

Furthermore, most biological resources will always be outside of strictly protected areas. Most biologists believe that the larger the contiguous habitat area is, the greater are the probabilities that its constituent biological diversity will be sustained. Limited research to date suggests that, at least in humid tropical forests, the "minimum critical size" required to conserve biological diversity is at least 100,000 contiguous hectares. As habitat area decreases, increasingly intensive wildlife and plant management is required to maintain the habitat's original

diversity.²⁵

4. Soil Loss and Watershed Degradation

Arable soils and freshwater from river systems and underground aquifers are among any country's most precious resources. Their availability depends not only natural conditions (which gives the monsoon belt countries rich, if seasonal, supplies, while leaving the Near East countries water-poor), but also on the care that countries take to preserve and enhance their watersheds.

For the most part, natural forces determine the movement of soil and water within drainage basins, but human activities in the upper watersheds are having an increasing impact. Approximately 40 percent of the land area in Asia is steeply sloping (e.g., above 30 percent). Another 14 percent has slopes ranging from 8-30 percent.²⁶ So long as their populations were sparse, ANE upland peoples were able to manage the steep slopes and less fertile soils in a sustainable fashion. Population increases and the influx of poor land-seekers from the lowlands, however, increasingly threaten these agroecosystems. Logging, cultivation, grazing, mining, and human settlements are resulting in loss of vegetative cover, which combined with the natural erodability of the soils, leads to increased water runoff and erosion.

Severely eroding watersheds lose as much as 100 tons of soil per hectare per year, compared to a normal watershed loss of 30-60 tons. Erosion of this magnitude reduces the depth and quality of topsoil and the capacity of the soil to absorb and hold moisture. Not only does this reduce the productivity of upland lands and increase the frequency of landslides, it also changes the distribution and timing of water delivery downstream, decreasing the flow during dry seasons and increasing it in rainy seasons, thus exacerbating droughts and floods. Downstream, excessive sedimentation from upland erosion silts up reservoirs, harbors, and irrigation canals; damages fisheries; and reduces water quality. In addition, agricultural pumping and other downstream activities result in excessive use of groundwater, which, on the one hand, can cause the water table to drop and permit salt water to intrude and, on the other hand, can lead to waterlogging and salinization of soils.

Conditions and Trends. Degradation of watersheds in the ANE region is already far advanced, especially where the forests have been cleared. Erosion is heaviest in the uplands, which are home to about 27 million people in the Himalayan region and another 30 million in the uplands of insular Southeast Asia.²⁷ Thus, in Indonesia, 36 of the country's 125 river basins are considered to have critical erosion problems.²⁸ At least one-third of Java's cultivated mountainous areas are eroding seriously, and some one million hectares have been

rendered useless for farming.²⁹ Similar conditions are found in parts of the Philippines, Thailand, and in many places throughout South Asia and the Himalayas. In India, recent estimates indicate that 38 percent of rural land – about 100 million hectares – is producing well below potential, owing to soil erosion, overgrazing, toxic salinity levels, and waterlogging.³⁰

Excessive use of groundwater for agricultural irrigation has caused the water table in the Tamil Nadu region of India to drop by 25-30 meters, requiring greater use of energy for irrigation. Bangkok's water table has dropped 25 meters since 1958, necessitating subsidies and increased pumping for drinking water. Saltwater intrusion is becoming a problem in coastal areas. Ten percent of Thailand is now underlain by saline water, and India and Pakistan have similar problems. In the water-short Near East, groundwater is being rapidly exhausted and in many places, polluted with agrochemicals or affected by salinization. Indeed, water threatens to replace oil as the most precious commodity of the future in these countries.³¹

Impacts and Economic Significance. The social and economic costs of watershed degradation, though problematic to calculate because it is difficult to separate natural processes from those caused by human activities, are crucial to local and regional economies. In the Philippines, soil erosion has caused significant loss in productivity in 8 million hectares of upland area. The World Bank estimates the cost of replacing soil and nutrients in this area at \$50/per hectare. In the Hill area of Nepal, overall yields of cereal fell by over 1 percent per year between 1970 and 1980 largely due to excessive erosion of productive soils. And, throughout the region, the cost to society is growing as more and more watersheds are being modified.

For reservoirs in particular, downstream sedimentation from upland erosion imposes significant costs in terms of shortened investment life, high maintenance requirements, and reduced services. In India, for example, the storage capacity of the Niznamsager Reservoir has been reduced by 60 percent due to much-greater-than-expected siltation, resulting in inadequate water for irrigating the 1,100 square kilometers of rice and sugarcane for which the reservoir was built, and considerable under-utilization of the nearby sugar factories. The expected lifespans of India's Tehri Dam and Pakistan's Mangla Reservoir have been cut in half, from a planned 100 years to 40-50 years. Examples from Southeast Asia include the Upper Solo Watershed and Karanglates and Cacaban reservoirs in Indonesia, the Lower Agno River watershed in the Philippines, and the Nam Pong Reservoir in Northeast Thailand.³² On the island of Java, which retains only 15 percent of its original forest cover, the costs of soil erosion are estimated in a recent study by the World Bank to be \$350-410 million per year: \$323 million from on-site losses in productivity and between \$25-90 million from off-site damages to irrigation and reservoirs.³³

Although the cause-and-effect relationship has not been proved, upland watershed degradation may also increase the frequency and severity of flooding downstream, depending on the size of the watershed. For example, the incidence of flooding along the Indus river system in Pakistan is far higher in the past 25 years than during the previous 60 years.³⁴ One researcher has estimated that it would cost nearly \$48 billion to construct earthwork reservoirs to store the same volume of water that India's forests soak up and release gradually each year.

Historically, officials have paid little attention to resource problems in the uplands, which were the least desirable for development. This is changing. Partly because of the downstream effects noted earlier, most ANE countries are making investments to control soil erosion and water flows associated with watershed degradation. By and large, however, they have not approached the problem of watershed management in a coherent and coordinated manner. Not enough effort, for example, has gone into improving farming practices. Furthermore, about half the countries in the region do not have full control over some of their most important river systems. For over three decades, India, Pakistan, Nepal, and Bangladesh have argued over the use of the waters arising in the Himalayas. Bangladesh is at a particular disadvantage, since it receives nearly 90 percent of its water from rivers originating in other countries. In the Near East, none of the rivers are the sole preserve of any one country, and conflict among states is growing.

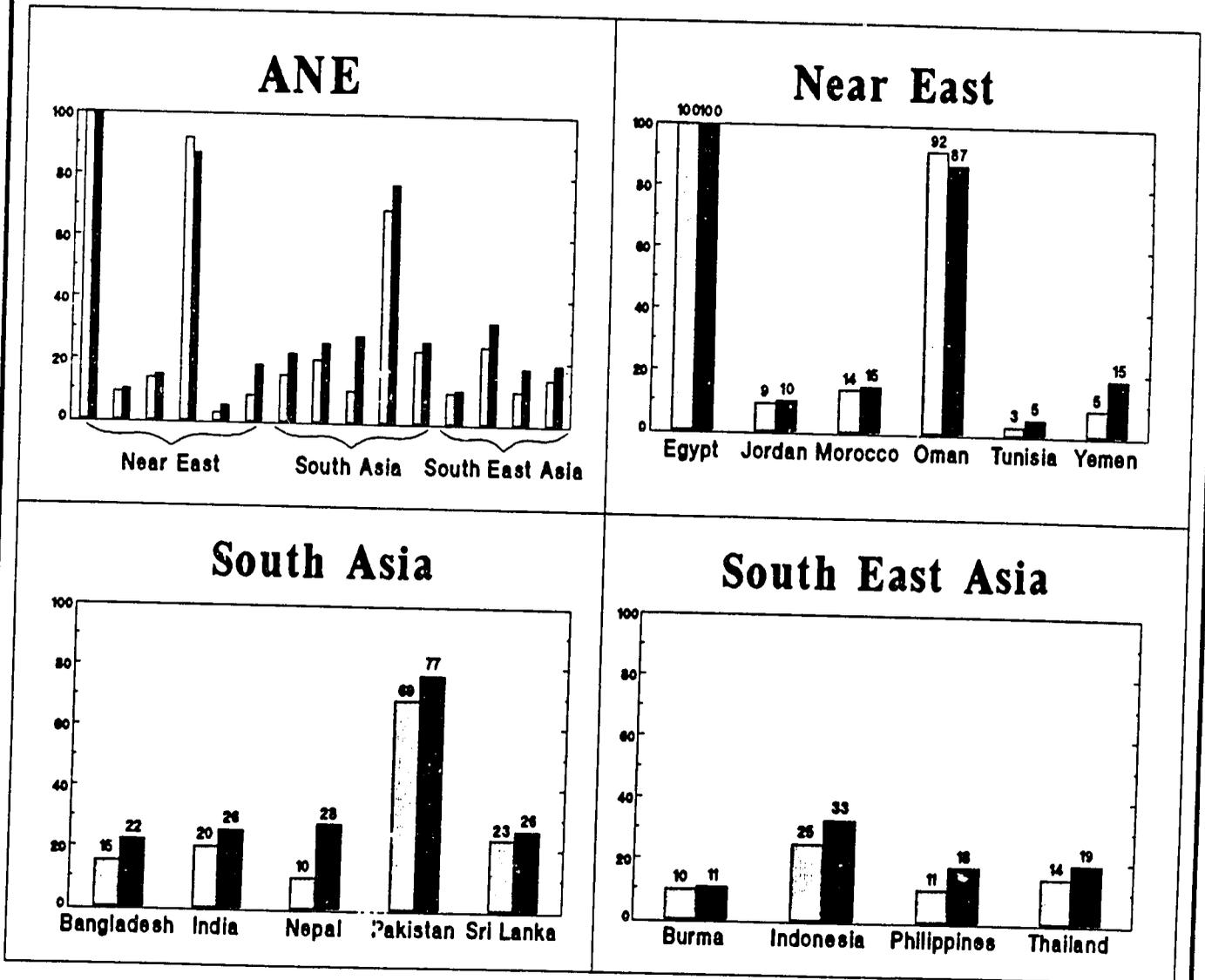
5. Inefficient Irrigation

Irrigation is a vital component of agriculture throughout the ANE region. India and Indonesia derive 50-55 percent of their total food production from irrigated lands. In Pakistan, the figure is 80 percent; in Egypt, nearly 100 percent. Combined with the biological and chemical innovations associated with the Green Revolution, irrigation has given the region a 3 percent annual increase in cereal yields.³⁵ The critical question for the 1990s is whether this yield increase can be sustained and increased to take up the growth deficit being left by the approaching end to the land frontier.

Conditions and Trends. Between the mid-1960s and the early 1980s, 22 million hectares of land were brought under irrigation in Asia, bringing the proportion of arable land under irrigation from 20 percent to about 30 percent. South Asia contains almost half of the region's net irrigated area, while Southeast Asia contributes 10.7 percent and China another 38.3 percent. Trends in the Near East are dominated by Egypt, where net irrigated area peaked in the early 1970s and then declined somewhat.³⁶ (See Figure 2-3.)

Figure 2-3

Irrigated Cropland As Percent of Total Cropland (1975-85)



Source: U.N. Food and Agricultural Organization

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The constraints to expanding irrigation in the region are growing. The most suitable irrigation sites have already been utilized. With the fall in international grain prices and the increase in world grain supplies, as well as with enhanced environmental concerns, multilateral development banks have become less willing to finance investments in new systems. Furthermore, expansion of irrigation systems will involve steeply rising costs. The Asian Development Bank reports, for example, that the cost of new irrigation investments doubled between 1978 and 1983, going from \$2,500 per hectare to \$5,000.³⁷

Nor is water being delivered as efficiently as possible. Irrigation efficiency in Thailand is estimated at 15 percent of the potential; in the Philippines, 20-25 percent; and in Malaysia, 40 percent – compared with 60 percent in Taiwan. Research in Pakistan found that water losses from seepage and evaporation in watercourses ranged from 33-67 percent, with an average loss rate of 47 percent, while losses within the farmers' fields ranged from 20-36 percent. The study also found that over-irrigation coexisted with under-irrigation in the same system, with 73 percent of farmers complaining of insufficient supplies while farmers close to the water source were over-irrigating, causing salinity and drainage problems.³⁸

In Taiwan, water has long been recognized as a socially scarce commodity. Taiwan practices rotational irrigation according to a strict plan, uses control gates and measuring devices, and has an extensive network of farm ditches. Careful management practices are encouraged through irrigation associations, with incentives for managers of the systems and for farmers. In most ANE countries, by contrast, there are few effective controls in the channels and turnouts; channels are not well maintained; and there exist only a few farm ditches and hardly any measuring devices. With no water rights, and no effective water user associations or other mechanisms to allocate water efficiently, water scarcity does not register, and farmers tend to think of water as free and unlimited. The resulting tendency toward over-irrigation, combined with inadequate drainage and poor water quality resulting from lack of maintenance and management of irrigation systems, means that salinization and waterlogging are increasing.

These problems are far more serious than anticipated throughout Asia and the Near East, particularly in arid and semi-arid regions, but also along the coasts in humid climates. In some cases, the damage is irreversible and lands have had to be abandoned. In Pakistan, about 12 million hectares, or half the command area of the Indus Basin canal system, is waterlogged or saline or both. In India, waterlogging has forced farmers to abandon 10 million hectares, and salinization is currently threatening another 25 million hectares. In Northeast Thailand, 17 percent of the arable land suffers from saline soils due to poor drainage. In the Near East, 50 percent of Iraq's Lower Tigris Euphrates Valley suffers from salinity and waterlogging, while in the irrigated lands of Egypt and Iran, 30 percent and 15 percent, respectively, are affected.³⁹

Impacts and Economic Significance. The consequences of waterlogging and salinization are reduced crop yields, loss of irrigated lands, increased salt loadings of return flows and aquifers (which also reduce the yields of farmers who use them), and generally poor water quality, detrimental to other uses such as fish culture and industry. Over-irrigation and poor drainage are also critical constraints in any efforts to diversify agriculture, since most crops other than rice are sensitive to poor drainage and continuous high moisture. Furthermore, long periods of humidity produces optimum conditions for the germination and spread of fungi, diseases, and pests that threaten crop productivity, and standing water creates conditions highly favorable to the breeding of vectors that transmit such human diseases as schistosomiasis and malaria.

Nevertheless, irrigation policy in the ANE region has been biased in favor of new construction rather than rehabilitation and management of existing systems, despite the cost advantages of the latter. (In 1978, the average cost of irrigating one additional hectare of land in Asia by rehabilitating existing systems was approximately \$690, compared to \$2,500 for new construction; both costs are much higher today.) Furthermore, the systems are heavily subsidized. Only a fraction of the costs of operating and maintaining Asian irrigation systems – 20 percent for Bangladesh, 27 percent for Thailand, and 60 percent in Nepal, for example – is covered by revenues collected from water users, even at the current low level of maintenance.⁴⁰ Although irrigation authorities often assume that farmers will at least contribute time and energy to help maintain the system, the farmers generally expect the authorities to do it. Furthermore, where farmers do not have secure land titles, they may be reluctant to make long-term investments in irrigation and drainage structures and other system enhancements. Sometimes they even damage irrigation structures intentionally, as a protest against the inability of the systems to deliver water in times of need. With a policy bias against operation and maintenance and no effective cost recovery, it is no wonder that so many of Asia's irrigation systems are in need of major repairs. All in all, about half of Asia's irrigation systems are said by the United Nations to require improvements, half of them major.

6. Contamination from Agricultural Chemicals

Over the past 30 years, chemical fertilizers and pesticides have become an integral part of agricultural and food production systems throughout the ANE region. Their use has been associated with substantial yield increases and the attainment of self-sufficiency in basic grains. However, this use has often been inefficient and unsafe, threatening human health and the environment, introducing a new suite of management problems, and ultimately threatening the continued stability and sustainability of the agricultural production system.

Conditions and Trends. Demand for fertilizers and pesticides has grown rapidly since the mid-1960s. Indeed, demand for and use of nitrogen fertilizers is higher in the ANE region than anywhere else in the developing world. India is the major consumer by volume, while Egypt has the highest per hectare use.⁴¹ (See Figure 2-4.) Pesticide use has increased by 35 percent per annum in the ANE region since the mid-1960s. India is by far the largest consumer in Asia, and Egypt in the Middle East.⁴²

Most agricultural chemicals are applied on the best-quality lands, those with fertile soils and reliable water supplies. In Tunisia, for example, over 80 percent of all pesticides are used on the 5 percent of arable land that is irrigated. Pesticide use varies as well between crops. In Egypt, about 65 percent of all insecticides are used on cotton grown on only 15 percent of the cultivated land. And vegetables, while not grown as extensively, often receive higher quantities of pesticides on a per hectare basis than cotton. Similarly, per hectare application rates and percent of farmers using nitrogen fertilizer are highest on irrigated and better-quality rainfed lands.⁴³

The use of agricultural chemicals in the ANE region will probably continue to grow, given declining availability of arable land per capita and increasing demands for higher-value food by urban and international markets. Most ANE governments favor expanding their use, particularly fertilizers, and have instituted a variety of mechanisms to help encourage this practice, including access to foreign exchange on favorable terms, tax exemptions or reduced tax rates, soft credit, fixed prices, and sales below cost by government-controlled distributors. The weak regulatory climate existing in many ANE countries and the shortage of good integrated management programs mean that hazardous and inappropriate use of these chemicals, particularly pesticides, is very common.

Impacts and Economic Significance. Financing the use of agricultural chemicals has been a costly endeavor in most ANE countries. In Bangladesh, for example, nearly 75 percent of the total agricultural development budget goes for fertilizer subsidies, even though 30 percent of the country's needs are met through foreign aid organizations. Indonesia spent \$220 million and \$25 million, respectively, on fertilizer and pesticide subsidies in 1985, though most pesticide subsidies have since been eliminated. Similar high cost figures are available for a number of ANE countries.

Furthermore, pesticide-dependent strategies have led to growing resistance to pesticides, requiring ever stronger and more frequent applications (which are invariably more costly). Pesticides frequently kill not only the target insects but also the natural enemies of pests, leading to a resurgence of the target insect and the need for even more applications. While a thorough documentation of

resistance is not available for the ANE region, it has clearly become a major management problem in every ANE country for one crop or another as well as for vectors for human diseases.

The health impacts of pesticides and fertilizers arise either from direct contact during application, or through ingestion of residues on contaminated foodstuffs and water by consumers, or indirectly from the release of chemicals into the environment. Applicators face a particularly high risk of exposure. Reports consistently describe the lack of or failure to use protective gear (overalls, gloves, hat, mask, and boots), the use of faulty or miscalibrated equipment and the use of pesticide "cocktails," or mixtures within one spray application. The chronic impact of continued exposure to pesticides and the delayed health impacts are very poorly understood. However, increased incidence of cancer as well as reproductive and blood disorders have been noted. Chronic and acute exposure may be compounded by the poor nutritional and health status of many citizens in these countries.

Table 2-2 shows trends in occupational and accidental pesticide poisonings for a few ANE countries, exclusive of attempted suicides. These figures represent only a fraction of actual cases, since they record only those for which hospital visits were required, which is a small percentage of the total. One survey in Thailand, for example, reported 8,268 cases of pesticide poisoning per 100,000 agricultural workers, only 169 of which were reported to hospitals. Even then, misdiagnosis and lack of diagnostic tools further reduce the accuracy of poisoning estimates.⁴⁴

In addition to the risk to applicators and their families, there is an unquantified public health risk to consumers when spraying, particularly of vegetables, is done close to harvest time and residues are left on the crop. Fertilizer-related health impacts are also little known and/or contentious. Nitrates themselves are relatively non-toxic; the health hazards they pose arise from leaching or draining into the environment as well as other factors.

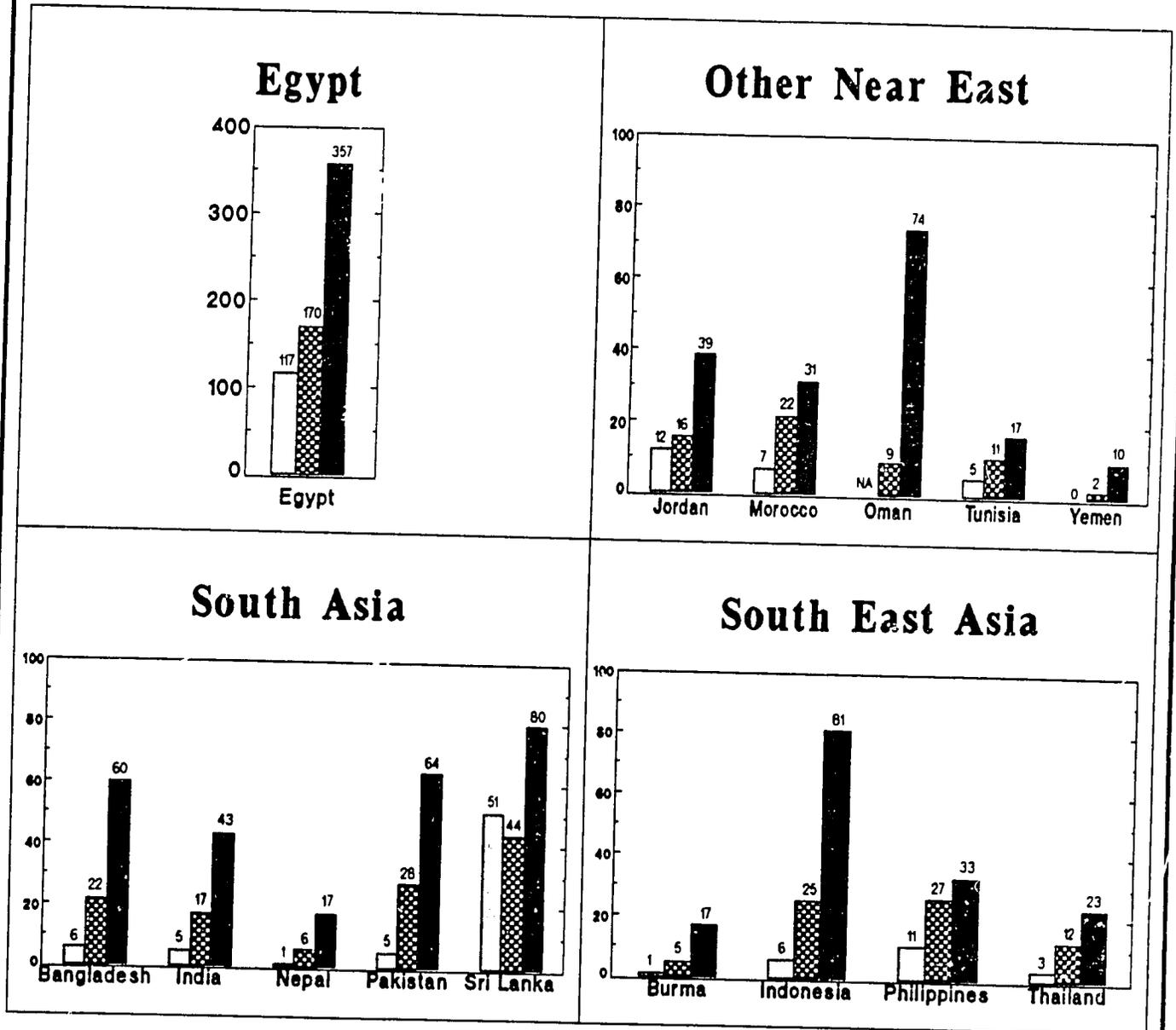
The environmental impact of pesticides and fertilizers is highly variable depending on the chemical involved and the specific biophysical conditions. Pesticides can have a definite impact on non-target organisms, and much of this has been well documented in developed countries. Less clear is the relative importance of this impact in developing countries, the ability of affected ecosystems to recover, and the economic costs of environmental contamination involved. Fertilizers increase nitrate and phosphorous loads in water throughout the region. They are implicated in algal blooms, can trigger fish kills due to oxygen depletion, and also may be important atmospheric pollutants, although human and livestock waste probably account for more of these effects than do chemical fertilizers. Given the lack of monitoring efforts in the ANE region, actual

Figure 2-4

Fertilizer Use On Cropland

(Kilograms per Hectare of Cropland)

(1965, 1975, 1984)



Source: U.N. Food and Agricultural Organization

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Table 2-2

PESTICIDE POISONINGS IN SELECTED ANE COUNTRIES

	1979	1980	1981	1982	1983	1984	1985	1986
ANE NEAR EAST								
Egypt	--	129	352	70	36	--	--	--
Jordan	117	--	--	--	--	--	--	--
Tunisia	1132	--	--	--	--	--	--	--
ANE SOUTH ASIA								
Bangladesh	--	--	--	--	54	--	--	--
India	3151	--	--	--	--	--	--	--
Sri Lanka	3070	3189	--	--	4543	--	--	--
ANE SOUTHEAST ASIA								
Burma	--	--	--	--	386	--	--	--
Indonesia *	413 (14)	431 (17)	91	102 (20)	--	862	--	--
Indonesia *	450 (26)	100 (10)	133 (17)	701 (54)	320 (52)	153 (18)	444 (27)	404 (32)
Philippines *	--	--	--	77	337	183	29	--
Philippines *	--	1300	1290	238	824	249	--	--
Thailand	1835 (18)	1851 (15)	2159 (17)	2187 (10)	3213 (12)	2094	2339	--

Note: Numbers in parentheses are deaths as a result of poisoning.

Source:

Table from: Higgins, M.L., W.W. Barclay, and J.N. Pretty, 1989,

The Use and Management of Agricultural Chemicals in the Asia and Near East Region.

* Note: Multiple entries for countries (Indonesia, Philippines) are from different sources.

impacts on organisms and ecological communities are difficult to ascertain.

7. Inefficient Energy Use

The continued expansion and industrialization of the economies of ANE countries as well as rapid urbanization and population growth, have required greatly increased energy use. Indeed, energy consumption has grown faster in the ANE region than any place else in the world, averaging 6 percent a year between 1973 and 1986. (See Figure 2-5.) Experience has shown that each 1 percent increase in GDP in developing countries requires a 1.3 percent increase in energy inputs, but in several ANE countries, this ratio has been substantially exceeded. For example, between 1980 and 1986, each 1 percent increase in GDP required an increase in energy inputs of 2.4 percent in Bangladesh; 3.3 percent in Nepal; 1.5 percent in Egypt; 1.7 percent in Thailand; and 1.8 percent in both Jordan and Tunisia.⁴⁵ Energy demand is projected to continue growing at high rates in most ANE countries at least through 2000.

Conditions and Trends. Commercial energy supply and use in the ANE region is dominated by fossil fuels.⁴⁶ The largest energy-consuming end-use sector has been industry, and transport is the largest consumer of petroleum products. India is by far the largest energy consumer, accounting for 50 percent of the region's primary energy use in 1986. Indonesia and Egypt are the region's second and third largest energy consumers, respectively.

- o Oil accounted for 47 percent of primary energy supply and 57 percent of final energy consumption in 1986, and is the primary source of energy for all countries except Bangladesh, India, the Philippines, and Oman. (See Figure 2-6.)
- o Coal accounted for 30 percent of supply and 20 percent of consumption in 1986 and is India's major source of energy. India produces 90 percent of the region's coal, with the Philippines, Thailand, Indonesia, and Pakistan accounting for the rest.
- o Several countries (including Bangladesh, India, Indonesia, Pakistan, Egypt, Thailand, and Oman) have greatly increased their use of natural gas, generally through development of indigenous resources. The largest primary consumer of natural gas in the region is Indonesia, followed by Pakistan, India, and Egypt. Natural gas is the major source of primary energy supply in Oman (66 percent) and Bangladesh (56 percent). Consumption in the region as a whole has been growing at 16 percent a year.

In addition, the region has a considerable number of facilities for hydropower. Hydroelectric power supplied over 40 percent of total electricity in 1986 in the Philippines, Nepal, Sri Lanka, and Pakistan.

Outside the commercial sector, wood fuel and other biomass fuels remain a major source of energy. They are the only cooking fuels for the majority of rural households and for a significant portion of the urban population. Many rural industries that require heat – e.g., brick-making, fish-smoking, tea-drying, and lime-burning – also use wood as the primary fuel. Charcoal is predominantly an urban fuel, where it is preferred to wood for its ease of use and lack of smoke.⁴⁷

ANE countries' demand for these fuels has been growing rapidly, and the demand for energy, especially electricity, is projected to grow at high rates in most ANE countries at least through 2000. The fastest growth is expected in Thailand, Egypt, Pakistan, Yemen, India, and Indonesia. Electricity demand is likely to grow at much higher rates than overall commercial energy demand, and in most countries will exceed 7 percent a year.⁴⁸

To meet existing and projected demand, most countries plan to accelerate the development of their indigenous fossil energy resources and their hydroelectric potential. In the region overall, there is likely to be a continued shift away from oil and toward coal and natural gas. India expects annual coal demand to increase to 420 million tons by 2000, and projects an average growth of 10 percent a year in coal production for the power sector alone over the next ten years. A number of countries – including India, Indonesia, Pakistan, and Morocco – also plan to add large amounts of hydro capacity.⁴⁹

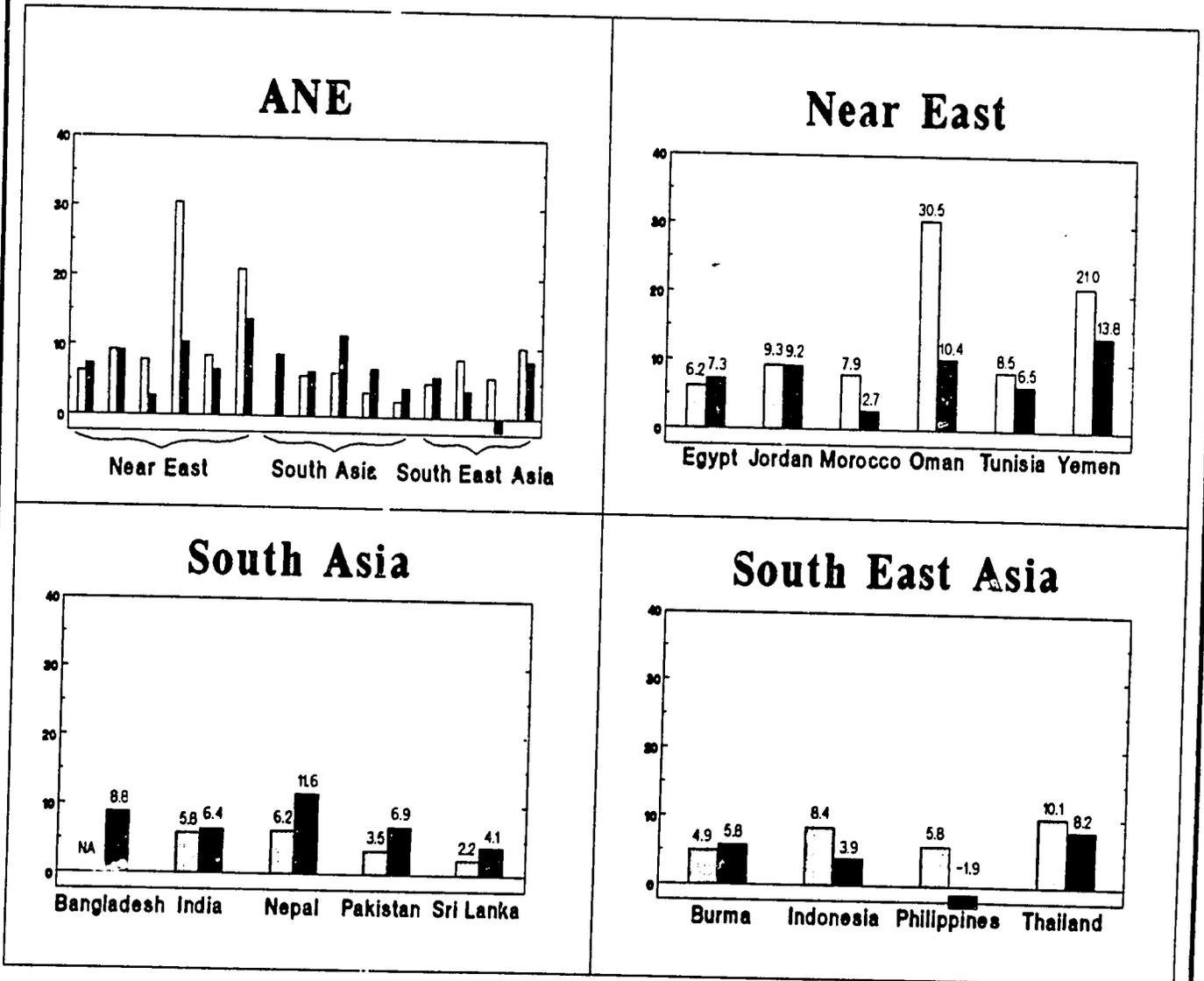
Impacts and Economic Significance. ANE governments face a number of constraints that threaten their ability to provide the energy needed to fuel development. Several countries in the region, including Bangladesh, Egypt, India, Pakistan, Indonesia, and the Philippines, already face severe shortages of energy, especially of power. For example, in India power shortages have been over 10 percent of demand in the last five years. Pakistan is experiencing severe shortages of power and natural gas, which are constraining industrial and economic growth and requiring higher imports of oil.

In part, these shortages result from the extremely inefficient use of energy across all sectors and all countries in the region.⁵⁰ Surveys in Pakistan have shown that the same industrial output could be achieved using 22 percent less energy. In Egypt, industrial energy consumption per unit of output averages 60 percent higher than international standards. It has been estimated that energy inefficiency costs the Egyptian economy more than \$1 billion per year through lost foreign exchange earnings from potential petroleum exports and reduced productivity. Throughout the region, electric power transmission and distribution losses exceed

Figure 2-5

Energy Consumption Growth Rates (Percent per Year)

(1965-80, 1980-86)



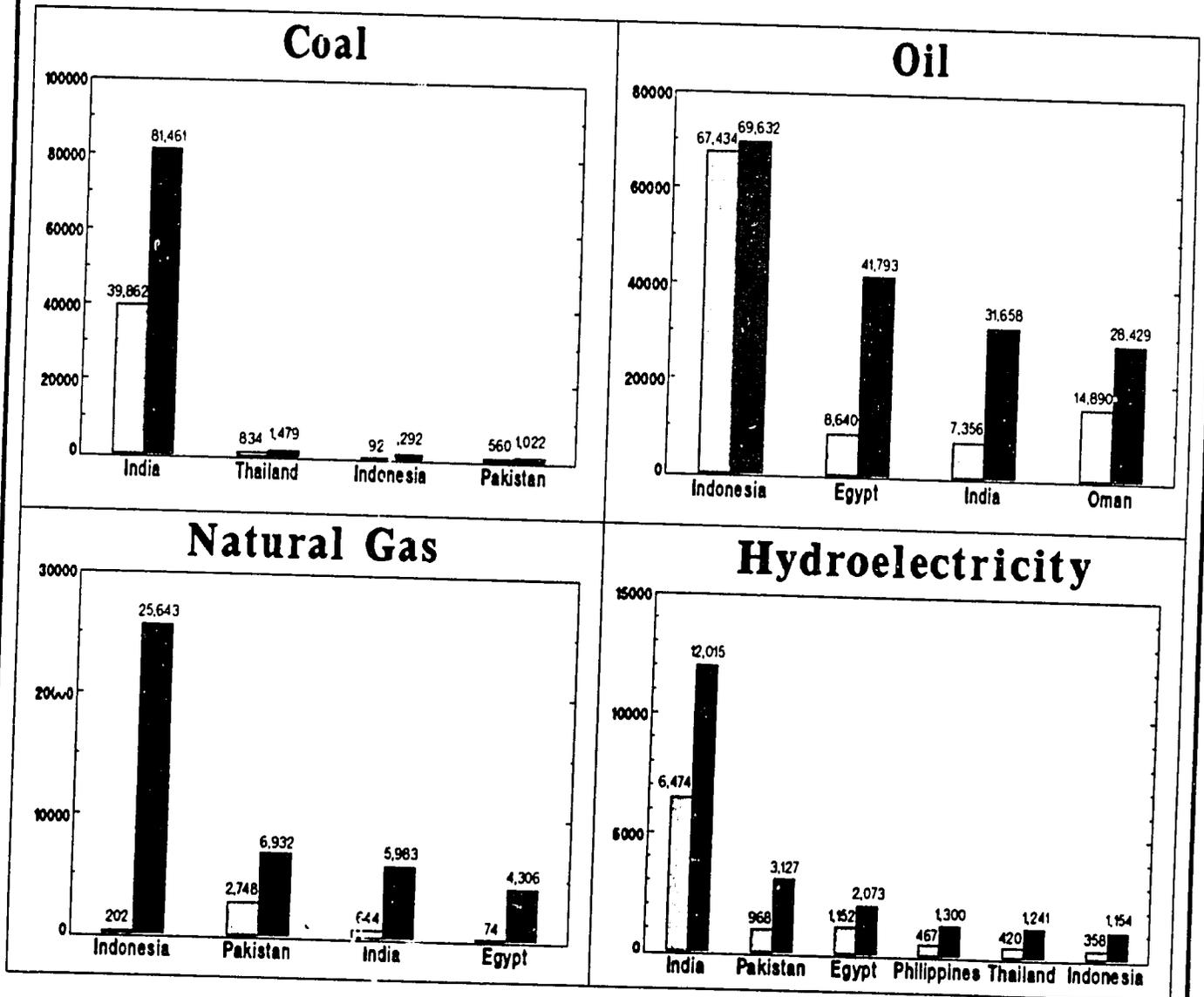
Source: World Bank

Figure 2-6

Major Producers of Commercial Energy

(1973, 1986)

(Thousand Tons of Oil Equivalent)



Sources: International Energy Agency; Asian Development Bank

20 percent.

Energy use is also inefficient for traditional fuels. An efficiency of about 10 percent is often assumed in studies of traditional cookstoves, for example. Early programs to improve stoves attempted to reduce the costs of new appliances by focusing on stoves that were made by the user out of un-fired clay. However there were many difficulties in the diffusion of design information and in maintaining the quality of fabrication. More recent programs have focused on introducing metal and ceramic stoves, which use less charcoal and wood, for use by urban and peri-urban households that buy their fuel from commercial traders.

Significantly, all but four countries in the region subsidize either fuel or electricity prices, a policy that undoubtedly contributes to wasteful use of energy. In Burma and Egypt, where fuel prices are heavily subsidized, energy intensity (e.g., the tons of oil equivalent required to produce each unit of GDP) was much higher than for other countries at similar income levels. (See Figure 2-7.)

Given the costs of subsidies as well as needed investments, ANE countries will be hard-pressed to meet their future energy needs. Their energy development plans will be extremely expensive, and will impinge on government financing of health, education, and other programs. Financing the needs of the power sector alone will require an estimated \$230 billion between 1986 and 2000, and will add to the already severe financial strains on most governments in the region.⁵¹

Furthermore, given the intent of most governments to rely on fossil fuels and hydropower to meet their growing demand for energy, the local, regional, and global environmental impacts of energy use in ANE countries will continue to increase. Coal, which has the greatest environmental impact, plays a particularly important role in India. Coal mining releases fugitive dust and damages the natural landscape. Its combustion, along with that of other fossil fuels, releases "greenhouse" gases which contribute to global warming, and other pollutants which affect public health, damage crops, and cause acid rain. At present, the region's share of global CO₂ emissions from fossil fuel combustion is small but increasing; levels of SO₂ and particulates already exceed WHO standards in several major cities in the region.⁵² The growing demand for wood fuels in rural areas will exacerbate the region's deforestation problem. Finally, hydropower installations, which are included in the electricity expansion plans of most ANE countries, will inundate large areas of land, altering river-basin ecologies, and often requiring the relocation of sizable populations.

8. Urban Pollution and Hazardous Waste

Hazardous wastes are a growing component of the waste management problem in the ANE region, especially the large, rapidly industrializing countries of Egypt, Pakistan, India, Thailand, the Philippines, and Indonesia.⁵³ These wastes, along with older forms of pollution, are contaminating drinking water, air and food, exposing workers to poisons, and degrading the quality of land and water at disposal sites.

Conditions and Trends. Urban pollution in developing countries has only recently become subject to study and analysis. Nevertheless, enough is known to provide a general picture of this emerging problem.

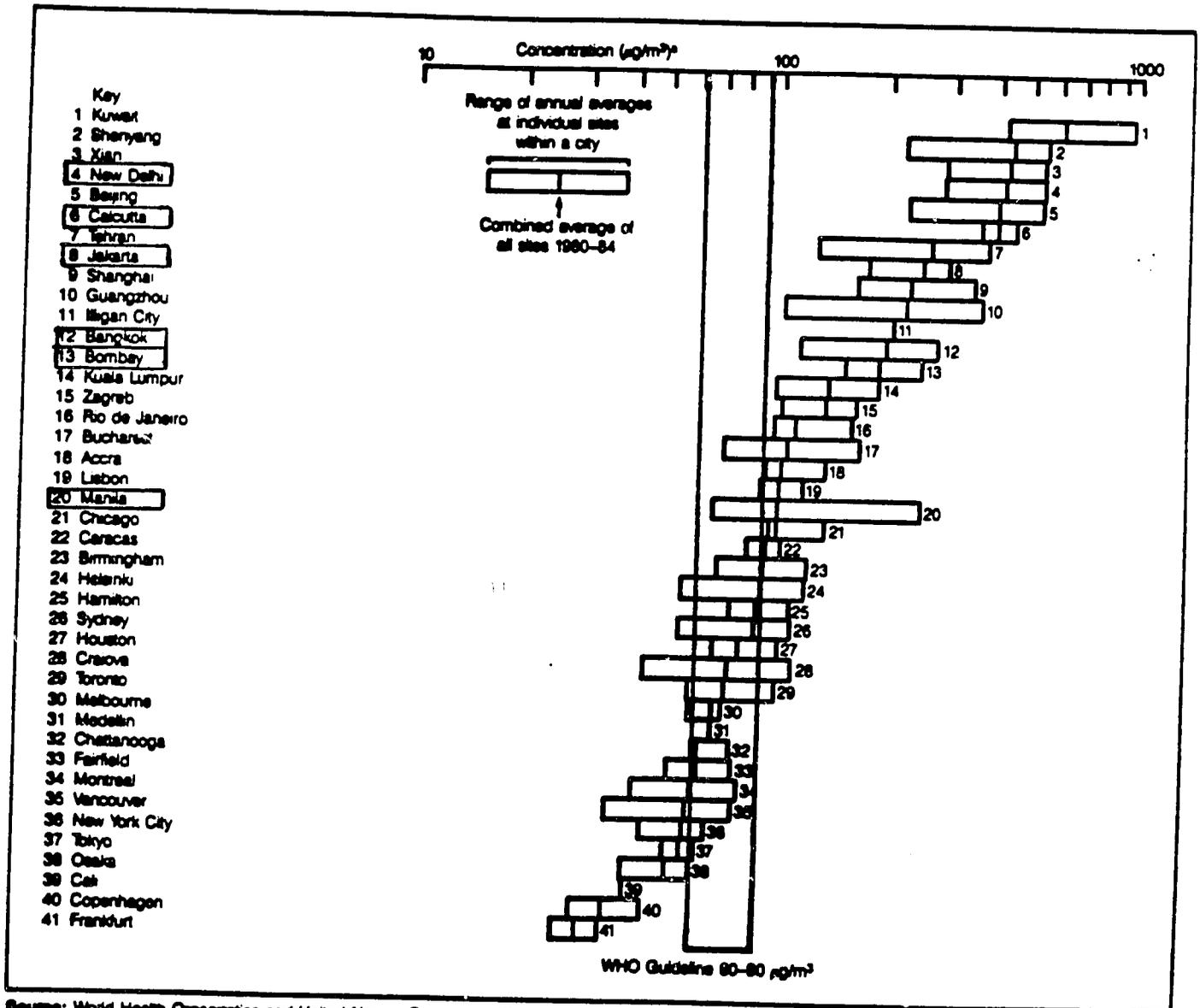
(a) Air Pollution. Urban air in most ANE countries is filled with growing amounts of organic and inorganic chemicals as well as suspended particulates emanating from motor vehicles, industrial plants, thermal power generators, cottage industry, and natural sources. For Asian countries on which data are available, for example, sulfur dioxide levels rose by about 10 percent a year between 1973 and 1984. New Delhi, Calcutta, Jakarta, and Bangkok ranked 4th, 6th, 8th, and 12th, respectively, among the 41 cities analyzed by the UN-sponsored Global Environmental Monitoring System (GEMS) in 1980-84, for concentrations of suspended particulate matter. (See Figure 2-8.) Emissions of heavy metals (lead, arsenic, mercury, cadmium) are also increasing.⁵⁴

To these more modern sources of air pollution must be added those that result from under-development. Bacteria-laden dust and dirt, for example, still rise from open trash heaps, street sweepings, and sanitation dumps in most towns and cities. Firewood, dried dung, and agricultural wastes used for domestic cooking and space heating also produce large amounts of pollutants.

(b) Water Pollution. Asia's rivers and streams have long carried heavy burdens of sewage and have had high concentrations of coliform bacteria, which often indicate the presence of other bacteria that are harmful to humans. Of the rivers sampled by the GEMS program in Asia and the Pacific, for example, 20 percent had high or very high coliform bacteria content.⁵⁵ City canals and drains have effectively become open sewers, receiving surface runoff as well as garbage, effluent from septic tanks and cesspools, and other water.

Because few industrial plants have installed waste treatment facilities, industrial and mining wastes compound the water pollution problem. Indonesia, for example, has identified ten industrial zones where excessive amounts of hazardous wastes are being discharged into rivers and oceans. In Surabaya, despite a city moratorium on new waste-producing industry, the local river was virtually devoid of oxygen by 1980, and untreatable by standard methods for

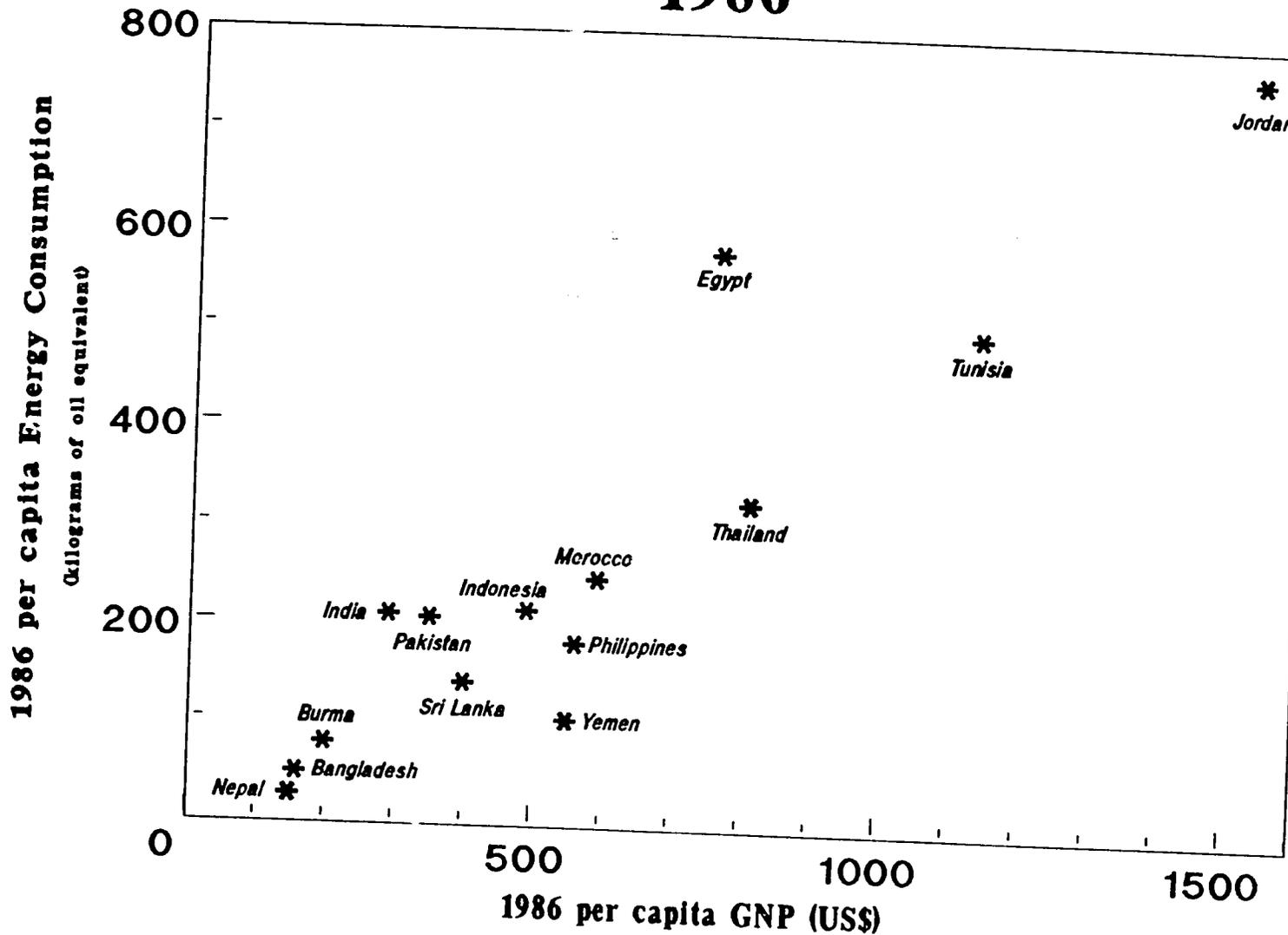
Figure 2-8 Suspended Particulate Matter in Selected Cities, 1980-84



Source: World Health Organization and United Nations Environment Programme, *Global Pollution and Health* (Yale University Press, London, 1987), Figure 3, p. 6.
 Note: a. Note logarithmic scale.

Figure 2-7

Energy Intensity in ANE Countries 1986



Source: World Bank.

Note: figure excludes Oman: 2146 kgoe; 4990 SUS.

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producing potable water. Indonesian officials also cite the numerous, small tapioca producers as significant contributors to river pollution.⁵⁶

(c) Land Pollution. Large cities in the low-income ANE countries (e.g., Calcutta, Karachi, and Jakarta) generate between 500 and 600 metric tons of solid waste per day for each million inhabitants, while cities in middle-income countries (e.g., Cairo, Manila, and Tunis) generate as much as 850 metric tons, primarily because of their greater industrial and commercial activity. Indeed, collecting such waste provides employment for thousands of scavengers throughout the region.⁵⁷

Composting is often used for household and street wastes that contain large amounts of water and vegetable matter, excreta, and other organic matter. The higher a country's per capita income, however, the more likely it is that urban trash will include substantial amounts of paper, glass, ceramics, and metals. Much of this is recycled through a combination of scavenging and more modern techniques, but some industrial wastes are highly toxic (perhaps 50 to 100 compounds out of the hundreds in common use are toxic to humans, plants, or animals), flammable, or otherwise dangerous to handle or dispose of.⁵⁸ Rough estimates suggest that, for every \$1 billion in GDP, about 100 tons of hazardous waste are generated from plants manufacturing such goods as pharmaceuticals, paints and dyes, chemicals, pulp and paper, and fossil-based fuels, as well as small-scale industries such as electroplating shops and tanneries.⁵⁹ One survey in Istanbul found that hazardous waste amounted to about 9 percent of the total waste identified for disposal.⁶⁰

While it is conventional to discuss pollution under the general headings of air, water, and solid waste, much pollution is simply transferred, sometimes in more concentrated form, from one medium to another. Thus, toxins from landfills leach into groundwater; ash from incinerated industrial waste is dumped into rivers; and air pollution falls to earth as acid deposition. Residues from wastewater treatment plants and air pollution control devices are themselves sources of hazardous waste because they are likely to contain heavy metals.

Impacts and Economic Significance. Overall, the Asian Development Bank predicts a five- to ten-fold increase in regional air and water pollution over the next 15 years because of an expected 300 percent increase in the number of motor vehicles and a 150-200 percent expansion of industrial and mining activity.

Quantitative measures of the impact of hazardous chemicals and wastes are not readily available, principally because of the lack of monitoring equipment, trained personnel and operating budget, and the difficulty in isolating causal factors, especially in the case of long-term consequences. Industrial workers -- poorly trained and usually without safety equipment or protective clothing -- are at the most immediate risk of illness or accident. Thus, the rate of industrial

injuries in Thailand rose from 1,173/100,000 workers in 1974 to 4,003/100,000 in 1984, though the rate has since dropped slightly.⁶¹ Furthermore, workers are at unquantifiable but probably significant long-term risk. Additional risks accrue to the workers' families and others who cluster near most factories, not only from potential accidents of the sort that happened in Bhopal, India, in 1984, but also from long-term exposure to pollutants. The risks of chronic exposure to pollution are not well documented. However, they are believed to range from cancer and birth defects to mental retardation.

Urban populations in general are subject to multiple assaults from unpotable water, toxic wastes and foul air, so that specific causes of death and disability are hard to identify. There is no doubt, however, that pollution adds to the already large health burden from traditional sources of illness and infection, in addition to greatly lowering the quality of urban life.

In addition to its health effects, pollution is known to damage important crops, including maize, cotton, and soya beans, as well as forests and coastal ecosystems. Degraded water quality may be the most pervasive consequence, producing losses to fishing and tourism as well as drinking water.

Pollution control is not, however, a priority issue in most ANE countries. Governments have been particularly slow to recognize the direct and indirect subsidies that encourage overuse of pollution-causing substances. Prices of electricity and gasoline, for example, are often held artificially low to promote industrialization and to help the urban middle class to meet expenses. Failure to regulate, tax, or sue polluters for the damage they cause also creates an incentive system biased against pollution prevention. In addition, government policies have reinforced a concentration of industries generating toxic and hazardous wastes in urban areas.

While many ANE governments now have anti-pollution laws and regulations on the books, particularly for toxic substances, enforcement is spotty. Environmental protection agencies and occupational health and safety offices lack financial and technical resources, as well as enforcement authority, capability, and political backing. Insofar as they exist, waste treatment facilities – landfills, incinerators, etc. – are generally not designed to handle hazardous materials. Older industrial facilities are particularly difficult and expensive to retrofit with pollution-control devices. State-owned plants violate emission standards as regularly as do private ones, and officials tend to overlook infractions.

9. Lack of Clean Water and Sanitation

Water is the natural resource that is central to sustainable development. Other sections of this report have discussed its relevance to agriculture, forest and watershed management, fisheries, and coastal resources. For individuals, both the quality and the quantity of water available to the household is a determining factor in the quality of life and health. Adequate sanitation, too, contributes to maintaining healthful conditions. Rural inhabitants (and development experts) continue to stress the need for assured safe water supplies and sanitation as a principal means to alleviate poverty and improve the quality of life in developing countries.

Conditions and Trends. As part of the UN's International Drinking Water Supply and Sanitation Decade (1981-90), almost all of the ANE countries developed strategies for providing services in both rural and urban areas, with a goal to provide universal coverage. This has not occurred, and without access to clean water, the expected benefits in improved health, time-savings, increased economic productivity, and income have not been realized.⁶²

At the time of the most recent assessment, 1985, less than 50 percent of ANE citizens had access to clean water and less than 17 percent to adequate sanitation. In rural areas the percentages were lower, 44 percent and 12 percent. In Bangladesh, India, Nepal, and Pakistan, fewer than 6 percent of rural residents have access to proper sanitation. (See Figure 2-9.) Population growth means that the absolute numbers of those without safe drinking water and, especially, sanitation will continue to grow. Furthermore, there may not be enough water to meet other domestic needs – for bathing, cleaning, home gardens, and domestic livestock.

WHO clean-water standards require that 98 percent of water samples from any one area be completely free of coliform bacteria. But untreated sewage, whether disposed of directly into watercourses, through seepage from latrines, or through flooding, makes this standard virtually impossible to meet. Thus, by WHO standards, more than two-thirds of India's freshwater resources are polluted. Of the country's 3,119 towns and cities, only 217 have even partial sewage treatment facilities. The Jumna River, typical of many in India, picks up an estimated 50 million gallons of untreated sewage every day as it passes by New Delhi. Before entering the city, the river water contains 7,500 coliform bacteria per 100 milliliters; below the city, the bacteria count rises to 24 million per 100 milliliters.⁶³ In general, the poorer the country, the more likely that its drinking water will be contaminated.

Impacts and Economic Significance. The importance of water, for women in particular, cannot be overstated. Water is a basic necessity in the performance of most of their domestic chores - cooking, washing clothes, house-cleaning, child care, and care of livestock - and in the maintenance of family health and hygiene. Furthermore, in rural areas it is generally the women's responsibility to assure the family water supply, and they must often travel long distances, carrying heavy jugs, to find the water they need. An improved water supply can have a remarkable impact on the ability to cook and feed the family, maintain healthy children, and expand productive activities.

Contaminated water and poor sanitation make possible extremely high rates of diarrhea, worm infestation, and other water-borne diseases. Indeed, WHO estimates that three-quarters of all illness and 80 percent of child deaths in the developing world are associated, one way or another, with unsafe excreta disposal, poor hygiene, and water supplies that are inadequate either in quantity or quality. Decreased health and well-being, in turn, have negative repercussions on productivity, and thus on the prospects for development.

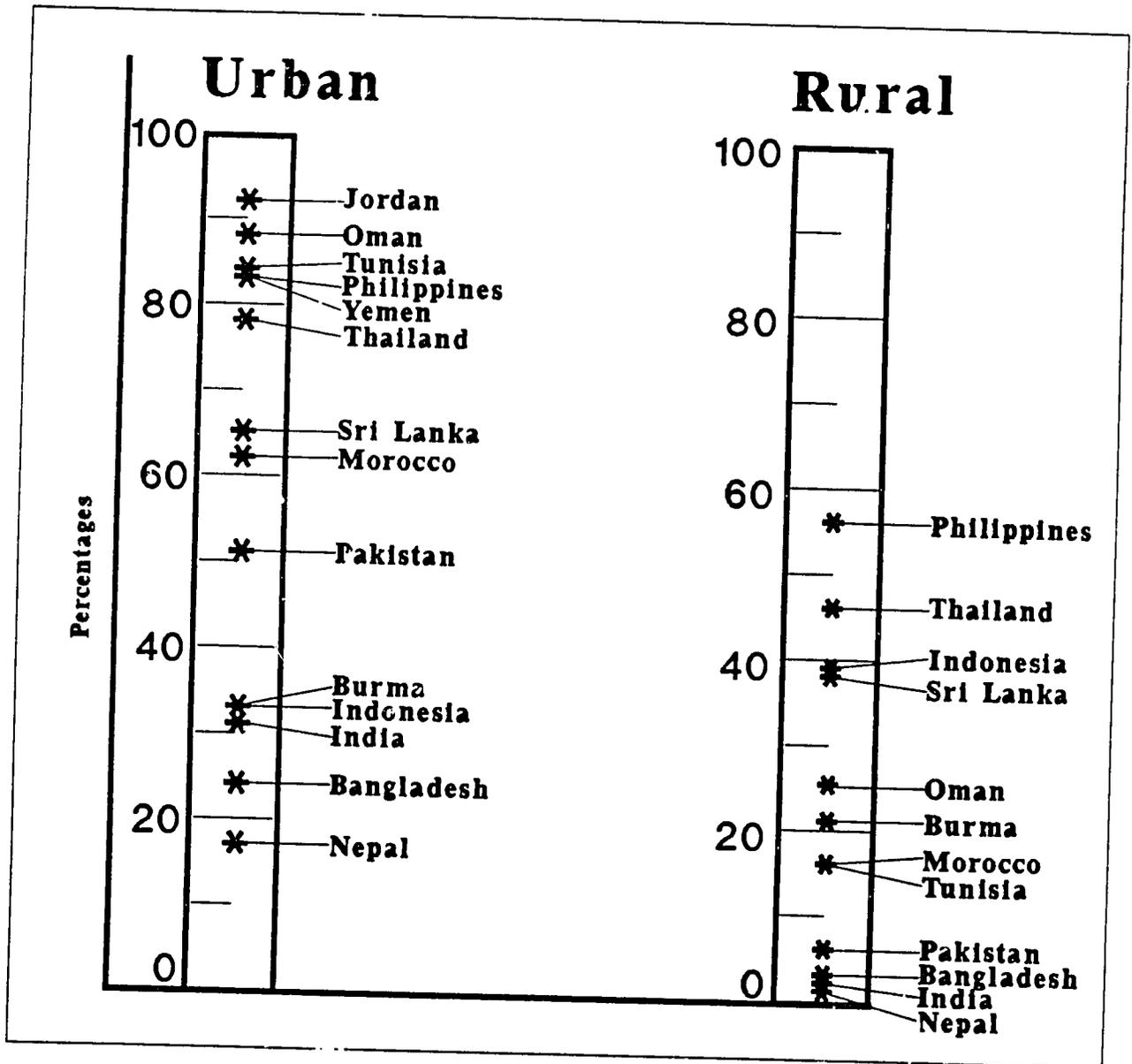
When assessing the environmental implications of providing water and sanitation facilities, consideration must also be given to the long-term protection of water supplies. Overuse of water resources, both surface and groundwater, can jeopardize future water supplies not only through over-extraction, but also through degradation from industrial and agricultural chemicals. Water shortages are already predicted to be crucial problems for many ANE cities in the future.

B. GENERAL CONSTRAINTS ON EFFECTIVE NATURAL RESOURCES MANAGEMENT

Our analysis of resource issues and trends has identified five general constraints on effective natural resources management in the ANE region: market failures; policy distortions; institutional inadequacies; inadequate information and analysis; and lack of popular participation. They underlie virtually every worsening environmental trend we have reviewed. They are also problems about which something can be done. Indeed, in the next two chapters we identify twenty specific opportunities for addressing them.

Figure 2-9

Percentage of Population With Access To Sanitation Services 1985



Sources: World Health Organization and
United Nations Population Division.

1. Market Failures

Identifying and correcting market failures that result in the over-exploitation of resources and in the undervaluing of environmental impacts, goods, and services is imperative for ensuring the sustainability of the resource base, upon which economic growth in the ANE region so greatly depends. Economic liberalization and increased private sector participation can be the basis for more efficient and sustainable resource management, provided that market prices and signals take into account the value of environmental goods and services, and the costs of their degradation. Ownership rights are the key to developing more efficient markets.

As it stands, however, markets do not fully reflect the value of forests, watersheds, coastal systems, the products they produce, and the biological diversity they comprise. Neither do they reflect the very real and substantial economic costs of environmental degradation, whether in the form of deforestation, topsoil loss, pollution, or loss of species and habitats. Until these externalities are accounted for, the market will not be able to realize its potential as the central mechanism for promoting sustainable use and conservation of the resource base.

Furthermore, no matter how perfect they are, markets cannot completely ensure that resources are used and protected wisely. Some environmental goods and services, such as clean air, are truly public goods, the benefits of which cannot be captured and marketed by any one economic actor. Others, such as the potential future value of species as yet undiscovered, are extremely hard to assign economic values to. In addition, markets do not adequately address equity concerns. In these and other cases, policy interventions in the form of incentives, regulations, and fiscal measures are needed. The challenge is to differentiate between market failures, and inherent limitations on the market requiring policy intervention.

2. Policy Distortions

ANE government policies are aimed at meeting social and economic goals for development and therefore seek to increase production of agriculture, forestry, fisheries, and energy. Many of these policies, which include public subsidies, tax credits, concessionary leases, and price controls, have implications that lead to unsustainable use of natural resources. On the whole, they tend to favor environmentally unsound practices while, at the same time, they discriminate against the poor and waste budgetary resources. Some policies actually promote inefficient use of natural resources, so that the production of crops, timber, or fish does not even meet short-term goals. The benefits that do accrue, mostly go to a few wealthy individuals and firms.

Policy distortions such as these are caused by faulty assumptions, lack of understanding of individual responses to incentives, and a lack of accountability. Agricultural subsidies lower the cost of pesticides and chemical fertilizers, leading to overuse which can degrade the environment as well as cost farmers money. Subsidized irrigation leads to the waste of water. Low fees on timber concessions lead to rapid exploitation of forests and a disincentive for sustainably managing forest reserves.

Once the effects of these policies are observed, they can be changed, and because many of the distortions are costing governments money, there is a strong incentive for policy reform. Lacking is the timely policy research that will more clearly indicate winners and losers, how policies actually work, and how they can be changed. Also lacking is the institutional support for bringing policy research to bear on these problems, and the political will to make reform a major political issue.

3. Institutional Inadequacies

Human beings act and interact through institutions -- governments and their agencies, businesses, schools, cooperatives, religious institutions, non-governmental organizations, and many others. Strategies and policies to promote sustainable development in the ANE region must therefore address the strengths, weaknesses, and potential of the institutions that manage the resource base or otherwise affect it. Indeed, policies must be shaped around the present and potential capacities of available institutions. Otherwise, they are wish-lists, not policies.

The three basic components of the institutional fabric are the laws and regulations that mandate, proscribe, and otherwise direct institutional and individual behavior; the public and private sector organizations within which human activities affecting the environment are planned and carried out; and the human capacities and skills found within those organizations. Weaknesses in all three areas are widespread throughout the region. Much of the next chapter discusses opportunities for addressing those weaknesses.

4. Inadequate Information and Analysis

The nine sections on resource trends and issues clearly indicate that resources are rapidly being used and destroyed and degraded in most ANE countries. But much of the data is incomplete, imprecise, and out of date. The lack of information and analysis is a major obstacle to using resources in a sustainable manner.

Four problems are evident: First, current data collection and monitoring are not attuned to the needs of policy makers nor to the needs of resource managers who are intent on managing resources in a more sustainable manner. Both the data collected and the analyses fail to pinpoint the problems and policy options that are open to influence. The national income accounts and other important national indicators fail to adequately reflect resource depletion and degradation. As a result, policy makers are not aware of just how important natural resources and environmental quality are to the economic growth of their countries.

Second, resource and environmental quality monitoring does not meet the growing need for data on the extent, condition, use, and value of the resource. Data on production and harvests are abundant; not so data that farmers and other resource managers need -- e.g., precipitation, groundwater availability, soil condition, wildlife abundance, and agroecosystem dynamics -- to sustain yields over time.

Third, information is not sufficient to measure performance. Information is needed to help the public hold its government and other major institutions accountable for their actions. What are they doing to achieve agreed-upon goals, what is it costing, and what are the results? This is clearly a problem for all countries and governments, not just the ANE countries.

Fourth, information that is collected -- and some of these countries are making use of the latest technology for monitoring land use, agricultural production, and rates of deforestation -- is not disseminated widely and therefore not used. Data are tightly held by those who collect it and usually released only when it suits the needs and purposes of the government. Even then, much information is not made available between ministries, which must coordinate their activities if resources are to be managed effectively. Barriers to access reduce the availability of statistics and research findings to the public and the many users that need information. Threats to national security, industrial secrets, and cultural sensitivities are overused as excuses to control and limit access. Bureaucratic red tape and fear of facing the facts also plays a role.

Controlling the collection and dissemination of information is a powerful way to influence how resources are used, and it is imperative that information policies and practices be reoriented to better address long-term management needs.

5. Lack of Popular Participation

Ultimately, the fate of the region's resource base -- and hence, the prospects for economic development -- will be determined by the billions of everyday actions taken by individuals. The needs and interests of the majority in most ANE

countries are not, however, adequately represented in policy making and resource allocation processes. In addition, local communities have not been allowed the opportunity – nor provided the tools and the incentives – to fully participate in the management of local resources. The frequent result is that development policies, because they are formulated without widespread participation, fail to mobilize the support of local communities in implementation. Until individuals and communities are represented fairly in the policy process, they are likely to go their own way, which – particularly for the majority who live in poverty – will generally dictate rapid and unsustainable depletion of the resource base.

Increasing popular participation needs to be done on a number of fronts. Local and national political systems need to evolve toward a greater breadth and depth of representation; Legal systems need to become more accessible, efficient, independent, and responsive; Local communities need to obtain the authority and capacity to take a greater role in managing their resources; Non-governmental organizations need to be given the political space and the capacity to put forward under-represented interests and concerns; and government bureaucracies need to become more open, flexible, and responsive, particularly with regard to data and information. These kinds of changes are essential for the wise, sustainable, and equitable stewardship of the region's resource base.

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CHAPTER III

RESPONDING TO THE CHALLENGE:

POLICIES, INSTITUTIONS, AND PERSPECTIVES

RESPONDING TO THE CHALLENGE: POLICIES, INSTITUTIONS, AND PERSPECTIVES

In this chapter and the next, we have identified 20 specific opportunities for working toward sustainable development in the ANE region. The seven opportunities in this chapter deal with changing the basic framework so important in determining the use, value, and condition of resources. This involves reforming policies and strengthening the institutions that must manage resources effectively. The opportunities here also address the need for greater public awareness and participation and the use of more, and more pertinent, information in decision making and management. Chapter IV deals with specific resource issues.

Opportunities were chosen based on the urgency and importance of the problem, the availability of models and approaches that have proven successful within the region, and the expectation that governments, the private sector, and donors working together can make a measurable difference. While not all actions recommended need be undertaken in every country or at the same time, most of these actions are necessary if substantive and long-term change is to occur. It is not intended, however, that AID will undertake programs or projects in all ANE countries in response to each of these opportunities. Indeed, the principles and criteria by which AID can make choices and set priorities are spelled out in Chapter V.

Opportunity 1: Incorporating Environmental Considerations into Economic Policy Reform

There is increasing recognition that many policy-induced distortions in the functioning of market processes are both contributing to environmental degradation and hampering economic progress. The severe environmental problems discussed in the previous chapter are the cumulative result of millions of small agricultural and industrial decisions and operations, as well as of large capital projects. Careful planning and regulation can mitigate the negative effects of large projects, but they have little impact on the decisions and actions of the small farmer, pastoralist, or manufacturer. What is needed, therefore, are policy reforms that alter the structure of incentives that economic actors, large and small, respond to. Appropriate incentives are those that support economic growth and at the same time, help to preserve the productivity of the natural resource base.

Economic policy reforms include a range of measures, from the broad macroeconomic to sub-sectoral levels. Macroeconomic policies cover exchange rates, management of external debt, trade policies, measures that alter relative prices between sectors of the economy, and other measures that have multisectoral effects across the whole economy. Incentive-manipulating sectoral policies include measures that change the structure of incentives in a particular sector such as

forestry or agriculture; input subsidies (e.g., for water, fertilizer, credit), taxation (e.g., of timber production), and output price controls. Some policy interventions are directed at specific subsectors, such as livestock, although their indirect effects are often sector-wide.

Economic policy reforms are being carried out by a number of ANE governments to rationalize their economies and allow more freedom and incentive for private economic activity. Although these reforms are rarely carried out solely for environmental reasons, policy makers are beginning to understand the mutually beneficial relationship between economic development and environmental sustainability, and the role that economic policy reforms can play in both.

In the Philippines, for example, subsidies on irrigation services have been reduced, and a policy of variable irrigation fees based on water-volume use has been adopted. Rules and procedures for collection of irrigation fees have been strengthened, and responsibilities for operation and maintenance of some irrigation systems have been turned over to irrigators' associations. Pricing and tariff reforms are also taking place within the urban energy sector, with the objective of increasing energy efficiency and mobilizing resources.¹

In both Tunisia and Morocco, land policy is being restructured (through both land consolidation and provision of greater tenurial security) to provide better incentives for sustainable investments in land productivity. Measures include the transfer of collective lands to private individuals, provision for long-term leasing of public lands to private enterprise, land consolidation measures and incentives, and accelerated land titling. Pakistan is gradually eliminating subsidies on fertilizers, pesticides, and energy, and is increasing water charges and other irrigation levies. Indonesia has reduced pesticide and energy subsidies and is considering a restructuring of its timber concession system. Both Thailand and Nepal are instituting systems for providing secure tenurial rights on legally designated "forest" lands. In Nepal, recent legal and policy changes mandate a return of many forest areas to legally constituted forest user groups. In Thailand, inheritable but non-alienable "right to farm" certificates are being issued for some lands classified as forest, but suitable for long-term agricultural use.

The most promising opportunities for promoting economic policy reforms for sustainable development in the 1990s lie in three complementary directions. First, the already considerable fund of general knowledge on the topic needs to be deepened and adapted to the conditions and needs of specific ANE countries. This requires policy research and assessment, and development of in-country capacities to carry it out. Second, the process of policy dialogue within and among countries and between governments and donors needs to be further stimulated and channeled toward the implementation of reforms. Finally, a wide range of complementary measures needs to be explored. "Getting the incentives

right" is a necessary but not sufficient condition for bringing about sustainable economic growth; in the absence of perfect markets and information, and in the dynamic conditions of ANE economies and societies, carefully crafted and flexible institutional, legal, and technological interventions are also necessary.²

a. Policy Research and Analysis

Research to document the links between specific public policies and their environmental effects is a prerequisite for effective policy reform. In particular, inquiry needs to focus on the effects of pricing policies, taxation and subsidies, and tenurial arrangements in forestry, fisheries, irrigation, pesticides, and other agricultural inputs.

Recent studies have examined the linkages between a variety of policy measures and deforestation in Indonesia and the Philippines,³ and have analyzed the environmental effects of irrigation and pesticide pricing and subsidy policies in Indonesia, Egypt, and Pakistan.⁴ In Thailand, AID-supported research has taken a similar approach across a number of sectors,⁵ and another project has documented the economic and environmental effects of land tenure policies.⁶ At the World Bank, a recent study examined the environmental impacts of structural adjustment policies, with a good deal of focus on countries of the ANE region.⁷

More research is needed that responds to specific conditions in the ANE region. Policy research should focus on the sectors and countries where: (a) a serious environmental problem threatens; (b) prima facie links between economic policies and the environment can be seen; and (c) the government is showing some interest in both environmental protection and economic policy reform. Water policies are important throughout the region, but particularly so in the Near East. Policies affecting forests are key in Southeast Asia. Agricultural policies are important virtually everywhere. Very little work has been done on the relation of energy subsidies, to air pollution, on the one hand, and to fuelwood consumption and deforestation on the other.

In addition to focusing on specific linkages, research needs to focus on developing the basis for including natural resources "capital stock" and environmental services in the calculation of national income accounts. Because natural resources are not treated as productive assets and depreciated over time, their depletion is treated as current net income, without an offsetting calculation of the depletion in the nation's basic environmental capital. The result is an illusory gain in current income, bought at the cost of permanent losses in national wealth.⁸ If this situation is to be corrected in the ANE region, governments will have to adopt some type of natural resources accounting, which assigns values to resources and environmental services and integrates them into the overall national balance

sheet. While this whole field of inquiry and policy reform is just taking shape, it represents an important opportunity for addressing determinants of unsustainable natural resource utilization at their very roots.

Building a cadre of in-country experts who can carry out research on the environmental and other effects of economic policies, and use the results to promote policy reform, is probably the most promising route to implementing reforms. Research capabilities need to be strengthened in, and research carried out by a variety of institutions. Chief among these are planning and finance agencies and ministries, economic policy research institutes, university economics faculties, environmental study centers, and research-oriented NGOs. In some countries, possibilities exist for the establishment of joint economics-environmental study institutes.

b. Promoting Policy Dialogue

Economic planners, sectoral and environmental officials, academics, non-governmental environmental groups, donors, and representatives of private industry and banking all need to be involved in policy dialogue on the environmental and other dimensions of economic policy reform. The appropriate forum will vary from country to country. In some places, existing planning bodies may provide a vehicle, if participation in their deliberations can be broadened. In other cases, it may be appropriate to hold special workshops, and possibly establish a national commission to further develop the institutional mechanism. A sector-specific approach may be appropriate in some cases (e.g., focusing on policy reforms in the forestry sector). In all cases, however, the efficacy of policy dialogue will likely depend on the specificity of the problems and reforms discussed, and the quality of available data and policy analyses.

Beyond the internal policy dialogue, it is also important that ANE countries develop a dialogue on a "South-South" basis. The economies of each of the three broad subregions of ANE – the Near East, South Asia, and Southeast Asia – are increasingly interrelated, and many policy reforms (e.g., constriction of timber exports) could have regional repercussions. Since economic policy dialogue already takes place at forums such as ASEAN, there are opportunities to begin focusing on the environmental dimensions and their implications for regional economic relationships.

Development donors can play an important role at both national and international levels as catalysts for dialogue on economic policy reform. Standing outside the formal hierarchies and processes of government and society, donor-initiated dialogue can provide a "neutral ground," where a wide range of actors can more easily be brought together. In addition, the promise of donor assistance

can provide an incentive for governments to take action sooner rather than later.

c. **Complementary Measures to Reinforce the Environmental Sustainability of Economic Policy Reforms**

The policy reform process opens a range of opportunities for complementary steps by governments, MDBs, donors, the private sector, local communities, NGOs, and research institutions. For example, policy reforms may raise prices and thus create hardships for the poor – or for specific subgroups of the poor – and steps must be taken to mitigate their suffering. Furthermore, more positive measures are needed to facilitate attainment of environmental goals. Thus, in connection with forest policy reform in both Nepal and Thailand, appropriate production systems for forests and crops need to be tested and implemented, inputs and credit need to be provided, and systems for the processing and marketing of outputs need to be established to allow farmers to act on the new incentive structures. New institutional vehicles for local cooperation and participation, and for community-government linkage, need to be developed. Policy-driven incentives alone will not fill these needs.

Subsidy reductions in countries such as Indonesia and Pakistan also present a number of opportunities for complementary measures. Reduction of pesticide subsidies raises pesticide prices, thus making biologically based "integrated pest management" more attractive. Development of these new systems, however, requires a good deal of research, pilot testing and extension, as well as the institutional skills and capacities to do so. The key is in the term complementary, the linking of measures widely recognized as supportive of environmental sustainability to broader economic policy reforms.

d. **Incorporating Environmental Sustainability into Multilateral Adjustment Lending: A Special Opportunity for the 1990s**

Adjustment lending by multilateral financial institutions to support policy reforms has expanded rapidly since the early 1980s, and now constitutes nearly 25 percent of the World Bank's portfolio.⁹ Rooted in the need to respond to the international economic shocks of the 1970s and early 1980s and the resultant balance-of-payments crises, this kind of lending has come to focus increasingly on policy and institutional reforms necessary for long-term economic growth and resilience. It has several advantages. First, adjustment loans present lenders with a powerful "carrot" to offer in policy dialogue. Second, they provide borrowing countries with the funds to offset short-term dislocations and inequities that might otherwise slow or prevent policy reforms. Finally, the loan agreements speed the reform process by setting relatively short timetables for specific reforms.

The opportunity for governments and donors lies in integrating environmental concerns into the relatively rapid pace of policy reforms that adjustment lending is bringing about. Adjustment lending policy packages provide a framework for both borrowers and lenders to discuss the likely consequences of each policy change for the long-term sustainability of the natural resource base. Well-designed and carefully implemented structural adjustment programs can protect the environmental basis for economic growth, through their effect on the mix and quantity of resources to be used in an economy and on the rules and procedures by which resources are allocated. Conversely, adjustments that impact adversely on the resource base can diminish the prospects for healthy economic development.

The burden of ensuring that adjustment lending is beneficial environmentally as well as economically lies in large part on the World Bank and other lenders. There are three basic steps that these lenders should take to ensure that environmental considerations are fully integrated into the design and implementation of loan agreements.

- (a) They should initiate a systematic program of research to analyze the environmental effects of past and ongoing adjustment loans. The World Bank has already begun this process, but it should commit more funding for research and conduct in-country research that draws on a wide range of donor, governmental, academic, and NGO expertise.
- (b) The lenders should clearly incorporate environmental objectives and criteria into policy dialogues and loan negotiations. The recent Pakistan Energy Sector II loan, for example, requires an environmental action plan with guidelines on air pollution emissions and assessments of environmental implications of energy projects.¹⁰ This, however, has been done only for a small minority of loans made.
- (c) The lenders should build provisions and funds into loan agreements for ongoing monitoring of environmental consequences and devise procedures for "mid-course corrections" when environmental effects are unexpectedly negative.

Opportunity 2: Strengthening Environmental Policies¹¹

The increasing urgency of environmental threats has spurred the creation of a new generation of explicitly environmental policies, laws, and institutions throughout the ANE region. Since the early 1970s, countries as diverse as Tunisia, Pakistan, Sri Lanka, Papua New Guinea, and Egypt have passed basic national

environmental laws, and have developed supra-sectoral institutions charged with various aspects of environmental policy. Further development and strengthening of these policies, legislative frameworks, and institutions is a priority throughout the region, presenting many opportunities for governments, donors and NGOs to act.

a. Elaborating Environmental Law

A basic legal framework is a necessary prerequisite for development of viable environmental institutions. Law by itself does not guarantee that environmental policies will be carried out, but it serves powerful symbolic and practical purposes. Some ANE countries (Bangladesh, Burma, Yemen, Morocco, many Pacific Island nations) have yet to develop a basic framework for environmental law and policy. The opportunity in those countries is for sympathetic government officials, donors, and NGOs to encourage the establishment of such a framework and to provide the impetus, resources, and expertise to do so.

Many ANE countries (e.g., Tunisia, Pakistan, Nepal) have passed "Basic Environmental Laws" in the past decade, but are still in the process of elaborating and refining them, so that broad legal principles may be translated into specific criteria and standards, and workable enforcement mechanisms. Other countries (Indonesia, Thailand, India, the Philippines) have developed fairly elaborate operational legal and institutional systems, yet are faced with the shortages of funding, technical capacities, implementational authority, and enforcement muscle that frustrate environmental policy throughout the world. The range of opportunities for action and support by governments, donors, and others in these countries is considerable.

Three broad areas for environmental law development can be identified. First, there is a need for the drafting and promulgation of enabling provincial, environmental impact assessment and other types of subsidiary regulations. This, in turn, calls for the development of technical standards and criteria upon which to base such regulations. Second, existing sectoral laws with environmental impact (e.g., forestry, land use) need to be scrutinized for deficiencies and gaps and harmonized with the newer body of environmental law. Third, attention must be paid to development of meaningful enforcement provisions, including penalties, provision for public input, and the allocation of unambiguous authority for their enforcement.

b. Establishing Effective Environmental Agencies and Councils

Most Basic Environmental Laws in the ANE region mandate creation of some form of environmental agency or council. While most are still relatively weak and have not yet developed effective relationships with sectoral agencies and economic policy making bodies, the development of these institutions represents a potentially important step.

Environmental agencies take many forms. In Pakistan, the 1983 Environmental Protection Ordinance mandated the creation of a National Environment Council to provide high-level leadership, and an Environmental Protection Agency, charged with elaborating standards and enforcing regulations. In Pakistan's federal system, provincial EPAs in the four Provinces are to be the actual implementors, and they are already operational in Punjab and Sind. While the system is still far from effective, it is developing, and represents a promising opportunity for improving national and provincial environmental policy capacities.

Indonesia has had a state ministry dealing with environmental matters since the late 1970s and a Basic Environmental Law since 1982. The ministry has played a leading role in mobilizing a public and policy consensus for increased attention to environmental threats, and for greater inclusion of NGOs in the formulation of responses. It is also participating in the development of criteria and procedures for environmental impact assessment, under Indonesia's 1986 Government Regulation on Environmental Impacts. The ministry is handicapped, however, by its lack of authority to influence the programs of sectoral ministries and by its minimal budget and presence outside of the national capital. Increasing the ministry's authority and technical capacities is a major opportunity for Indonesia, and for donors concerned with the country's formidable environmental challenges.

Egypt has also established a set of institutions for environmental affairs, building on its strong capabilities in science and technology. The Egyptian Environmental Affairs Agency (EEAA) was created in 1982, with a mandate to define priorities, prepare national environmental plans, propose appropriate legal instruments, sponsor public information and awareness activities, and monitor implementation by sectoral government agencies. Although EEAA has made a good start in many of these areas, it is constrained by its lack of regulatory and law enforcement powers; it is merely a planning and coordinating body. These constraints are partially overcome by the prominent role taken by the National Academy of Scientific Research and Technology (ASRT), whose various research councils and other organs help in the formulation of government environmental policy. ASRT carries out environmental research in the areas of air pollution, environmental health, natural resources mapping, and environmental education.

While the models chosen by particular countries have varied, they generally share two basic problems. First, they must reconcile pre-existing sectoral authority over natural resources and the environment with a new set of legal and organizational arrangements that blur the boundaries of those sectors in a new "environmental" paradigm. Second, they must carry out their functions without strong regulatory authority or a "line" structure and presence in the field, and within severe budget limitations. The frequent result is an institutional lack of authority to compel sectoral environmental policies and coordination to change, combined with a lack of capacity to independently carry out line functions.

The opportunities for strengthening environmental agencies in the region vary, but some combination of the following five elements are applicable to the needs of most countries:

- (a) Strengthening technical capabilities and facilities for scientific and policy research;
- (b) Developing sub-national institutional capacity, and linkages to academic industry, and NGO institutions;
- (c) Integrating environmental analyses into the process of economic policy making through regularized consultative mechanisms;
- (d) Developing greater agency authority vis-a-vis sectoral ministries such as Forestry, Industry, and Agriculture;
- (e) Enlarging agency capacities and activities in the field of public awareness and education.

c. Developing Environmental Assessments and Strategies

By and large, ANE countries have not developed the basic information needed to assess changes in environmental quality and the growing threats to human welfare. Considerable amounts of data are collected, stored, and processed, but they are rarely analyzed to support and guide policy. Also, when information about environmental problems and the causes of degradation is developed, it is not made available to the public.

Monitoring. Building a cost-effective environmental monitoring system to support policy making requires that environmental councils work cooperatively with major government agencies, the private sector, and government statistical offices. They should develop an environmental monitoring plan for the country and regions and coordinate the administrative structure needed to gather timely

and useful data. Provincial and municipal governments, NGOs, and industry should be brought in to help decide on a minimum, core set of statistics to be collected on a routine basis. Coverage should include statistics on the extent, condition, use and value of resources and cover land, water, living, and non-renewable resources.

Assessment. There are many different types of assessments that need to be carried out in support of policy. At the local level, rapid rural appraisals can be used to indicate the need for land and water conservation. Statistics gathered at the local level can be aggregated at the regional and watershed level to assess environmental sustainability and can be used in regional and sector planning. At the national level, assessments should be carried out on a periodic basis and be used to evaluate progress in achieving environmental and economic goals as well as assessing the state of the environment. Opportunities for improving the quality of assessments should be based whenever possible on existing activities. For example, each of Indonesia's 27 provinces already produces an annual statistical report on population and environment, which is sent to Jakarta for review. The provincial governments could be encouraged to expand coverage to include all natural resources and to begin to analyze the trends.

Reporting. Getting information on the quality of the environment into the hands of the public is essential. Assessments are too often prepared with an aim to securing donor project funding. Reports on the state of the environment or similar assessments should be prepared in-country, by national experts from government and non-government universities and organizations, with review and critique by the public, NGOs, government, industry, and others. And, these reports should be updated on a periodic basis, preferably every one or two years.

With the support of donors and international NGOs, a few of the ANE countries during the 1980s prepared Environmental Profiles, National Conservation Strategies, and other natural resource assessments. Profiles in Thailand, Indonesia, and Pakistan¹² have helped policy makers to get a better understanding of the condition of the environment, to link environmental conditions to the health and social welfare of the population, and to identify problems that need to be addressed by government and the private sector. National Conservation Strategies in Nepal, Pakistan, and Sri Lanka¹³ have provided an excellent opportunity for bringing together government, business, NGOs, academics, and, most importantly, representatives from grassroots voluntary organizations to discuss and debate development goals and targets for their countries. When supported by government and based on consensus, these strategies have had a direct impact on legislation, government policy, and public awareness and support for environmental goals.

Other countries and regional organizations should examine the experience of these countries and then develop their own. The role of donors should be to strengthen the indigenous institutions that conduct the assessments and publish the reports, be they NGOs as in India, or academic institutions as in Thailand, or government-related agencies as in Indonesia.

d. Instituting Effective Environmental Impact Assessment Procedures

The Environmental Impact Assessment (EIA) is the point at which environmental concerns are incorporated into the planning, design, and management of specific projects. Development of effective EIA capacities and procedures is therefore, a "make or break" element in the establishment of environmental policies and institutions.

The basic purpose of an EIA is to develop more informed decision making and to increase public participation. This is carried out by: (a) evaluating the impacts of a proposed project – and alternatives – on the natural resource base and environmental values in the vicinity or region; and then (b) utilizing this information, if necessary, to modify the project plan (including detailed design, and proposed methods of construction and operation). The goals are to avoid unnecessary adverse environmental impacts, to minimize adverse impacts that cannot be avoided, and to offset unavoidable losses through positive enhancement measures. A fully developed EIA process should possess authority ranging from the absolute cancellation of a project to allowing it to go forward without further modification.

A number of ANE countries (e.g., Indonesia, Sri Lanka, the Philippines) are in the process of developing EIA criteria and procedures, but no country in the region has yet developed a truly effective system that functions on a regular and uniform basis.¹⁴ In many cases, ANE countries are carrying out Step (a) above – the collection of data on impacts – with little if any meaningful attention to Step (b) on how to use the data to correct the project's environmental deficiencies. This is, of course, because the latter step is where major costs accrue and powerful, politically connected economic interests are challenged.

In Sri Lanka, the EIA process is the country's single most important regulatory control for environmental protection, although its potential is still largely unrealized.¹⁵ The 1982 Cabinet Order which established the procedure required that the 15 state development agencies with project approval authority make all state and private sector development projects subject to an EIA beginning in January 1984. The order also required the Central Environmental Authority (CEA) to prepare comprehensive EIA guidelines and mandated the drafting of enabling legislation. With assistance from AID, several EIA training workshops were held

for officials of project-approving agencies. In 1988, amendments to the National Environment Act put the existing administrative requirements for Initial Environmental Examinations (IEEs) and EIAs firmly into law, with added provisions for public notice and comment.

Despite these significant steps, only two EIAs have been required since 1984. Of these two, one project was dropped for non-environmental reasons, and the other one's EIA was done under the requirements of the Coastal Conservation Act, not the Cabinet Order. The lack of EIA legislation (until 1988) is often cited as the reason that EIAs have not been carried out. Less-detailed IEEs, on the other hand, have become quite routine, and CEA has three staff reviewing the 15-20 IEEs it receives each week. Each project receives a CEA site visit as part of the review. The most glaring loophole in the EIA process is the complete lack of review for government infrastructure projects, although this and other weaknesses are addressed in the recent NEA amendments, which vastly strengthened CEA's project review authority.

With a strengthened NEA, one of the greatest needs is for development of strong environmental "cells" within sectoral agencies. EIA is not yet routinely integrated into feasibility and pre-feasibility studies, and EIA guidelines for major planning decisions, particularly in the forestry and water sectors, have not yet been spelled out. The legal framework and political impetus are clearly there, however, and the potential for developing an effective EIA system in Sri Lanka is good.

Indonesia enacted a Regulation on Environmental Impacts in 1986, effective in June 1987. The regulation requires all ministries to formulate implementation procedures, and a number of ministries have begun to do so. The EIA process requires all project proponents to prepare a preliminary environmental report to determine whether significant environmental impacts are expected. If the report and/or the approving agency determines that this is the case, a full-scale EIA must be prepared as part of the project feasibility study. Review and approval of the EIA, and the project, rest with the government official with authority to approve the proposed activity. Intersectoral committees at the central and provincial levels are also involved in evaluating the EIA. The State Minister for Population and Environment plays a consultative role, but has no real power to influence the approval or design of the proposed project.

Under the Indonesian system, the decision to proceed with a project is made before the decision to conduct an EIA. Thus, the EIA is not a "decision document," but rather is used to develop mitigation and monitoring plans for projects already approved, regardless of the gravity of the project's environmental impact. Other deficiencies include a lack of trained EIA personnel in either the public or private sector, lack of standardization between the procedures and criteria of different ministries, and lack of a process to screen siting and land use

priorities. There are also no substantive provisions for public notice and comment, or for appeal of EIA decisions.¹⁶

It is too soon to judge the eventual role and effectiveness of Indonesia's EIA process. As various ministries develop their own procedures, the picture will become clearer. There is some danger of EIA becoming a "paper requirement" with little power to stop or modify bad projects. On the other hand, existence of the EIA law has recently been utilized by NGOs to bring a lawsuit against a rayon and pulp factory project that did not conduct an EIA, and to exert pressure on a multinational paper company planning a massive pulp plantation and factory in a remote forested area.¹⁷

In all ANE countries where EIA processes are being planned or implemented, there is a need to develop effective "negotiating models" capable of incorporating and harmonizing diverse economic and political interests in workable compromise solutions. The needs, interests, and power of industry must be taken into account through EIA flexibility. At the same time, the power of private economic interests, and the rigidity of sectoral targets, need to be counterbalanced by the development of broad-based forums and procedures for public participation.

One of the most significant developments in environmental assessment has been the increased interest of donors in internal project review. Starting with AID, the World Bank, the Asian Development Bank (ADB), and most other bilateral donors have begun to examine more closely the environmental effects of their own development projects. In some cases, this has already led to a formal review process that can alter the course of a development project or block it altogether.

AID, for example, requires all qualifying projects to undergo three reviews – an initial environmental impact statement. Other bilateral aid agencies are beginning to adopt similar requirements. At the World Bank, clearance by regional environmental units is now required for all lending operations prior to final negotiation and approval.¹⁸ The ADB's environmental department has a new mandate to conduct similar internal reviews of all large-scale projects with potentially adverse environmental effects. While these mechanisms have to be developed further, they are a substantial improvement over the limited levels of environmental review that existed not too long ago.

Opportunity 3: Integrating Environmental Concerns into Sectoral Programs

While strengthening of specifically environmental institutions is a promising opportunity, the traditional sectoral institutions of government – Ministries of Agriculture, Forestry, Public Works, Industry, and the like – currently play a much larger role in managing natural resources and the environment and will continue

to do so through the 1990s. It is essential that environmental capabilities and responsibilities be developed and strengthened in these mainstream government institutions.

Three basic issues are raised in attempting to develop effective sectoral responses to environmental problems. First, there is a need to integrate an environmental mandate into sectoral laws and policies and give it organizational expression. Second, there is a need for sectoral agencies to develop capacities and institutional mechanisms for intersectoral coordination. Finally, there is a need (not confined to environmental problems) to develop more effective sectoral capacities at regional and local levels, in tandem with some degree of decentralization.

a. Strengthening the Environmental Mandate

By and large, the legal and institutional sector frameworks in most ANE countries were developed without reference to the environment. Recently, heightened attention to environmental issues has resulted in the grafting of environmental units onto pre-existing institutional frameworks, and the drafting of environmental regulations to supplement basic laws on forests, water, land, and other resources. The result is a certain degree of tension between pre-existing institutional goals and structures, and new environmental mandates.

Forestry agencies, for example, must reconcile their long-standing commitment to timber production and custodial protection of forest reserves with new tasks involving land rehabilitation, and the social context of forest management. Agencies dealing with marine resources must turn from maximizing catches to dealing with marine pollution. The skills required for these new areas of emphasis are often poorly developed, and career incentives within agencies are not often supportive of their enhancement.

The development of a legal and institutional mandate for increased attention to environmental issues is the first priority for sectoral agencies. In many ANE countries, the ongoing development of indicators and implementation guidelines for Environmental Impact Assessment provides sectoral agencies with an opportunity to develop environmental policies and initiatives that go beyond evaluation of discrete projects. The creation of environmental units within ministries is another useful step. At the same time, it is important that environmental considerations enter the work of all relevant portions of an agency and not be marginalized in a new (and therefore usually weak) "environmental unit." Training programs, revised job descriptions, and other standard tools of bureaucratic reorientation can be utilized to ensure that the "mainstream" of a sectoral agency begins to take the environmental aspects of its work more seriously.

b. Promoting Coordination Among Sectors

In the environmental context, horizontal coordination with an ecological-geographical focus is the most promising approach. Watersheds, coastal areas, parks and protected areas, and even urban areas are resource systems that need to be managed in an integrated fashion, and can provide the focus for coordinative efforts. The increasingly evident environmental threats to these systems can provide a focal point -- and political will -- for overcoming sectoral isolation, while the limited geographical focus provides a manageable framework. This is not to say that higher-level, more general planning, and coordinative mechanisms cannot also play a role.

General conditions for improving horizontal cooperation include: (a) awareness of environmental decline in a particular resource system; (b) awareness that the existing (sectoral) approach is ineffective; (c) existence of a constituency for coordination in each of the affected agencies and jurisdictions, and (d) existence of a regulatory framework, forum and mechanism for the legitimation and regularization of coordinated activities. Donors can sometimes play a catalytic role, serving as mediator and communications channel. The same is true for local NGOs. In short, there is no one model for enhancing intersectoral coordination, and while governments must take the lead, a range of other actors can also play a significant role.

Sri Lanka's coastal resource management system, the most advanced in the ANE region, illustrates the potential of the ecogeographical approach. The Coastal Conservation Act created a Coastal Conservation Department (CCD) within the Ministry of Fisheries. The CCD is responsible for conducting coastal zone surveys, preparing a Coastal Management Plan, regulating all development activities in the coastal zone, and ensuring that Environmental Impact Assessments are carried out for all projects with a significant potential impact on the coastal environment. Given its small staff, CCD's efforts have been very effective.¹⁹

Amendments to the Coastal Conservation Act, to be introduced in the near future, may give CCD authority to declare an area, such as an entire lagoon, part of the coastal zone. Additional amendments may also grant CCD authority to stop coral reef destruction through confiscation of kilns used to convert coral into cement powder. CCD itself has been promoting development of "special management zones" in particular districts, although the current political situation has slowed this initiative. While limited budgets, staff, and technical capabilities still constrain this system, it shows that the institutional basis for integrated coastal management systems can be established through relatively incremental institutional change.

In Indonesia, the evolving system for management of the Brantas River watershed in East Java Province provides another example of the opportunities for ecogeographically focused intersectoral coordination that does not require new laws or agencies. An ongoing donor-assisted project in the area was given authority by the provincial government to carry out mapping of the whole watershed into ecological zones. Coordination between agriculture, forestry and other agencies and actors grew slowly and depended on a good deal of personal contact. Eventually, the actors collaborated on the design of an integrated extension program keyed to the various agro-ecological zones in the watershed. Bit by bit, a "critical mass" for intersectoral cooperation developed. While the effort has encountered obstacles, progress toward an integrated and effective approach has been steady, and the program has been singled out by the National Development Planning Board as a model for other provinces and watersheds.²⁰

c. Strengthening Provincial Authority and Effectiveness

Resource management throughout the ANE region is still generally characterized by centralized bureaucratic control and public ownership or control over most non-agricultural lands and resources. Effective environmental policy, however, requires heightened sensitivity to local variation and feedback, and the ability to work effectively with local communities on the ground. The strengthening of sub-national capacities -- "decentralization" -- is thus an important prerequisite for effective environmental management.

Decentralization typically takes several forms: (a) de-concentration (more authority to sub-national offices of central agencies); (b) delegation to semi-autonomous or parastatal agencies; (c) devolution to provincial and local governments; and (d) transfer of functions from public to non-governmental institutions or joint exercise of such functions. Whatever the form, the underlying purposes generally include some combination of the following: to allow for planning, policy making, and project design that more accurately reflect local needs, conditions, and capacities; to facilitate improvements in the efficiency and effectiveness of policy and project implementation; and to respond to the political pressures for increased sub-national autonomy that frequently accompany increased socioeconomic and political development.²¹

In all decentralization efforts, it is important to remember that linkages to the center remain critical. Without a strong center to lead, oversee and discipline, decentralization may simply mean the decentralization of corruption and arbitrary power to local officials and elites. Nevertheless, many ANE governments have concluded that the question is not whether to strengthen local capacity, but how best to do it while avoiding potential negative consequences.

In Nepal, the 1982 Law and 1984 Rules on Decentralization have provided the mandate and impetus for strengthening sub-national authority and capacity for natural resource management, particularly with regard to forest lands. The law devolves planning and implementation responsibilities to the district level and sanctions the establishment of sub-district "resource-user groups" and "resource-user committees" covering forestry, irrigation, livestock, and other sectors. Activities where governments and users interact (such as provision of agricultural inputs, extension, and marketing) were reorganized through multisectoral "Service Centres," nine of which are planned for each district.

At the same time, the 1978 Forestry Rules authorized the transfer of some nationally held forest lands to local Panchayats (the basic unit of local government), and the 1982 Soil and Water Conservation Act authorized the creation of district committees to administer watershed areas protected under the Act.²² While actual development of effective sub-national authority and capacity to realize the mandate of decentralization is still in a nascent stage, the potential for development of more effective vertical capacities is clear.

In the Philippines, the Department of Environment and Natural Resources (DENR) is engaged in an ambitious attempt at decentralization. Created in 1987, DENR also represents an effort to consolidate management of natural resources and the environment horizontally in a single agency. Within that newly integrated framework, DENR is currently decentralizing its line functions to Regional Environment and Natural Resource Offices, located in regional capitals and headed by Regional Executive Directors (REDs). Through this process, formerly centralized line agencies, such as the Bureau of Forest Development, have been restructured as staff bureaus, with their line functions delegated to the REDs. It is too soon to judge the viability and sustainability of this new model, and it is not clear what elements are transferable to other ANE countries. Nevertheless, the development of DENR is a promising initiative that deserves study and support.

Opportunities for reorienting government institutions for more effective environmental management should not be pursued in isolation. Linkages to the environmental institutions discussed in the last section are an important aspect of coordination. In addition, horizontal and vertical linkages must extend beyond government, to local communities and resource users, on the one hand, and horizontally to NGOs, academic institutions, and private enterprise on the other.

d. Improving Information for Natural Resources Management

Ministries and bureaus of forestry, fishery, mining, energy, wildlife, and agriculture are already responsible for collecting data on production, prices, employment, and trade. This information is essential for setting quotas for

harvesting, establishing tariffs for exports and imports, securing rents and taxes, and in general, managing these resources.

Now, in order to fulfill new conservation mandates, line ministries are being asked to monitor the condition of the forest, the stock of fisheries, the impacts of mining operations on nearby streams and rivers, the impacts of energy projects on the natural environment, the extent to which the nation's wildlife is becoming endangered, the conservation practices of farmers, and much more. The demand for more and better information is growing, and the capacity of official government ministries at the national and provincial levels is strained. In fact, much of the information needed to manage these resources in a sustained manner is not being collected, analyzed, or used.

Improving resource management also requires strengthening the capacity of farmers, rural cooperatives, and other resource owners and managers to collect and analyze information. In the past, much of the information needed to manage resources was common knowledge and communicated verbally. Today, this information needs to be captured and integrated with modern data collection activities. Data gathering and analysis can be supported by existing extension services, or with support from local PVOs and private industry. The amount and quality of the data needed depends on the type of resource and its use (single, multiple, strict protection, no use).

Because of low-cost technology, particularly computer hardware and software, institutions at the provincial and national level can provide important services to the local resource managers and help to aggregate data and analyses to the national and international level. This may require strengthening their capabilities to develop and adapt suitable analytical techniques. Thus, in a recent study of air pollution in the Jakarta region of Indonesia, the Central Statistics Bureau, working with the State Ministry for Population and Environment, found that it was necessary to bring together 16 different groups, including government ministries, universities, NGOs, and the chief of police to determine which data were already available and which organizations had the capacity to collect what was missing. The critical stage in the project was getting agreement on the use of a simple computerized database management system that was available to all, inexpensive, and useful for data storage and analysis.²³

In other situations, systems dynamics can be used to help resource managers better understand their problems and what impacts various strategies will have on production and conservation goals. Geographic information systems can be used to manipulate and analyze spatial data to determine optimum sites for roads, irrigation schemes, port facilities, and national parks. And computer networks can be used to connect even the most remote research stations with colleagues in other regions and other countries.

Opportunity 4: Clarifying Ownership and Control of Land

When farmers and other resource users lack stable and legitimate access to land and its resources, the incentives for sustainable resource management are considerably diminished, and environmental destruction is likely to follow. In the ANE region, millions of people lack legal rights to the land they work. Large areas of legally designated forest and other public lands are, in reality, under private use, while many private lands lack legal title.

Traditional patterns of assigning rights and responsibilities to resource users have largely broken down, in part because traditional authority has been displaced by national laws and policies. New national systems, however, have not fully penetrated to many rural areas, in part because local communities reject them as inappropriate, and in part because government capacities to implement and enforce them are weak. On public lands, the frequent result is an "open access" situation in which incentives favor the rapid utilization of resources without concern for the future. On private lands where ownership is settled by custom and practice, if not by law, lack of legal title deprives owners of a potential source of collateral and renders sale and inheritance transfers less secure. Either way, deforestation, land degradation, and species extinction are encouraged.

There are significant opportunities to clarify and strengthen land tenure systems in many countries of the ANE region. To realize these opportunities, governments, donors, NGOs, and other actors need to pursue a three-fold strategy. First, there is a great need for policy research and analysis to evaluate the current situation, assess ongoing reform initiatives, and suggest promising avenues for change. Second, basic land laws and regulations need to be reformed in support of equitable and flexible clarification of rights in land. Third, the state machinery for land tenure administration must be revamped and strengthened in line with policy research findings and the mandates of legal reform. Any tenurial system, however, is only as effective as its administration, its accessibility to the wide range of actors that hold and use land, and its ability to resolve disputes between them.

a. Policy Research and Analysis

There is a striking lack of information and analysis directed at understanding the effects of land tenure systems and conditions on management and utilization of land and its resources. The following are among the tenure issues that need priority attention because they have the most potential for improving the management of the land resource base:

- (1) Traditional forms of tenure, the changes they are undergoing, and their effects on management of natural resources: While modernity is transforming even the last vestiges of purely traditional societies, many aspects of traditional land management and ownership remain in force and are likely to influence the viability of imposed systems. The centuries-old irrigation and tenure systems of the Igorots of Central Luzon (the Philippines), of the Balinese in the Baliem Valley of Irian Jaya in Indonesia, the forest management practices of tribal groups in India, and the complex tenurial traditions widely extant in Papua New Guinea are just a few examples of the body of traditional resource management knowledge still in existence. Study of these systems can contribute both to the development of viable national tenure policies and to the protection of these groups' rights to determine the direction of development on lands they have occupied for centuries.
- (2) The connections between tenurial conditions and the adoption of soil and water conservation practices by upland farmers and pastoralists throughout the region: While it is clear that land tenure arrangements do influence land users' decisions to adopt or reject conservation technologies, there has been little sound analysis of the specific relationship between tenure and improved land management practices. The result is that tenure may be overlooked in some projects, and its role overemphasized in others. Since many governments are increasingly concerned about the degradation of upland areas, the time is right for an increased effort to understand the role that tenure plays in land degradation and can play in reversing that trend.
- (3) The effect of tenurial interventions undertaken by governments: Many ANE governments have undertaken tenurial initiatives, including the titling of private holdings, recognition of traditional tenures in national law, the granting and titling of land rights on cultivated forest and other public lands, and the granting of a variety of stewardship, tree tenure, common property, and other arrangements short of outright private ownership. Experience is available from countries as diverse as Tunisia, India, Thailand, the Philippines, Indonesia, and Papua New Guinea. Systematic research and comparative analysis could provide the basis for developing tenurial strategies that are better grounded in experience.

b. Reforming Land Law

While the lack of detailed data and analysis makes it difficult to generalize about specific reforms in land law that will support more sustainable resource management, a number of general points can be made. First, it must be remembered that title to land serves four basic functions: security of ownership against other claimants; a recognized right of present and future occupancy; proof of ownership for use as collateral; and the legal right to transfer ownership through sale or inheritance. It is the function, and not the form, that matters, and a wide variety of tenurial systems may serve these functions.

Second, it may be better in some cases to fit conservation technologies to existing tenure situations, rather than assume that tenure must always be strengthened before any improvements in resource management will be adopted. While a farmer may balk at investing labor and capital in major earthworks under a 20-year "stewardship" lease, other technologies with quicker payoffs (e.g., planting vegetative contour barriers) may be quite attractive.

Third, since land tenure is largely a legal matter, changes in basic land laws and their subsidiary regulations constitute the central element of any significant reform in tenurial policy. In general, the land law systems of the ANE region do not recognize enough categories of tenure. They frequently ignore customary land law, or at best pay it lip service. In addition, they rarely facilitate the granting of partial or complete tenures on forest and other public lands. The common property rights of farming and pastoralist communities are also rarely addressed adequately. Law reform is never easy, but the increasing awareness that existing tenure systems are economically inefficient as well as ecologically destructive is, contributing to a growing movement toward land law reform. Structural adjustment lending has contributed to this trend, since rationalization of land law is a major condition in a good number of loan agreements throughout the region.

Legal changes of the types just discussed will often necessitate changes in the laws and regulations governing the agencies that deal with land tenure and titling at national, provincial, and local levels. These may include more than just the formal "land office." In a reformed system, departments of forestry, public works, and agriculture as well as offices dealing with resettlement, will probably have to deal with tenure issues, and they will have to be given the legal mandate to do so.

Finally, since tenure issues often raise serious human rights as well as environmental considerations, donors would do well to take tenure seriously. For example, the recent debacle concerning the World Bank-funded Kedung Ombo Dam in Central Java (including widespread student protests, alleged abuses of human rights, and a good deal of bad press for the Bank) could have been

avoided if the tenorial situation had been dealt with seriously at the outset. Donors should reconsider and reform their equivalent of land law – i.e., the tenorial criteria they use to evaluate the social, economic, and environmental worthiness of particular projects and loans.

c. Strengthening the State Apparatus for the Administration of Land Law

The administration of land law is uniquely a government function, and the main opportunity for improving its administration in many ANE countries lies in reforming and strengthening those agencies that survey land, grant land rights, deliver land titles and resolve land disputes. Procedures for assessing, granting, and transferring rights in land need to be simplified and streamlined. Indonesia, for example, has had some success with mass land titling programs, in which large areas are surveyed and titled at subsidized rates.²⁴ In most countries, the maze of bureaucratic steps required for even the simplest land transaction is unnecessarily costly and time consuming, allows too many opportunities for petty corruption, and often leaves the small landholder outside of the system. The widespread lack of trained field staff, transportation facilities, and equipment for land surveying also impedes smooth operation of land tenure administration.

Since many tenorial issues arise in the context of government or private sector development schemes, projects that utilize large areas of land or are affected by local tenorial status (e.g., resettlement, large dams, plantations, watershed management) should be encouraged to take up more of the responsibility for (and cost of) dealing with land tenure matters.

While local land offices must carry out the bulk of field work in surveying, processing documents, and dealing with disputes, it is important that national and provincial land agencies provide strong guidance and oversight. If this is to happen, the central agencies will need to strengthen their own oversight procedures and capacities and provide career incentives for local offices to act efficiently and honestly. At the same time, local coordination with sectoral projects should be buttressed with coordination at high levels of the bureaucracy, and legal and administrative provision should be made for public input and appeal for redress. Simplification of procedures can free up field staff time. In addition, the possibility of earmarking increased tax revenues from land registration for land office operations should be explored.

Finally, there is a considerable need for more efficient and equitable procedures and forums for resolution of the land disputes that will inevitably arise, especially in the context of rapid development found in most ANE countries. The court systems of most ANE countries are unwieldy, overburdened and

characterized by archaic legal procedures unsuited to the resolution of complex land disputes, especially those involving many small landholders, and the time pressures exerted by large development projects. At the same time, the ANE region is rich in traditional dispute resolution systems. There are, thus, many opportunities for devising innovative, informal, and speedy systems for resolving land disputes through the use of traditional forums, ombudsmen attached to land offices, and mediation by NGOs.

Opportunity 5: Mobilizing Private Energies for Environmental and Natural Resources Management

Managing natural resources for sustainable development requires the skills, talents, and commitment of all segments of society, whether they be from industry, government, indigenous peoples, women (particularly rural women), universities and research institutes, PVOs, and NGOs. Industry, and private enterprise generally, has a particularly important role. Two other groups, the independent or non-governmental sector and women, should also be looked to for expanded responsibility and authority. But this will require changes in policy, law, education, and training, along with a change in attitudes.

a. Encouraging Private Enterprise

The private sector in the ANE regions is incredibly diverse. It encompasses multinational corporations (including banks), large- and medium-scale national enterprises, joint ventures, local shopkeepers and entrepreneurs, and the vast informal sector of merchants, salesmen, traders, vendors, and middlemen that fill markets, sidewalk stalls, and street corners throughout the region. In addition, many state-owned enterprises (parastatals) behave substantially like private firms, and many NGOs, while in the private sector, perform such state functions as primary health care delivery. Broadly construed, the private sector is perhaps the main instrument of change that affects the natural resource base of development in the ANE countries, both positively and negatively.

Up to now, private sector investments in ventures supportive of sustainable development have been largely absent in the ANE region. Indeed, it is generally acknowledged that much private sector activity – particularly in relationship to resource extraction, industrial pollution, and hazardous chemicals and wastes – is helping to destroy the environmental base upon which economic development depends. There are several reasons for this. First, private enterprise tends to gravitate toward investments with quick and high returns, often at the expense of future productivity. There is rarely a commercial return on projects that emphasize a sustained long-term yield. Furthermore, the incentives set by the

state all too often encourage wasteful and short-sighted exploitation of the environment by private enterprise. Finally, the benefits of many environment-saving investments -- clean air and water, species diversity, and intact natural ecosystems -- are difficult or impossible to market, given the lack of exclusive property rights in natural systems.

Nevertheless, where the incentives are right and the entrepreneurial drive is not unduly hindered by state interference, the private sector can play a central and positive role in insuring that economic growth in the ANE region is sustainable and environmentally benign into the 21st century. The special characteristics of the private sector -- flexibility, willingness to innovate, entrepreneurial spirit, and above all the profit motive -- allow it to be more efficient and productive than public institutions. Equally important, the private sector has the capital to invest, while most ANE governments do not.

In particular, rapid growth of the private sector is essential for labor absorption and production of capital and consumer goods. The private sector also needs to play a major role in the development, transfer, and application of new technologies, especially in the fields of pollution abatement, hazardous waste management, and energy efficiency, and in the development of innovative systems for exploiting natural resources (e.g., forests) on a sustainable basis.

These functions present many opportunities for private firms of all sizes. Thus, there are often significant economic as well as environmental savings from upgrading technologies, especially if new plants are fitted with the most up-to-date technology from the outset. Aluminum producers in India, for example, reduced the electricity use of their processes by 15 percent between 1975 and 1980, enabling them both to conserve energy and to cut costs. In Thailand, sugar cane residues could be used to fuel 300 megawatts of electric generating capacity and thereby add 25 percent to the value of the industry. One Indonesian factory, faced with heavy fines for polluting, developed an innovative process for recovering paper pulp fiber, which it sells to an egg-carton manufacturer. An Egyptian chemical plant, which is presently dumping mercury into the Mediterranean Sea, could invest in a recovery process that would pay for itself in six years.²⁵

Industrialists are not the only ones who could profit from environment-saving investments. Egypt, for example, is offering low-cost loans to enable Cairene scavengers to buy improved donkey carts and tractor-trailers, which could double their capacity to collect municipal garbage and help to solve Cairo's enormous solid waste problem. Loans have been provided for projects involving plastic granulation, rag pulling, and paper baling.²⁶ Many biological control organisms needed for integrated pest management systems can be produced in smaller, simpler facilities than those needed to manufacture chemicals, thus providing economic opportunities for farmer cooperatives and small businesses.

The role of the public sector is central in determining the extent to which the private sector's role in economic growth is environmentally sustainable or not. The state provides the framework of incentives which control the nature of private sector activity. Governments influence the role and dynamism of the private sector in two basic ways. First, governments can provide a more hospitable climate for private sector activity through liberalization measures that lessen distortions in the relative prices operating within the economy. Second, governments can privatize public enterprises, transferring assets and management authority to private enterprise. As a general matter, privatization only leads to greater economic efficiency when it is accompanied by liberalization policies.

b. Strengthening the NGO Sector

The dominant role of government agencies in the planning and execution of natural resource management activities is firmly established and growing. But the last decade has seen the sudden emergence of non-governmental organizations (NGOs) as significant actors in the ANE region, with the largest numbers in India, Bangladesh, the Philippines, and Indonesia, and the fewest in the Near East countries, with the exception of Egypt.²⁷ While no consolidated figures are available, those who have monitored this growth believe that more than 100,000 NGOs have emerged over the last ten years. The term "NGO" includes a range of organizations, from grassroots voluntary groups to relatively sophisticated national-level policy research, training, and advocacy institutes, to national branches of international private voluntary organizations.

The great majority of NGO work on environmental issues is carried out by NGOs whose primary focus is development. This will continue to be the case through the 1990s. Many of these NGOs have taken up new functions that move them well beyond their traditional fields of social welfare and narrowly construed development activities. More and more of them are moving into the fields of environmental protection and natural resources management.

At the same time, a number of NGOs with explicitly environmental mandates have come into existence. The distinctive competencies of these groups lie in conveying environmental information and strategies to development NGOs, and in their role in national-level coalition-building and advocacy of the environmental cause with governments, donors, and private industry. Environmental NGOs also generally have better linkages with international environmental groups and the services and expertise they can provide.

Development and environment NGOs increasingly share an integrated analysis of the linkages within and between their respective fields of concentration. The pivot of this shared analysis is the need for sustainable livelihoods for the poor majorities that will largely determine the fate of the environment in all of the ANE countries. While it is relatively easy to agree in principle on the interdependence of development and its environmental base, translation of that analysis into action is the major challenge facing NGOs in the region.

The diversity and potential of the region's NGOs are illustrated by the following sketches:

- o The Institute for Social and Economic Research, Education & Information (LP3ES), an indigenous Indonesian NGO, is collaborating with the Indonesian Ministry of Public Works, the Ford Foundation, and AID to strengthen water-user associations and their role in irrigation system construction and management. In addition to training and supervision of community organizers, LP3ES assists the ministry in assessing and revising its own operating procedures in ways supportive of a stronger community role. It is also undertaking studies on a number of related issues in collaboration with the Ministry of Domestic Affairs.
- o The Bangladesh Rural Advancement Committee (BRAC) is establishing a Bangladesh Center for Rural Management to strengthen capacities of NGOs, rural banks, people's organizations, and central and local government officials to collaborate in local development problem-solving. Initially, the new center will concentrate on the health sector, working closely with the Ministry of Health on the development of more effective community-based approaches to primary health care. BRAC is reviewing its program activities in rural development, non-formal primary education, rural industries, and natural resources management.
- o The Indonesian Environmental Forum (WALHI), founded in 1980, is an umbrella organization, which currently coordinates more than 400 community-based and other NGOs concerned with environmental issues throughout Indonesia. WALHI organizes education programs such as conservation education programs for young activists, Environmental Impact Assessment training programs, and several training programs on environmentally appropriate technology. Other programs include provision of technical assistance to NGOs (e.g., for fund-raising), designing national sub-networks (e.g., on pesticides, forest destruction, pollution control), and lobbying through parliamentary hearings and other approaches to government. Most

recently, WALHI has led several environmental groups in bringing Indonesia's first suit against a corporation for violating environmental laws.

As NGO activity in the environmental sphere has increased, some ANE governments have begun to view NGOs as allies in carrying out sustainable national development policies. NGOs and government agencies have cooperated on environmental assessments, training and extension programs, research projects, and basic community development activities in Indonesia, the Philippines, Thailand, India, and Bangladesh. Donors are also increasing their cooperation with NGOs, especially in the environmental field. Their small size, independence, and focused-value commitment give NGOs a capacity for social and institutional innovation seldom found in either government or business. At the same time, these are often fragile institutions subject to unrealistically inflated expectations of their capacities and potential roles.

Institutional Assessments. The time is ripe for donors, international and larger national NGOs, and sympathetic government agencies to undertake strategic country assessments of the independent sector. Where this has been done -- in Indonesia for example -- the result has been more effective and strategic support for the NGO role. The primary role of such assessments is to illuminate the nature and extent of the NGO community within a country, and to highlight the distinctive competencies and effective initiatives of its various actors. In addition, assessments can:

- o Increase understanding of indigenous philanthropy, and the ways NGOs might take advantage of it;
- o Provide analysis of the interface between NGOs and the private business sector;
- o Provide the basis for a strategy for building coalitions that make optimal use of the complementary and distinctive competencies of the many kinds of NGOs, and suggest technologies and mechanisms for doing so;
- o Facilitate an increase in the quantity and sophistication of recommendations for the NGO sector growing out of the many environmental profiles being carried out in the ANE region. (Currently, most recommendations are aimed at government, donors, and business.)

Political Space for Independent Sector Growth. The growth in number and influence of NGOs has evoked mixed reactions from governments in the region. In the Philippines, the Aquino government has welcomed the participation of NGOs in policy making and implementation, particularly in environmental matters. In other countries, the relationship is ambivalent and has become mired in layers of registration, government regulation, funding restrictions, and other controls. In the worst cases, governments have reorganized or dissolved NGOs and imprisoned their leaders as threats to national security. Nevertheless, development of broader-based institutional pluralism is supported by elements in virtually all ANE governments, and the potential for broadening NGO's political space in the coming decade is considerable.

Bilateral donors, international PVOs, and international financing institutions can play important roles as catalyst and mediator in broadening the political space for NGOs. They can do this by, for example, convening national, provincial, and sub-provincial symposia focused on the complementary relationship between the government and independent sectors and featuring recognized NGO leaders as well as sympathetic government officials. They can also build NGO components into their own project design, management and evaluation processes, and into the projects and programs that they fund. The importance of increasing political space for NGO participation in development can also be stressed in policy dialogues. Nevertheless, donors must recognize that this is a politically sensitive area and must proceed with care.

Managerial and Technical Capacity. NGOs are characterized by small size, budgets, and staff; modest pay scales; high staff turnover; and generally weak managerial and technical capacities. If NGOs are to move beyond basic data gathering and advocacy to participate in policy making and project design, management, and evaluation, they must develop their technical and managerial capacities.

Lack of basic management skills is a common weakness of NGOs throughout the region; a problem that often prevents them from playing the role that their ideas and commitment promise. Young and/or rapidly expanding NGOs are particularly vulnerable in this regard. Managerial weakness particularly restricts access to donor funding and encourages donors to continue working with a few well-established national groups. Improved management skills are needed in financial planning and budgeting, accounting, personnel management, information systems, fund-raising, and administration of small grants programs.

Considerable resources exist in the ANE region for NGO management training, in the way of specialized training packages and programs. The Asian Non-Governmental Organizations Coalition for Agrarian Reform and Rural Development (ANGOC), located in Manila, is a regional organization of NGOs in

South and Southeast Asia with such programs. It organizes management training for NGO supervisors, focused on project development, general management, and supervision. The International Institute for Rural Reconstruction (IIRR), also in the Philippines, is a research and training center which offers a variety of courses, including standard on-campus and in-country programs for both middle-level and senior managers and courses specially tailored to the needs of particular institutions. Areas covered include project planning and management and basic organizational management skills. The Development Innovations and Networks (IREN), located in Sri Lanka, is an international network of NGOs rendering support services to local development NGOs. Recent management programs include seminars on "Management Tools for NGOs in Development" and on "Financing Alternatives for Development Activities." Other more traditional management institutions, such as the Asian Institute of Management and the Indian Institute of Management, are also expanding their offerings for NGOs.

Some national NGOs also have strong management training programs. In Indonesia, Bina Swadaya runs a number of such programs for NGOs, concentrating on development of leadership skills, basic management, training, fund-raising, personnel policy and the like. In Thailand, the Thai Volunteer Service (TVS) offers training courses for less experienced managers of Thai NGOs whose experience is not longer than two or three years. Courses cover planning, project writing and reporting, evaluation, budgeting, and personnel management. The Social Development Management Institute (SDMI), set up by the Philippine Business for Social Progress (PBSP), provides similar services.

As development NGOs adopt environmental objectives, they need to enhance their technical capabilities to deal with the natural and social science aspects of environmental and natural resources management. Environmental NGOs possess some of these skills, but they too require strengthening in this area. A successful model for the transfer of technical environmental skills is the Indonesia-Canada Twinning Project, which links two Canadian NGOs – Pollution Probe and the Canadian Institute for Environmental Law and Policy – with three counterpart organizations in Indonesia. The project's research will focus on the Surabaya River in East Java, intensely polluted with industrial wastes. Canadian specialists will help Indonesians to use available technology to monitor the pollution, and together they will determine how to use existing legislation to protect the health and environmental quality of the area. Given the sharp rise in U.S. NGO's interest in Third World environmental problems, the opportunities for this type of twinning are considerable.

Another effective way to increase technical capacities is to establish working relationships between NGOs and local or regional research institutes that can offer them high-quality technical advice, training, and research support. With the exception of India, Bangladesh, Indonesia, and the Philippines, the link between the

university community and NGO work is very weak. If such links were a criterion for donor funding, better programming would result. Good opportunities for this kind of collaboration exist in Nepal, Jordan, Egypt, and Morocco.

Supporting NGO Expansion. While many NGOs in the ANE region have demonstrated their ability to carry out successful projects and activities on a small scale, efforts to replicate successes on a regional or national scale raise a different set of challenges. There are basically three strategies for NGO expansion. An NGO can: (a) grow in size, expanding its activities within the same basic structure, but taking care to build decentralization and local control into the process; (b) can assist in setting up "satellite" NGOs working on different issues and/or in different geographical areas, but retaining a loose affiliation; and (c) associate itself with other NGOs working on similar issues and strategies, through umbrella network organizations. A particular NGO may, of course, pursue more than one of these strategies simultaneously.

Whatever the strategy for expansion, the key objective for both individual NGOs and for the whole NGO community in any country is to develop a "critical mass" of many little activities in a certain area of concern, to generate widespread support and to attract funding from governments and donors. As important as it is to build consensus around substantive issues (e.g., deforestation), it is perhaps more important that the means used by NGOs (e.g., high levels of local participation, affiliation of many groups in loose and flexible networks) gain acceptance as valid mainstream strategies for addressing environmental problems.

c. Enhancing the Role of Women

Women in rural ANE households participate in many activities that have a direct bearing on the use and conservation of natural resources. In agriculture, women provide more than half of the labor needed for planting, weeding, harvesting, transporting, storing, processing, and marketing produce. They also carry water and collect fuel, manage domestic livestock, fish, gather medicinal plants, and pass on to their children considerable knowledge of nature and local wildlife.²⁸

Because of their roles as resource managers and consumers, women are major agents in the degradation of the environment, but they are potentially major agents for improving natural resource management in the future. The problem is that women's roles are inadequately recognized and supported. Lack of awareness of the way men and women use and rely on natural resources, as well as the different gender impacts of policies, technologies, and institutional actions has led to misdirected investments and missed opportunities. Support for women in the field of natural resource management will have to come through change in

national policies and programs, gender-specific research, and support for projects and programs that benefit women and take advantage of their ability to organize and manage. Both governments and donors need to address these problems.

National Policies and Programs. ANE governments are becoming more committed to enhancing the roles of women in their economic development programs. But, progress is slow. Getting in the way of expanding women's roles in natural resource management are inequitable laws on marriage and inheritance and the lack of sufficient support for basic education, health, and family planning. Training programs are often geared to men because women have lower literacy rates.

Donors can help to address these problems by encouraging countries to develop projects that consciously address women's needs. A review of 22 social forestry projects appraised by the World Bank from 1984 through 1987 found that only one explicitly mentioned women as project beneficiaries or participants.²⁹ Yet, in an overwhelming number of projects with forestry components, women are important participants. Forestry projects can increase returns on investment by taking women's preferences for products and species into consideration, by recognizing women as effective lobbyists for protecting common property, by understanding that women will increase their contribution to household income if raw materials for home-based industries are available, and by providing credit to women for commercial ventures. These projects and the policies that support them would not only be more equitable, they also mean that natural resources would be managed more efficiently.

Research. More incentives are needed to encourage researchers to document gender differences related to resource use by rural households. Subjects of particular interest include: quantifying the economic contributions to household livelihood from women's collection of natural products such as fodder, fruits, and fuelwood; tapping the knowledge of local women about effective traditional practices for managing land, water and biological resources; understanding how different customs and sociocultural traditions permit or prohibit certain resource activities by women; and correcting policies and legal institutions that perpetuate inequities and restrict women's access to and control over resources. For example, the failure of several tree-growing projects in Nepal might have been avoided if men had not been given responsibility for tending nurseries and caring for seedlings, while women, who are traditionally responsible for watering trees, were excluded.

Mechanisms for encouraging research on women's issues include special fellowships and grants, curriculum development at universities, and the exchange of information among research institutions in the ANE region that are addressing social issues relating to environment and development. Additional support is

needed for institutions that address these research needs, such as the International Center for Integrated Mountain Development, in Nepal and the Regional Community Forestry Training Center for the Asia-Pacific, in Thailand.

Women's Organizations. In many parts of the ANE region, development groups have organized women into clubs or cooperatives to manage resources for the benefit of the community. For example, women living along the coastal wasteland of Gujarat, India, traditionally collected seeds from the salt-tolerant Salvadora trees and sold them to merchants. These seeds yield an oil that can be used in manufacturing soap and varnish. With the support of a non-governmental organization, Mahiti, the women increased their harvest and arranged to sell directly to oil-seed processors, who paid a much higher price. With the increase in earnings, the women expanded tree planting, added new varieties, and began to use some of the profits to build water catchment tanks, this time with government, donor, and private sector involvement.

Donors, governments, and NGOs can encourage women to organize around issues such as natural resource conservation, credit, and income generation. They can also help to establish regional and national information networks to document organizational success stories such as the above and to share these experiences (successes and failures) with other women and local groups. More importantly, leaders of women's organizations should be encouraged to participate in helping to plan regional and national environmental and natural resource projects.

Opportunity 6: Strengthening Public Awareness and Education

Managing natural resources in a more sustainable fashion requires that the public understands the importance of environmental quality and resources to their lives and that it supports, even demands, policy reform. This comes about when the public is informed about government- and private-sector activities and has an opportunity to participate in making policy and in expressing their interest in what these institutions do. Public awareness comes about only when there is an increased flow of information from industry and government to the public, and vice versa. The aware public is the best source of pressure for change.

Fortunately, the basic conditions for strengthening public awareness and environmental education and training in the ANE region are improving. Literacy is growing, although starting from a very small base for women, and communication and transportation infrastructure is reaching a greater proportion of the population, including rural villages. Knowledge about environment quality and its links to economic conditions is growing and a host of new, appropriate technologies and practices have been tested in pilot projects and are ready for wider use.

The two most important target groups for expanding awareness are the general public and leaders in government and industry.

a. **Informing the General Public**

The mass media (television, radio, and newspapers), exhibits and shows, brochures and booklets, and special events can promote greater awareness and communicate simple facts and figures. Journalists can play an essential role by getting the government and industry to release information about the causes and sources of pollution and resource degradation and the underlying causes and impacts on people. The establishment in 1988 of the Asian Forum of Environmental Journalists (AFEJ) is an indication of growing interest in environmental issues and their connections with sustainable development. The AFEJ serves as a network between National forums in 11 countries, including Bangladesh, India, Indonesia, Nepal, Pakistan, Sri Lanka, and Thailand.³⁰

Seminars for journalists can also improve the quality of investigative reporting and expand the coverage of natural resource and environmental issues. In Indonesia, for example, NGO-supported workshops include a two-week assignment in which journalists prepare articles on biological conservation, columnists from the Far Eastern Economic Review critique their stories, and the articles are published in national and local media.³¹

Environmental concepts and practices can also be taught in primary and secondary schools. It is better to integrate this material into basic science and social studies than to mount special classes. Furthermore, school activities can involve the entire community and can result in direct benefits to the community as well as expanding awareness. Tree-planting and litter clean-up campaigns and demonstrations on reforestation, pollution control, soil management, and wildlife protection can be done jointly by schoolchildren and parents. By bringing in the local community, the teaching of modern techniques can be combined with the use of traditional knowledge. Also, the important role of women in planting crops, caring for livestock, and harvesting can be recognized and enhanced.³²

Better education is not a substitute for open government. Information on government and private sector policies and projects that have potentially serious environmental effects must be made available to the public. Implementing a thorough environmental impact assessment process is one way to open government and industry decisions to public scrutiny. Increased government support for environmental NGO participation in project planning, design, implementation, and evaluation is another. The public should have an opportunity to comment on all major development plans and have recourse to higher-level government review if their well-being is threatened. This requires both governments and donors to

allow greater access to information on planned projects, well in advance of any decision to proceed.

b. Informing Leaders in Government and Industry

The key to getting leaders to become more aware of the importance of resource management is to communicate environmental information in the context of goals that are important to them. Thus, regional workshops, in-country seminars, and study tours should help leaders understand the importance of resource management to sustaining the growth of their economies. National planning officials, through conferences by local and international groups, can be brought to understand that excessive subsidies for pesticides, irrigated water, and fertilizers are a drain on the budget, and that reducing them can save money as well as reduce pollution and resource degradation. Chemical manufacturers, through industry- and government-supported seminars, can learn that they can increase profits if they adopt technologies that reduce processing losses and wastes of expensive imported basic chemicals, which in turn reduces pollution.

It is even more important to get leaders to participate in developing state-of-the-environment reports and national strategies for addressing environmental problems. Working with NGOs, other senior officials, industrialists, and a variety of interest groups to identify national problems and to set action priorities, builds awareness, and the process can be used to build political support for making difficult decisions. "Building on Success," the recently completed National Conservation Strategy for Nepal, utilized a weekly radio broadcast, meetings with urban community groups, meetings with leaders and farmers at the village level, and workshops with the Association of Environmental Journalists of Nepal to ensure that the Strategy represented the views of a large segment of society and included the active participation of government leaders and the king.³³

Opportunity 7: Training for Natural Resources Management

There is a great need throughout the ANE region for technical and professional training to meet growing needs for skilled personnel in environmental and natural resources planning and management and to ensure that trained personnel are placed in positions where their skills can make an optimal contribution.

For all ANE countries, a training strategy should include three basic elements. First, a needs assessment must be carried out to determine the most critical areas where skilled personnel and training institutions are in short supply. Second, more professional training is needed in relevant natural science, social

science, and management disciplines. Third, there is great need for more informal short-courses and other types of on-the-job training that strengthen hands-on environmental management skills in government, NGOs, and the private business sector. In all kinds of training, it is important to focus on building indigenous training capacity as well as on training individuals. It is also important that training strategies stress a multi-disciplinary approach.

a. **Needs Assessment**

Previous sections have stressed the need for evaluation of the country's most critical environmental challenges. This evaluation should include an assessment of the kind and quantity of skilled personnel needed to address those challenges. It should also assess the capacities of existing training institutions and evaluate past attempts to strengthen these capacities. The assessment should be as specific as possible, identifying what is needed at what levels in particular institutions. At the same time, the assessment should take a broad view of training opportunities which encompasses the needs and capacities of NGOs, community groups, and the private business sector as well as government; an NGO, for example, may need to receive training in toxicology, but it may also be able to provide training to government agencies in community development.

Universities and other centers of learning provide the basis upon which environmental training capacities can be built. Needs assessment is particularly important for investment in training of this kind; limited funds must be used strategically, since directions in formal higher education are often difficult to change once set. The needs assessment should focus on the current and potential absorptive capacity of various institutions. There is little utility in training ecologists if they will end up in positions that do not utilize their skills, or move to another country for a better-paying job. Finally, assessments should focus on building indigenous training capacity – "training the trainers" – and on prospects for sustained financing of enhanced training capacities. It is important that the assessment process involve education ministries as well as those concerned with the environment, since it is the former that generally have the power to put recommendations into practice.

b. **Professional Training**

The ANE countries suffer from critical shortages of trained professionals needed for sustainable environmental management, and a lack of capacity in their universities to provide high-quality professional education. The subject areas that most need attention are: ecology, resource economics, and human ecology; integrated resource planning and management; environmental sciences, including

health and engineering; and environmental law, policy, and administration. A number of critical themes in need of interdisciplinary treatment emerge throughout the region. These are: water resources management, including watershed protection and pollution control; environmental impact assessment; ecosystem inventory and monitoring; forestry production and protection; coastal, fisheries, and aquaculture management; soil science and conservation; and the proper handling, use, and disposal of pesticides and other hazardous chemicals.

In developing in-country capacities to address these needs, several dimensions need to be addressed. First, there needs to be more emphasis on field work and field applications. While many countries need managers, there is a greater need for hands-on natural and social scientists, who understand conditions in the field and are willing and able to work there. This is often difficult in the ANE region, as professional and financial incentives frequently point toward the national capital and to managerial rather than substantive occupations. Government agencies, in particular, need to rethink their career and incentive structures, if they are going to attract talented people to hands-on positions. And it is the occupational incentive structure that will in turn provide the incentive for educational institutions to reorient their priorities and curricula.

Second, there is a great need for more interdisciplinary training which brings together, for example, agriculture and forestry training in a distinctively ecological framework. One promising opportunity for doing so is illustrated by Indonesia's system of Environmental Study Centers (ESCs). Since the first one was founded in 1972, the number of ESCs in Indonesia has grown to 52, although many are still in their formative stages. Each ESC is attached to a university and has a close relationship with local and provincial environmental officials. While there is no standard ESC model, the basic ESC goals are interdisciplinary research, training, and public service (e.g., environmental profiles for local and provincial governments and planning bodies). Four universities with ESCs currently offer graduate-level interdisciplinary programs in environmental studies, directly and indirectly supported by the ESC. Many others offer similar courses at the undergraduate level. ESCs have also offered more than 100 short courses on Environmental Impact Assessment for participants from government, NGOs, and the private business sector. The ESC system has attracted considerable donor interest and funding, most notably from the Canadian International Development Agency (CIDA).³⁴

Finally, judicious and strategic use of overseas training and use of expatriate experts in-country is still necessary in most of the ANE countries. Long-term institutional development will not provide the skilled personnel needed over the next decade. Where specific needs exist that cannot be filled by existing institutions, overseas training should be used. To the extent possible, such training should be closely keyed to the needs and conditions in the home country. One

possible model is for a student to take a Master's degree overseas, but return to his or her country to pursue the Ph.D., under the joint supervision of a national and an overseas institution. In overseas programs, it is also desirable to encourage a significant clinical component, in which the ANE national spends time actually working in environmental management or policy analysis in the host country. More attention should also be paid to the potential for "South-South" training, where nationals of a country such as Burma, for example, receive training in a neighboring country such as Thailand. Finally, where expatriates teach in ANE countries, the development of in-country curriculum and capacity should be as much a goal as the training of individuals.

c. On-the-Job Training

Short-term, readily applicable training in environmental and natural resources management is needed throughout the region, focusing on those people from all sectors who are already doing work related to natural resources management and who need skills to do so more effectively. This kind of training should focus primarily on field operatives and middle-level managers, providing them with simple, yet effective skills for environmental assessment, analysis, monitoring, and management. Particular attention needs to be paid to environmental information management systems, especially basic computer skills.

On-the-job training strategies must be flexible, and adaptable to changing needs and conditions. As a general matter, international PVOs and in-country NGOs have proven themselves more adept than governments in this regard. For example, the Asian Institute of Technology, in Bangkok, has developed a successful one-month course on environmental impact assessments for government officials from the ANE region. There are plans to expand participation to include technicians from Asia's growing private industrial sector.³⁵

While formal university education remains the preserve of the privileged few throughout the region, short-term training can target a much wider range of environmental actors. Women, local officials, small businessmen, and farmers' associations, for example, should be priority targets. NGOs and private business can be tapped for expertise in training as well as receiving training themselves. The key is to carry out ongoing assessments, so that training responds to current needs and takes advantage of the widest possible range of human talent.

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CHAPTER IV

RESPONDING TO THE CHALLENGE:

ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT FOR SUSTAINABLE DEVELOPMENT

RESPONDING TO THE CHALLENGE: ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT FOR SUSTAINABLE DEVELOPMENT

In this chapter we identify 13 opportunities that address the most important environmental and natural resources issues in the ANE region – rapid deforestation, degradation of coasts, loss of biological diversity, sustainability of agriculture, water resource issues, energy management, and deterioration in environmental quality in urban areas. The actions recommended are directed at the underlying causes of environmental and resource degradation. Most solutions, therefore, require not one but a combination of actions.

A. PROTECTION AND MANAGEMENT OF BIOLOGICAL RESOURCES AND ECOSYSTEMS

Much of the drawdown of biological capital in the ANE region is caused by economic and political forces that favor destructive uses of land, uncontrolled urban sprawl, destructive logging and fishing, over-expansion of plantation agriculture, and water pollution. The challenge is to slow the decline in biological destruction by incorporating resource conservation into the development process in terms of government investments and initiatives and in terms of establishing incentives for the private sector to invest in biological resource conservation.

Opportunity 8: Sustainable and Equitable Management of Tropical Forests

ANE countries have begun to address problems of rapid deforestation by expanding their forest ministries, increasing charges to logging companies, establishing more parks and protected areas, and experimenting with a variety of "social forestry" systems. Donors have also begun to place greater emphasis on forestry. In general, there is increasing recognition of the important economic and environmental roles played by the region's forests, and the important interdependencies that exist between forestry and other sectors of the economy, particularly agriculture, although this recognition is not yet reflected in policy and practice.

Current policy frameworks grossly overvalue the net benefits from forest exploitation and conversion. The myriad of non-timber natural forest products such as fibers, foods, and medicines, and less quantifiable environmental services such as watershed protection, climate amelioration, and maintenance of biological diversity are frequently ignored in calculating the alternative worth of different forest uses. At the same time, the social and environmental costs of forest

conversion and over-exploitation, such as displacement of local communities, soil erosion, and the disruption of other environmental services are not calculated.

a. Policy Reform in the Forestry Sector

Many policy reforms necessary to slow deforestation and promote sustainable forest management must come in sectors other than forestry. Recent policy analyses, however, point the way toward desirable and specific reforms in forestry policy.¹

- (1) Fiscal and environmental savings can be made through better collection of forest rents, better design and enforcement of forest production revenue systems, corrected incentives to forest-based processing industries, and reduced subsidies to competing land uses such as agricultural settlements. (Forest tenure reforms are also important, as discussed below.) Levies and taxes on timber concessionaires, for example, rarely cover the loss of environmental services and burdens on local communities that most commercial forestry ventures in the region incur. The Indonesian government responded in the early 1980s by levying a \$4/per cubic meter "Reforestation Guarantee Fund" on timber extracted by concession holders, refundable if reforestation conditions were met. The failure of this system to encourage reforestation led the government to raise the fee to \$7 in early 1989 (and to \$10 in September 1989), and to treat it as a straight tax, earmarked for reforestation activities generally.²

In Thailand, there are also signs that more critical analysis of forest policies is leading to changes in the calculation of alternative forest uses. The Thai government recently opted to shelve a hydroelectric project planned for the Thung Yai Naresuan and Hua Kha Khaeng sanctuaries after weighing the benefits against the long-term costs of destroying its largest forest reserve.³ Meanwhile, the government also banned all logging countrywide in early 1989, spurred to action by public anger over the consequences of uncontrolled forest destruction.⁴

- (2) The recently developed FAO/UNDP-sponsored Tropical Forest Action Plan (TFAP) initiative is providing a useful model and process for improved forestry sector planning, donor coordination, and reorientation of government priorities, and for promoting dialogue on policy reform. Thus far, Nepal and Indonesia have completed formal forestry sector Reviews,⁵ and they are under way in six additional

countries.⁶ The review and plan formulation process is potentially as important as the product, as it provides a focus for building support for policy reforms and for the initiation of programs and projects. The TFAP process has been criticized by some non-governmental groups in the U.S. and in the ANE region for not incorporating enough "bottom-up" input,⁷ and it is indeed important that national TFAP exercises include meaningful participation by a range of actors, not just government officials. It is particularly important that local forest communities have a much greater say in decisions that affect their environment and livelihood.

b. Forest Tenures and Community Access

Reform of tenurial rights over forests -- legal rights of forest ownership, access, and control -- is an important and promising strategy for improving the state of forest management throughout the ANE region. The two most important issues are the rights of local communities and the nature of rights and responsibilities for timber operations granted to large-scale concession holders.

ANE public forestry agencies increasingly espouse the need to work with local forest communities and user groups as "partners," but this requires the legal recognition of local rights over resources necessary for community livelihood in order to provide forest-dwellers with a meaningful stake in the long-term sustainability of forest resources. Local control need not be absolute or unconditional, nor need it preclude generation of revenues for the state. The key is for local households and communities to hold secure, long-term, alienable rights in forest lands and resources, rights that provide the basis for a secure economic return over the long periods of time that forest management requires.

In Papua New Guinea, forest ownership by indigenous communities provides a model for forest production and protection in relative harmony with local needs and customs.⁸ No one form of tenure, however, provides the key. Cultural, ecological, and other variables may dictate individual ownership, common property regimes, or rights to particular species and uses without ownership of land per se. Thailand, the Philippines, and Indonesia are experimenting with a variety of "stewardship" contracts for reforestation of degraded lands and for management of buffer zones around protected areas.⁹ On Java, the state forestry corporation has launched a social forestry program that incorporates community needs into timber plantation management.¹⁰ India recognizes some tribal forest tenures within national law.¹¹ Indonesian law recognizes traditional rights to collect non-timber forest products.¹² Nepal is granting legal control over some forests to local "resource users groups."¹³ The opportunities are numerous, and existing initiatives have only begun to scratch the surface of the problem.

Tenurial arrangements for extracting commercial timber are also in need of reform, particularly in Indonesia, the Philippines, and Burma. Typically, timber concessions are granted for periods of time (e.g., 20 years in Indonesia) that provide no incentive for ensuring the forest's future viability. In combination with a demonstrated lack of governmental oversight capacity, and lack of legal and political mechanisms strong enough to permit environmental groups to take a meaningful oversight role, these short-term concession arrangements have encouraged the "mining" of the forest so common throughout Southeast Asia.

Of course, longer concession periods in themselves would not necessarily improve management, since market conditions can change greatly over a period of, say, 50 years, and might dictate clear cutting. One solution would be a "roll-over" system, in which a 35- or 50-year concession is renewed every year for another full concession term, contingent on adherence to sustainable management principles and regulations. Improved monitoring and regulatory capabilities are important for such a system, but they are important for the success of any system.

Recent developments underline the opportunities and the urgent need for action. In Indonesia, there is currently a substantial policy debate about reforming the concession system (nearly 85 percent of existing concessions will expire or be renewed by 1993), but the 20-year system remains in place.¹⁴ In Burma, the military regime has recently granted concessions to Thai timber companies for periods as short as five years, commencing a process of rapid forest destruction and tribal displacement by military force.¹⁵ Given Burma's current political isolation, efforts at concession-policy reform may best be directed at the Thai government and the concession holders that operate under its laws and authority.

c. Research, Assessment, and Monitoring

Despite the increasing attention given to the problems of tropical deforestation, reliable information for the ANE region on the extent of forests, rates of deforestation, and condition of remaining forests is extremely limited. Even less is known about the true social and economic costs of forest degradation and forest loss. A primary shortcoming of existing forestry indicators – apart from their inaccuracy and incompleteness – is that they fail to present the interdependence of forests and other sectors of the economy (e.g., agriculture, industry, energy, tourism) forcefully enough to convince policy makers of the importance of forest conservation. There are particularly few data concerning the multiple roles that forests play in the economic life of local communities, especially in regard to products that do not enter formal markets.

Improving the quality and quantity of forest assessment and monitoring is a crucial prerequisite for all other opportunities discussed in this section, and the ANE countries need to develop improved analytical capabilities to produce it. Basic national-level inventories and ongoing monitoring systems are urgently required. To this end, national governments, often with donor assistance, have conducted forest and land use inventories in India, the Philippines, and other ANE countries. A comprehensive inventory of Indonesia's forests (more than 40 percent of the ANE total) is just beginning with World Bank support.

As recognition has grown that deforestation in the ANE region is primarily a "people problem," more emphasis has been placed on documenting the complex interactions between forest and human agents which determine the conditions of the forest. Because traditional "forestry research" pays little attention to these human dimensions, the most promising work in this area has been carried out by people and institutions -- often NGOs -- studying the problems of rural development generally and putting forestry in that context. Traditional forestry research institutions are beginning to follow this lead and to integrate sociological and human ecological perspectives into their agendas, a trend which should be encouraged.

At the same time, the more technical aspects of forestry research are beginning to change, as the need for multi-purpose forest management in the region grows. More and more work is focusing on the current and potential value of non-timber forest products (fruits, medicinal plants, etc.), utilization of lesser-known timber species, and regeneration of natural forests. AID, for example, is assisting the Philippines with studies and implementation of "assisted natural regeneration" under the Rainfed Resources Development Project. Through its ten-year Forestry/Fuelwood Research and Development Project, AID is also supporting collaborative research throughout Asia on multi-purpose tree species and accelerating their acceptance by farmers.

Work on the feasibility of sustainable systems for large-scale commercial logging in Southeast Asia is urgently needed. It is increasingly evident that most existing systems have been a failure in all but the most crass, short-term economic sense. Research is urgently needed to document the failures of existing practices, analyze more successful systems, and devise alternatives. The focus of such work should be not on "which systems are sustainable," but rather on determining if large-scale commercial logging is sustainable under any system, given institutional infirmities (such as corruption and smuggling) and population pressures.

d. Managing Forests for Multiple Products and Services

If the remaining forests of the ANE region are to be preserved from wasteful destruction, a broader definition of "natural forest management" is needed, one that goes beyond timber production. Forest management must encompass a range of complementary uses, including collection of non-timber forest products, farm forestry, watershed and biodiversity protection, strict reserves, and agroforestry buffer zone strategies on the forest periphery. The definition of forest manager must concurrently be broadened to include those communities in and adjacent to forest areas.

The value of non-timber resources is increasingly acknowledged in many ANE countries, but much needs to be done to realize their full potential and to insure that their benefits accrue to local communities. Rattan, for example, is harvested from 600 species of palm vines native to moist tropical forests. In Indonesia, traditional mechanisms that prevented over-cutting have broken down under increases in external penetration and ill-conceived government efforts to control the industry. Along with a return to local control over the resource, research is needed to improve the chances for rattan cultivation in ecologically suitable areas.

Some 500,000 people in Asia already depend on rattan for full-time employment, and this source of livelihood could increase substantially if rattan were integrated into the mainstream of forest management concern.¹⁶ The same can be said for a number of other forest products, including collection of resins and gums and intensive wildlife farming. Crocodiles and butterflies, for example, are farmed in some Southeast Asian forest areas as well as in Papua New Guinea.¹⁷

e. Developing Timber Plantations for Diversity and Sustainability

Rising demand for wood products has prompted the establishment and expansion of tree plantations in many ANE countries. They can produce large volumes of timber and fuelwood (often growing three to ten times faster than corresponding natural stands), protect against soil erosion, help maintain watersheds, and help reduce the pressure to exploit remaining natural forests.

Plantations are of three types: short-rotation industrial plantations producing pulp, wood chips, and low-density saw logs; non-industrial plantations composed primarily of species grown for charcoal, fencing, and fuelwood; and long-rotation plantations producing high-quality sawn timber and veneer (e.g., the teak plantations of India and Indonesia). The recent trend in the ANE region is toward fast-growing multi-purpose species.¹⁸

Plantation forests are needed throughout the ANE region to serve as an alternative to natural forest sources. There are, however, a number of issues that must be considered if plantations are to provide optimal economic and environmental benefits in a sustainable fashion. To the extent that fast-growing species predominate, plantations cannot compensate for the loss of the full range of goods and environmental services that natural forests supply, and in any event, the plantation establishment has lagged behind deforestation in almost all ANE countries. In addition, since plantations are monocultures, the risks of tree mortality from insect pests and diseases are very high. Finally, some plantation species (primarily *eucalyptus*) have been adamantly opposed by local populations for their perceived adverse environmental effects, and the lack of local benefit generated by their cultivation. In 1983, for example, farmers in India's Karnataka State marched en masse to a tree nursery and pulled out all the *eucalyptus* seedlings, replacing them with native tamarind seedlings.¹⁹

A final, critical feature of plantation forestry that must be addressed is the tendency, noted in Indonesia, to establish industrial plantations on lands excised from existing tracts of high-value natural forest. In these cases, plantation forestry is being used more as a means of legally invading protected forest reserves, and thereby accelerating logging rates, than as an alternative method of producing wood products.

In short, plantations can serve an important economic and environmental role if they: (a) are established in consultation with local communities, provide for their needs, and respect their rights in land and other resources; (b) move away from the monocultural model toward more complex systems that provide a variety of benefits over time, are more resistant to disease and pests, and are more labor-intensive; and (c) are developed under a system of incentives and regulation that insures that they are sited on degraded lands, not natural forest areas.

f. **Promoting Social Forestry Strategies and Technologies**

Increasing realization that existing forestry policy and practice is inadequate to deal with the pressures on the region's forests has spurred interest in a range of "social forestry" strategies, which are espoused both by those who would defend and strengthen the power of the state over forest resources and by those who promote increased community control. Stripped of its diverse ideological baggage, social forestry refers to structural and policy changes in traditional forest management that have the purpose and effect of increasing the forest benefits flowing to local communities. It is small-scale in scope and responds to local needs and agroecological conditions. It includes some element of agroforestry, and produces a variety of products with different time frames and end uses. It involves some degree of participation from the local community, encompassing at

the very least the sharing of forest benefits, the articulation of local needs and preferences, and at least passive support for state forest management policies and goals.

Beyond these core elements, social forestry varies greatly in concept and execution. In Indonesia, it refers both to increased local participation, benefits, and tenurial security in the traditional taungya teak plantation reforestation system on Java, and to the development of community-managed buffer zones around protected forest areas in the "outer islands."²⁰ In the Philippines, it refers to the granting of "stewardship certificates" to local farmers in degraded upland forest areas.²¹ In India, social forestry has been used to describe village woodlots, strip plantation on road, rail, and canal embankments, and farm forestry on private land.²² Social forestry technologies include a variety of agroforestry and agro-silvo-pastoral systems, fuelwood plantations, home gardens on private lands, and improved shifting-cultivation systems in natural forests.

The opportunities inherent in the varied and innovative strategies falling under the social forestry rubric are numerous. Enough experience has accumulated for systematic review and analysis of social forestry initiatives throughout the region. This should be a priority for governments, donors, and NGOs, since the goals and results of social forestry are so diverse.

In particular, the goals of specific social forestry activities need to be better defined. Goals may include provision of forest products for subsistence or the market, income and employment generation, enhanced production of food through agroforestry, rehabilitation of degraded lands, and protection of natural forests through buffer zone strategies. While often complementary, these goals can conflict, as they have in many eucalyptus-based projects in India. Resulting failures do not indicate generic deficiencies in social forestry; rather, they indicate a poor fit between particular technologies and strategies, and the social and environmental contexts in which they are carried out.

g. Retraining Foresters in the Ministry and the Field

Building on colonial traditions, most ANE foresters and forestry departments define their core tasks as the production of timber, maintenance of watershed and other protection forests, and the limitation of public access to forest resources through patrol-style policing. Population pressures, low levels of financial and personnel resources, and the sheer size of forest areas under nominal state control in many countries have rendered this model ineffective. If they are to respond to the opportunities discussed above, the forestry administrations of the ANE region will need to reorient themselves for a variety of new tasks and objectives.

Effective forestry strategies in the region are increasingly heterogeneous, outward-looking, and interdisciplinary. The forester is increasingly called upon to serve as agent of development, interact with local communities, deal with a range of non-timber forest products, and integrate substantial agricultural components into forestry strategies. These changes require professional forestry administrations to take on new tasks and develop new institutional adaptations to those tasks. They must also institutionally adapt to the fact that many of the new functions required for sustainable forestry may best be carried out by people and organizations in fields other than forestry.

In the forest-rich countries of Southeast Asia, government forestry agencies are relatively strong and provide an institutional base for developing new skills and ways of doing things. Indonesia, for example, has recently established a Directorate for Conservation Extension within the Forestry Department, in recognition of the importance of people-forest interactions in the management of parks and protected areas.²³ The State Forestry Corporation, which manages Java's forests, has enlisted the assistance of a community development NGO to develop and implement social forestry skills and strategies.²⁴ The Philippines' Forest Management Bureau established a Social Forestry Division several years ago. In the smaller, forest-poor countries of South Asia and the Near East, where farm forestry is of primary importance, it may be more logical to develop the forestry orientation of agricultural agencies and actors, rather than try to extend the responsibilities of small and relatively inconsequential forestry departments.

Opportunity 9: Managing Coastal Resources

Traditional sectoral management cannot solve the major resource problems in coastal environments. Instead, integrated land use strategies are required that bring together the various interests – construction and transportation, heavy industry, urban and resort development, aqua- and mariculture, and military facilities – and focus on their interdependencies and the processes that can sustain the use of coastal ecosystems. The concepts of integrated resource management are known and generally accepted. The challenge for the ANE region will be to put these approaches into practice before the fragile and limited coastal resources are irreparably destroyed and degraded.

a. Profiling Coastal Issues

Preparing a national or regional profile of coastal resource and management issues is a useful way to identify important problems and foster an appreciation of the issues involved. It is important that coastal profiles be prepared by local experts and include the participation of local communities. The process should

include the analyses of resource conditions, trends, their use, and the contribution coastal resources make to the local, regional, and national economies. At a minimum, the profile should cover the resources in the coastal zone (marshes, deltas, estuaries, mangrove swamps, seagrass beds, coral reefs and lagoons, beaches, and islands), marine resources, and the problems associated with the use of these resources and their degradation from local, upstream, and marine activities.²⁴ The profile should also examine the institutional mechanisms at work in the coastal zone and identify the specific circumstances that are interfering with the preparation, adoption, or implementation of sound resource management policies. By using existing data sources, the profile can identify priorities for future research, monitoring, and policy analysis.

A well prepared coastal resource profile can become the basic source of information for policy discussions, public awareness, and education as well as a guide to more detailed project and site-specific studies. More importantly, the profiling process and follow-up discussion can identify a few key problems that communities can begin to address. In 1987, the Indonesian National Development Planning Agency (BAPPENAS), with the support of Canada, developed an Action Plan for Sustainable Development of Indonesia's Marine and Coastal Resource based, in part, on a rapid assessment and profile of coastal conditions and institutions.²⁵ Coastal resource management profiles are particularly needed in the Solomon Islands, Kiribati, Papua New Guinea, the Philippines, and the Near East countries of Morocco, Tunisia, and Egypt.

b. Developing Legal and Institutional Frameworks

A principal need in the region is to develop legal and institutional support at the national, regional, and local levels to guide and to govern the use of coastal resources. These frameworks should enable officials and resource users to resolve coastal conflicts, promote sustainable development of resources, protect critical natural and cultural areas, rehabilitate important habitats and species, and take into consideration the physical, social, economic, and political impacts of resource use.

In Sri Lanka, experience with the Coastal Conservation Department (CCD) in the Ministry of Fisheries underlines the difficulties involved. In 1987, the Ceylon Electricity Board requested a CCD permit for a coal-fired power plant within the coastal zone at Trincomalee. Comments on the Environmental Impact Assessment, which was required by law, pointed out the significant adverse effects on air, water, and biological resources. On this basis, after considerable review and appeal to the Minister, the CCD Advisory Committee recommended against the permit, and the Electricity Board was refused a permit to build the plant, at least until the EIA is revised. However, the CCD lacks authority to prepare a comprehensive coastal zone management plan for Trincomalee harbor, which

would provide guidance on how and where such energy facilities could be built while conserving resources.²⁶

Three elements are basic to developing a framework for planning and managing coastal resources: (a) the requirement that a comprehensive development and conservation plan for a resource or zone be prepared and agreed upon; (b) legislation specifying the process of review, analysis, appeal, and permit for specific projects; and (c) the establishment of an institution that will carry out the process and compile the information needed to carefully assess various interests and options.

A legal and institutional framework that fosters bargaining is essential. Coastal resource problems often involve a complex social and physical environment, where different resource users are pursuing a wide range of objectives. Resolving these conflicts requires multifaceted negotiations, sometimes among dozens of key actors and organizations.

c. Implementing Coastal Zone Management Programs

Coastal zone management (CZM) is an approach that is used to guide development in the coastal zone in a way that is consistent with long-term conservation of the natural resource. The best approach requires a combination of a CZM strategy at the national or regional level and more specific CZM activities at the project or site level.

With the legal and institutional framework in place, a CZM program requires that the coastal zone be identified, mapped, and inventoried. This information, along with data on the uses of the resource, is then used to determine where development will provide the greatest social good and do the least damage to the resource base. Ideally, coastal policies will be set for each area or region. A number of options are possible, including sanctuaries, preserves, marine parks, land-use zoning, limits on levels of use and exploitation, industrial parks, transportation corridors, and energy facilities. Policies should specify the administrative procedures and enforcement actions to be used to ensure that future coastal development will be in compliance. A draft plan should be prepared and reviewed by other government and private organizations and receive public input. A revised coastal zone management plan should indicate the institutions that will be responsible for implementing each part of the plan.²⁷

In many situations, particularly the highly polluted and degraded bays and estuaries that support the cities of Manila, Jakarta, Bangkok, Karachi, Calcutta, and Port Said, the problems are so serious that the major reasons for developing a strategy and plan are to clean up pollution and rehabilitate fisheries and coastal

habitats, not to plan new development.

The management of coastal resources and activities has an impact on the lives of many communities, and the effect of management of resources is not easily perceived. Indeed, in the short-term, some elements of the plan -- such as maintaining beaches, mangroves, or coral reefs -- may appear to restrict development and curtail employment. Since the benefits of these activities are often spread out and accrue over a long period of time, an education program is needed to mobilize public support for management initiatives. Those whose activities are regulated need to understand why they are being asked to forgo short-term benefits, and this can best be done by drawing on persons with detailed knowledge and understanding of local conditions.

Integrated management plans for Thailand, Sri Lanka, Indonesia, Bangladesh, and the Philippines have been developed for some sites. Sri Lanka has had success in implementing its limited national coastal resource management program. The Philippines has passed legislation creating a coastal zone program, but there has been no implementation of the law. Similarly, in Thailand numerous plans and regulations have been identified for specific areas, but very few have been implemented. Regional organizations such as the Association of Southeast Asian Nations (ASEAN) can be called upon to assess the progress made in implementation and share the results with other countries just getting started.

d. Training Coastal Managers

Most ANE countries conduct marine and coastal research, but their studies rarely support policy analysis and the management of coastal resources. Coastal resource management centers should be established in association with local universities and supported by government and industry to carry out basic education, applied and targeted research, and service activities. Such centers can help build local capacity for analyzing issues, designing projects, and conducting targeted research and monitoring. They can also carry out training programs. The need for this kind of help is varied and growing. In Bangladesh, research on mangrove degradation, shrimp cultures, and sediment management is urgently needed to expand food production and to ensure added protection from storms and floods. In Indonesia, training is needed to help provinces identify and manage marine reserves. In the Near East countries, centers could help develop coastal resource profiles, develop plans for expanded tourism and fishery activities, and provide the government with the talent needed to regulate and plan coastal development.

A coastal resource management center has been established at the University of Kelaniya, in Sri Lanka, with an initial task to help the Coastal Conservation Department set research priorities. Five of the Environmental Study Centers in Indonesia have begun to establish marine science research centers which can support coastal zone management activities.

Opportunity 10: Conserving Biological Diversity

Opportunities for conserving biodiversity in the ANE region have increased considerably in the past decade. As more knowledge has become available, donors have begun to respond, and ANE governments have focused on both the threat and the opportunities to counter it. Opportunities include: (a) increasing the knowledge base for both immediate and long-term action; (b) enacting policy reforms that will increase economic incentives to conserve a wider range of biological resources; (c) reorienting land use management to more effectively conserve and utilize the diversity of biological resources; (d) increasing the coverage and effectiveness of parks and protected areas systems; and (e) reorienting agriculture and forestry technologies to take advantage of and conserve biodiversity.²⁸

Conserving biodiversity is often thought of in terms of legal protection of habitats and species. However, such legal protections mean little without adequate management or actual protection from unauthorized uses. Furthermore, in all ANE countries, most biological resources will always be outside of strictly protected areas. Biological diversity is thus, a land use and agricultural issue as much as it is a matter of designating parks and protected areas. This being the case, sections of this Strategy on forestry, sustainable agriculture, and coastal management are also strategies for conserving biodiversity. Much of what is said here should be read as strategies for incorporating biodiversity objectives into those fields.

a. Rapid Assessments and Basic Research

Responding to the destruction of biological resources first requires rapid identification of the ecosystems and species in most urgent need of protection. Rapid assessments should utilize existing information on conditions and trends in biological resources, causes of habitat and species loss, and underlying economic and institutional factors. They may be national in scope, or focus on a particularly important region or biome. Selection of areas for immediate action should balance three factors: biological uniqueness, gravity of existing and potential threats, and the extent of opportunities for conservation.

Rapid assessments may be carried out in the context of broader environmental profiles, or as the initial step in a more comprehensive program of research and assessment. The institutional format will necessarily vary from country to country. Their overriding goal, however, must be the rapid identification of biodiversity "hot-spots," which require immediate action and the elaboration of practical, immediate steps for their protection.

Beyond such rapid assessments for crisis response, there is a great need for basic scientific research on biological systems in the ANE region. Scientific studies which clarify the extent of different natural habitats, their ecological dynamics, and species composition are crucial for the long-run. Of particular urgency are field studies which illuminate the ecological processes of tropical forest, coastal wetland, and marine systems to determine trends in biological productivity, degree of resilience to disruption from human activities, and current and potential economic and social value.

An adequate set of biodiversity indicators does not exist at present, at either the national or project level. Ideally, such indicators should provide four types of information: (a) a current reflection of the conditions and trends affecting biodiversity; (b) information on social and economic conditions likely to affect biodiversity conservation; (c) data on the economic value of biological resources under different uses; and (d) data to assess the capacity of in-country institutions to implement conservation programs. Much of this data should be collected in the context of coastal, forestry, agriculture, and general environmental information and monitoring efforts. The key is to devise indicators that present this information in such a way that it can be used in development policy deliberations.

Human ecological research at the field level is also needed to document how natural vegetation and wildlife contribute to the livelihoods of rural people and traditional systems of resource management. Such research should, in particular, reveal the degree to which the rural poor and landless depend on natural ecosystems for food, security, health, and income and for coping with natural hazards such as pest outbreaks and drought. This kind of data should provide the basis for more realistic calculations of the benefits of conserving biological resources, and thus demonstrate that conservation is an issue of economic efficiency as well as equity.

b. Increasing the Economic Value of Biological Resources

If biological resources are to be conserved, the economic value of biodiversity must be made clear to both local communities and national policy makers. At the national level, inclusion of biological resources as capital stock in national income accounts, previously discussed, provides the opportunity for doing

so. For this to happen, methods must be further developed and utilized to quantify the direct and indirect values of forests, wetlands, marine systems, and the genetic diversity of agricultural plant and livestock species.

While it is difficult to quantify some aspects of the worth of biodiversity, much can be done. In addition to assessing the value of commercially harvested products such as timber, fish, ivory, rattan, and medicinal plants, field research can be used to give value to natural products such as firewood, fodder, game meat, and non-timber forest products which are consumed directly without passing through a market. The indirect values of ecosystem functions, such as watershed protection, tourism, soil conservation, and climate regulation are harder to quantify, but rough estimates can be made, and they will certainly be more accurate than current de facto valuations (e.g., zero). At the same time, development of better measures of both economic and non-economic values for all of these elements should be pursued.

For local communities and resource users, more and more varied ways to provide direct economic benefits from the diversity of biological resources must be developed. Recognizing local rights to non-timber forest products, reef products, traditional fishing areas, and other natural wealth can provide the basis for sustainable community management and increased local incomes, as discussed in previous sections. Furthermore, both governments and local communities would have a greater stake in maintaining biodiversity if they were able to share in the profits made by pharmaceutical and seed companies from development of products based on indigenous varieties.

c. Strengthening Management of Parks and Protected Areas

Despite their limited geographical coverage, parks and protected areas remain among the most valuable management tools for preservation of species and habitats. Protected areas can serve a variety of functions, from strict protection of habitats in a natural state to sustainable harvesting of natural products. Since no one site can provide the full range of ecological and economic benefits available from natural and semi-natural systems, a country's protected areas should be conceived and managed as a continuum of protected sites within an integrated system. Indeed, optimal protected area systems often require cooperation with neighboring countries.

The ANE countries vary greatly in terms of both protected area coverage and the adequacy of management capabilities.²⁹ Action in the next five years is crucial to protect currently unprotected remnants of distinctive and unique habitats from irreversible modifications. At times, this designation has to occur in advance of the careful institutional and policy steps discussed above, but at the very least

must include an open dialogue with local communities that rely on the biological resources within these areas.

In general, the Near East countries have given very limited protection to natural areas. Of greatest urgency are the wetlands along the Mediterranean coast, which are breeding grounds for many migratory birds, and the coral reefs of the Red Sea. In Asia, under-protected areas include the Western Ghats area of India, the Irrawaddy and southern regions of Burma, and many ecosystems in the Philippines. Generally, the mangrove, coastal wetland, and tropical coral reef ecosystems throughout the ANE region are seriously under-represented.

Although expanding protected area coverage is important in some places, the greater challenge is to improve the management of existing protected areas. In virtually every ANE country, additional training is essential for staff at all levels. In many countries, reserves lack the infrastructure for basic monitoring, let alone for development of scientific research, tourism, low-intensity extractive production, and other activities that increase economic value -- and hence support for -- reserve maintenance, nationally and locally. If reserves are to become more than "paper parks," they will require substantial investments. These investments are unlikely to materialize, however, until it is demonstrated that protected areas can "pay their way."

In addition, the involvement of local communities in protected area management is a crucial element for success. Local communities should be directly incorporated into park and reserve management as rangers, guides, researchers and research assistants, builders of infrastructure, and providers of tourism services. Nepal provides two examples of how this can be done. In Sagarmatha National Park, responsibility for forest protection was returned to the local Sherpa community, and efforts were made to increase local employment in the tourist trade.³⁰ Deforestation has declined, local incomes have increased, and the community is generally supportive of the park. In Royal Chitwan National Park, regular interactions between park staff and local residents have substantially reduced conflicts and unauthorized encroachments.³¹ Field studies on the productivity of natural grasslands (supported by AID) led to a grass-cutting schedule for local people which yields approximately \$2.9 million worth of fodder, thatch, and reeds a year for adjacent communities. These kinds of strategies reduce pressures on protected areas by increasing incomes for surrounding populations, thereby demonstrating tangible economic benefits from conservation.

d. Conserving Genetic Diversity for Agriculture and Forestry

Some of the most direct benefits of biological diversity come from the diversity of genetic material, or germplasm, found in the domesticated and wild plant and animal species that constitute the basis for agriculture, aquaculture, and forestry. Genetic diversity can be used both to reduce the risks of crop failure and to develop new varieties adapted to specific environmental conditions, or providing higher yields. Furthermore, the genetic material in wild relatives of domestic species is often essential for overcoming the pests and diseases that inevitably evolve. Rice, for example, gets its resistance to two of Asia's four main rice diseases from a single sample of wild rice from central India.³² Genetic diversity is also important for maintaining its resilience and productivity of livestock, fish stocks, and forest resources.

Maintenance of plant and animal genetic material in the wild (in situ) and of wild or domesticated material in gardens, orchards, seed collections, or laboratories (ex situ) are both essential strategies for managing the basic genetic stock. Preservation of wild relatives should become an explicit goal for protected area design and management. Species for which conservation is of high priority include relatives of: groundnut, oil palm, banana, rubber, coffee, cocoa, members of the onion family, citrus fruits, mango, a number of forage crops, and rice. India has already set up a "gene sanctuary" for citrus species,³³ and similar efforts are needed throughout the region.

A wide range of forestry, grazing, extensive cultivation, and other land uses could, with proper management, contribute to biodiversity conservation. The key lies in developing incentives and land use planning systems that serve human needs while protecting the distinctive biological resources of each area or zone. For example, a core area under strict protection could be surrounded by one or more zones under varying types and intensities of human settlement and exploitation. The government might directly manage the protected reserve, while local farmers manage surrounding lands under a variety of uses ranging from collection of forest products to agroforestry, tourism promotion, and permanent agriculture and settlement. The need for basic scientific and sociological research, participatory pilot activities, and the strengthening of community tenures and organizational mechanisms -- as discussed in other sections -- are all important aspects of this model. Reorientation of old-line government agencies for a more flexible and "people-oriented" approach is also a crucial element.

Ex situ technologies (seed banks, in vitro plant tissue, orchards, frozen semen and embryos, etc.) have developed rapidly in recent years, but face many unresolved problems. Chief among these is the fact that the evolution of the species is "frozen," and no further adaptation to pests or environmental changes can occur. Nevertheless, ex situ efforts are an important part of an overall

strategy and should be pursued both internationally and within individual countries. Among the ANE countries, only India has an effective germplasm conservation program. The International Board for Plant Genetic Resources (IBPGR) which was established in 1974, can assist ANE countries in developing strategies and appropriate technologies for genetic conservation. Donors in turn can facilitate international exchange of information and resources in this regard.

In forestry, more attention should be paid to maintenance of genetic diversity in both natural forests and plantations. The commercial forestry practice of "high grading" – cutting only the best specimens – impoverishes the genetic timber stock and should be restricted through both regulation and economic incentives. In plantation forestry, reliance on monocultures should be reduced in order to increase resilience to pests and allow for the development of tree-planting systems that more closely mimic nature's diversity. Models for diverse agro-silviculture systems exist throughout the region, the home gardens of Java being a prominent example. The economic incentives that foster monocultural timber plantations can be reversed through establishment of appropriate economic incentives. Increasing appreciation of the value of genetic and species diversity can in turn provide the impetus for these policy reforms.

B. AGRICULTURAL SUSTAINABILITY

It is becoming evident throughout the ANE region that the historical increases in agricultural production observed over the past several decades cannot be sustained simply by cultivating and irrigating more land and applying more fertilizer and pesticide. At the same time, growing populations and changing consumer demand require a renewed effort to increase agricultural production. Governments, donors, and – most importantly – the region's millions of farmers must, therefore, develop new agricultural strategies which increase productivity on both favored and less-favored lands, reduce resource degradation, and enhance equitable distribution. The challenge is immense, but the opportunities for meeting it are also substantial, provided that the transition can be made to the theory and practice of "sustainable agriculture."

Three important factors underlying sustainability are: (a) its dynamic nature – i.e., what is sustainable varies through time, place, and in terms of what is being sustained for whom; (b) the need for agricultural interventions to meet the expressed (but evolving) needs of farmers and give them early and secure returns for their efforts; and (c) the absolute need to conserve the natural resource base. It follows that the era of the uniform technical "package" is for the most part over. Sustainable agriculture requires adherence to a flexible set of systemic principles

and approaches which:

- o Maintain and improve the quality and productivity of soils, water, and other biological resources (e.g., adjacent forests and watersheds) that directly and indirectly make agriculture and other economic activities possible;
- o Attain the highest possible efficiency in use and conservation of basic farm resources (soil, water, sunlight, energy, and farmers' capital and time), while providing for basic livelihoods and household needs (including energy and cash income).
- o Preserve and enhance maximum biological diversity in both natural and agricultural systems (i.e., genetic diversity within economically important species and species diversity per se, including animals and trees) and incorporate maximum biological interaction (e.g., mulching, agroforestry, intercropping, legumes), while minimizing the use of health-endangering and environmentally damaging external inputs, such as chemical fertilizers and pesticides;
- o Maximize farmer autonomy and empowerment through participation in decision making that affects them, grant legal recognition of paramount local rights in land and resources (whether private or common property), expand and enhance the use of local knowledge, recognize the critical roles of women farmers, and devolve the locus of management authority to the farm community;
- o Provide a policy framework that is flexible, capable of changing as needs change, establishes appropriate economic and institutional incentives for an ecologically-based, integrated approach to agriculture and provides training and extension that builds on current farmer practices.

Putting these principles into practice will require many ANE countries and donors to take a fresh look at their agricultural institutions, policies, and strategies. Sustainability cannot be limited to existing, favorable lands, but must be extended to the less favorable and in some cases already degraded and abandoned lands. And, the principles of sustainable agriculture will have to be applied in the production systems of farms, fisheries, grazing and rangelands, and other intensive and extensive uses of land for food, fodder, fuel, and fiber production. The main point is that these challenges must be addressed in the increasingly populous ANE countries of the 1990s.

Opportunity 11: Developing Policies and Programs for Sustainable Agriculture

Fortunately, there are a number of actions that ANE countries can pursue, which will directly improve the sustainability of their agriculture. These include policy reform, the application of new methods for field research and field testing, and the dissemination of agricultural information using a variety of existing and innovative techniques and institutions.

a. Policy Review and Reform

The importance of basic economic and institutional policy reforms for sustainable development has been discussed throughout this Strategy and is nowhere more important than in the agriculture sector. Governments must reconsider taxation, subsidy, food pricing, land tenure, and all other policies that put farmers – particularly poor farmers – at a disadvantage and skew incentives against the adoption of sustainable agricultural principles and practices. At the same time, they must develop an appropriate framework of incentives, without which farmers will simply not adopt new ways, no matter how well they work on the experiment station or in the pilot project. Similarly, private enterprises will only play their optimal role in sustainable agricultural development if there are incentives to do so, and the state frees them to pursue those incentives.

The first step that governments should take is to review policy-determined incentives in light of the objectives and needs of sustainable agriculture. One possibility for getting the review under way is to establish a semi-independent national commission to conduct a one-year assessment of the status of agricultural sustainability and to make specific recommendations for policy and institutional changes. In order to avoid an overly "top down" approach and to assess the impact of existing policies on farmer practices, such a body should make maximum use of farm-level participatory research, public hearings, academic input, and participation by a wide range of private sector actors and institutions, including NGOs and donors with proven track records in supporting sustainable and diversified agriculture. In some countries, regional or even subregional commissions corresponding to agroecological zones, may be more useful.

Particularly important subjects for policy review and reform are:

- o Macroeconomic policies, such as trade, exchange rate, fiscal and monetary policies that have a significant impact on agriculture;
- o Agricultural input and output pricing policies and interventions, such as export and import duties, subsidies, producer margins, and government monopolies;

- o Agricultural stabilization policies, including the use of consumer subsidies, price stabilization, marketing boards, and manipulation of stocks; and
- o Agricultural credit policies and the extent to which they focus on ecologically-sound farming practices.

The importance of incentives should not be caricatured into a belief that if we "get the incentives right," everything will magically fall into place. For one thing, one has to ask "right for whom?," "right for how long?," and other questions that encompass the dynamism of the sustainability challenge, and its important distributive dimensions. Policy reform must be an ongoing process of constant readjustment, in which it is recognized that we can never get the incentives "right," but we can continually get them better, based on systematic research, evaluation, and unfettered feedback from the farmers whose behavior and livelihood are the ultimate criteria for policy reform in the first place.

b. Research for Agricultural Sustainability

If research is to count for much, it must provide insight into the complex and varied environmental and socioeconomic conditions of farm households and communities, taking a distinctly ecological and interdisciplinary perspective rather than focusing on single crops or commodities or single management interventions. It should examine on- and off-site linkages of different cropping systems, impacts of temporal and regional cultivation practices, and the efficient use of internal resources and inputs. More research is needed on integrated farming systems, management of natural systems as a buffer for agricultural systems, and management of diverse agricultural systems.

National and international research institutions can make a greater contribution to promoting sustainable agriculture by adopting perspectives on farming systems research that include the following components:

- o An emphasis on the use of multi-disciplinary workshops and rapid appraisal techniques;
- o A focus on ecological as well as socioeconomic concepts;
- o A focus on the relative costs and benefits of alternative (e.g., monoculture versus polyculture) cultivation systems in different ecosystems and socioeconomic contexts;

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- o A recognition of the importance of the tradeoffs in agricultural development between productivity, sustainability, and equity; and
- o Application of these perspectives not only to farming systems but to analysis and development of larger systems at the village, watershed, region, and even national level.

This kind of approach is utilized in the "agroecosystems analysis" case study methodology, which has been tested in India, Thailand, Indonesia, and Pakistan.³⁴ This methodology relies on a form of rapid rural appraisal. Informal interviews with local people, sketch-mapping, and other methods are used to increase understanding of environmental and socioeconomic problems in a community and the factors influencing farmer decision making. The results are analyzed in terms of what interventions are most promising for improving productivity, sustainability, and equity through increasing household income, maintaining or improving resource management, or lowering the risk of catastrophic failures. The methodology is flexible enough to apply to field cropping, livestock, perennials, and aquaculture. The degree of farmer participation in this method is potentially very high, as it emphasizes a "bottom-up" approach to data gathering and option formulation.

A more costly and time-consuming – but often effective – variant of this methodology is "diagnostic research."³⁵ While the data-gathering methods are substantially the same, this model stresses the importance of a researcher living in each subject community for an extended period of time (at least six months), with periodic meetings between researchers from all sites. Apart from the more detailed quality of data obtained, this model allows for deeper understanding of sensitive socioeconomic and legal issues (e.g., illegal fuelwood sources, informal credit networks, political factors) that rapid appraisals often miss. In addition, a sustained period of research can serve as a catalyst for the building of support and interest among government officials and other actors for the interventions, pilot projects, and policy reforms to be recommended. Rapid and more extended research strategies can be combined with rapid appraisal of a large number of sites, leading to more detailed diagnostic research at strategic sites.

International and national agricultural research centers (IARCs and NARCs) can play an important role in promoting agricultural sustainability. However, a new approach to testing is needed, one which relies on working more closely with farmers. Too often the technological advances generated by these centers have been developed and tested only on experimental stations. The IARCs and NARCs are sensitive to this problem. Under the umbrella of the Consultative Group for International Agricultural Research (CGIAR), they are moving to incorporate sustainability into their agendas, to increase the participation of ordinary farmers, and to concentrate more of their efforts on helping farmers on less well-endowed

lands.³⁶ They must still pay more attention to adapting international advances to specific national and local conditions, for which strengthening of national research capacities and improved coordination between international and national centers are priorities. Conversely, NARCs should also devote greater attention to researching the ecological bases of traditional, indigenous farming systems as an additional source of innovation with wider application. In all cases, research results must be taken fully into account in the policy making process.

c. **Models of Sustainability: Field Testing**

Viable working models at the farm-community scale should be developed from research efforts. All too often, pilot projects are not treated as the important phase of research that they represent, in which conclusions and recommendations are tested in the field laboratory of the farm community by the most important researchers of all, the farmers.

As research must anticipate and encompass pilot project efforts, so too must pilot projects anticipate their forward linkages, both to policy reform and to diffusion of innovative technologies. Too many pilot projects are characterized by unrealistic levels of attention and financial input, neither of which can be sustained in large-scale replication or over time. As a part of the research process, good pilot projects can serve as the catalyst for developing policy coalitions in favor of reform and providing concrete directions for such reforms. At the same time, it must be remembered that inducing agricultural innovation in ten villages is different from doing it in 1,000 villages. Pilot projects must, therefore, constantly examine their potential for large-scale replication, taking technical, ecological, socioeconomic, budgetary, and institutional factors into account.

d. **Scaling Up: Extension for Sustainability**

Diffusion of sustainable agricultural technologies requires the voluntary adoption by millions of farmers of locally appropriate technologies and farming systems. Agricultural extension is the mechanism generally used to achieve this. As agricultural strategies change, there is a great need for innovative and more effective extension mechanisms that can work in the face of stable or declining government expenditures. A wider range of actors – including farmers themselves – needs to be mobilized to carry out and finance extension.

Extension must not only bring technologies to the farmer but must learn from farmers' performance and draw on their empirical skills to develop new approaches. Rather than an extension service, what is needed is an extension network within which the government extension service is but one of a number of

actors. The challenge is to combine the distinctive competencies of each actor in a flexible system which responds to the distinctive agroecological and socioeconomic characteristics of different communities and regions. In particular, extension should more fully promote farmer-to-farmer information exchange and training.

Personnel trained in the diverse skills needed for effective extension are in short supply throughout the region, and this shortage is an important reason why projects fail. Incentives must be created in research and extension to attract and hold the best scientists and managers in the system. Governments should be encouraged to sustain quality personnel by offering working conditions and incentives commensurate with skills and effectiveness. At the same time, new sources of skilled personnel must be sought out and developed from universities, NGOs, and the private sector, and integrated into the extension system.

Opportunity 12: Restoring the Productivity of Degraded Agricultural Lands

The imminent exhaustion of the arable land frontier in the ANE region, and the enormous increases in population projected for the next several decades, mean that degraded lands will have to be restored to productivity if human needs are to be met. Fragile upland and other steeply sloped areas degraded through inappropriate land use, and irrigated cropping systems rendered unproductive through waterlogging and salinization, present the greatest challenges. The productivity of such degraded lands can be restored through a combination of institutional and policy reforms, technological interventions, and socioeconomic measures, but the challenge is formidable, and the costs will be high. The costs of not rehabilitating significant segments of these potentially productive lands, however, are likely to be far greater in the long-run.

a. Restoring Degraded Uplands

The basic principles for upland land rehabilitation are known. Engineering interventions (check dams, bench terraces, trenches, and the like) constitute the first component. The second important element is upgrading vegetative ground cover through reforestation, afforestation, reseeding grassy slopes and high-country pastures, planting the lips of terraces, and introducing perennial crops.

The third and perhaps most important element is responsiveness to the needs and capacities of local farmers and communities. Without this, new technologies will inevitably fail. In addition, rehabilitation schemes must equitably distribute costs between lowland areas, which often reap the most immediate benefits of upland rehabilitation through reduced siltation, floods, and drought, and upland areas which must bear the costs. In Colombia's Upper Magdalena

Watershed project, for example, 4 percent of hydropower company revenues are required by law to be invested in upstream watershed management.³⁷ Finally, studies throughout the region have stressed the centrality of basic policy and institutional reforms for land rehabilitation, including clarification of land tenure (particularly on common property and public lands).

Experience in Jordan illustrates the utility of fruit trees and other perennials in restoring steep degraded lands.³⁸ Seventy percent of Jordan's rainfed cropland has a slope of 9 percent or more. The government has successfully persuaded farmers to replace cereal crops – ground preparation of which greatly contributes to erosion – with olives, peaches, pomegranates, and other fruit trees. At the same time, farms were stone- or earth-terraced to reduce erosion. Key to the program's success was the World Food Program's providing supplemental food and paid employment until the newly planted fruit trees provided an economic return.

The Indonesian government's social forestry program has targeted severely degraded public forest lands on Java with considerable initial success.³⁹ Important elements of the program are: intercropping of annuals, fruit trees, fuelwood, and commercial timber species; granting of long-term, inheritable- use contracts to farmers; providing of subsidies at initial stages of rehabilitation; intensifying farmer participation through forest farmer groups that target poor and landless farmers; and intensifying the involvement of a community-development NGO from the very beginning of the program.

For local successes in upland rehabilitation to be translated into effective national policy, institutions at the center must be strengthened. With this goal in mind, the government of India decided in 1985 to set up the National Land Use and Wasteland Development Council, under the chairmanship of the prime minister and including private as well as public sector members. Under the Council, the National Wasteland Development Board was set up to formulate and coordinate wasteland development programs throughout the country.⁴⁰ This kind of institutional arrangement is a helpful step in mobilizing resources for land rehabilitation and may provide a general model for other countries in the region.

b. Rehabilitating Salinized and Waterlogged Lands

Large areas of irrigated lands that have been rendered unproductive through salinization, alkalization, and waterlogging and can be rehabilitated only by pumping or draining away the excess water, or by leaching the soluble salts. Available technologies include horizontal tile drains, vertical tube wells, vegetative techniques, and changes in cultivation practices to lessen vulnerability to salinity. In heavily alkalized areas, introduction of tolerant crops (primarily rice and some

forage grasses) is often the most practical strategy. Since the investments required for all of these technologies are large, farmers intended to be served by such an effort must first be convinced of the value of good drainage for increasing productivity and learn the technical skills to maintain the systems. It is particularly important that restoration strategies be keyed to local socioeconomic conditions and needs, since it is local communities that must bear much of the initial and recurrent costs of land rehabilitation.

India has led the way in rehabilitating degraded lands. From 1982 to 1986, nearly 200,000 hectares were brought under cultivation in Haryana, Punjab, and Uttar Pradesh. The National Botanical Research Institute's test program at Banthra (near Lucknow) pioneered the strategies for doing so. Until the research facility was founded in 1956, the Banthra area had been a barren, alkalinized wasteland. Working with local residents, scientists began rehabilitation using low-cost labor-intensive methods. Tubewells were sunk and drainage canals and holding ponds were constructed. Organic matter was used instead of expensive chemical inputs to repair the soil, and a vegetation succession regime was designed. Once alkaline-tolerant species were established, they improved the soil for less tolerant ones. By 1973, productivity had been restored, and today the site is a mix of cropland, fodder grassland, and woodlands supporting a variety of wildlife. The economy of the village has been transformed, and the people draw a sustainable livelihood from the area.⁴¹

Opportunity 13: Making Greater Use of Integrated Pest and Soil Fertility Management

Key to attaining stable and sustainable management of pests and soil fertility is the incorporation and integration of a variety of techniques for integrated pest management (IPM) and integrated soil fertility management (IFM) in such a way as to minimize the need for chemical fertilizers and pesticides.⁴²

The goal of IPM is to maintain pest populations at tolerable levels, rather than to eradicate them with tolerance defined primarily in economic terms. What is needed is that combination of interventions which makes maximal use of natural control or mortality factors, such as biological enemies of pests, resistant crop cultivars, and cultivation practices (e.g., planting times and intercropping) that reduce infestation risks. Pesticides may be a part of the management system, but they should be used only when absolutely necessary and used in a way to minimize impact on natural enemies, the environment, and human health.

The maintenance or improvement of soil fertility also relies on an integrated approach, IFM, which includes: (a) combining use of organic and inorganic fertilizers with composting to reduce nitrate runoff; (b) improving fertilizer application and timing to increase efficiency and to reduce off-site runoff; (c) rotating crops and intercropping to regenerate soil organic matter, quality, and fertility; (d) balancing inorganic nitrogen use with other nutrients; (e) using nitrogen-fixing cover crops or green manure to improve soil structure and moisture, especially on drylands with erodible soils and low organic matter; and (f) using vegetation to reduce soil losses from wind and water erosion.

a. **Policies to Support Integrated Pest and Soil Fertility Management**

IPM and IFM programs require an understanding of both the biophysical conditions and the socioeconomic context of agroecosystems. Interventions are necessary at a range of levels, from a farmer's field to national policy. An economic climate favorable to IPM and IFM includes reducing subsidies which encourage excessive use of inputs, particularly pesticides, and divert scarce government resources from developing alternatives.

The experience in Indonesia illustrates the impact that policy changes can have. Indonesian policy toward pesticides has changed dramatically in recent years. During 1975-79, millions of tons of rice were lost to the brown planthopper, an insect that was not considered a pest five years earlier. Research showed that the rice brown planthopper became a pest because of excessive insecticide applications, which were heavily subsidized by the government. When a second outbreak occurred in 1985, threatening 70 percent of Java's rice crop, the President banned 57 registered brands of broad-spectrum pesticides, reduced subsidies on others, and declared IPM to be the national pest control strategy for rice.

IPM and IFM require heavy inputs of management and training, however, in addition to site-specific research. To encourage effective implementation at the field level, improved organization is necessary. A promising approach is the establishment of pest management districts that link together farmers, pest management advisors, and researchers along commodity lines or within boundaries of agroecological zones. Such districts or zones provide an effective regulatory structure for coordinating the use of key pesticides, developing a range of alternative cultivation practices (e.g., timing of planting and plowing), biological control (e.g., conservation, augmentation or introduction of natural enemies); and the introduction of disease- and pest-resistant cultivars. In addition, it permits exchange of information on a local level among growers and producers.

A moderately scaled program would involve the reduction of pesticide subsidies and increased investments in research and extension along pest management districts. Aggressive efforts are needed where pesticide use is already common and pest resistance is increasing, such as parts of Egypt. This entails establishing guidelines which eliminate non-economical pesticide applications and which maintain and protect beneficial insect predators and parasites.

Biological control alternatives can be very cost-effective compared to chemical control in terms of total expenditures and long-term reliability. Commercial production of biological control agents, such as parasitic wasps and insect pathogens, may provide alternative pest control opportunities at the community level. However, a well-organized infrastructure needs to be in place to produce, to handle, and to disseminate control agents in a timely and cost-effective way.

Research is needed to scale up biological control efforts to permit local as well as widespread dissemination. Of critical importance in all approaches to IPM and IFM is the development of farmer-friendly management techniques. Much greater emphasis should be placed on research to develop techniques for sampling and monitoring that farmers can use.

b. Regulation of Agrochemicals

In order to reduce the negative environmental and public health impacts of agrochemicals, clear regulations on storage, packaging, handling and disposal are required, with concomitant increased monitoring, reporting requirements, public education and enforcement. This includes strengthening pesticide regulatory and management authorities. The environmental impact assessment process can be used to anticipate and reduce water and air contamination from pesticide applications. Baseline data for every ANE country are essential for monitoring the extent of environmental contamination, such as residues in food, water and soil, and human exposure. This is especially urgent in fragile environments such as freshwater aquifers.

c. Training Farmers

The most important element for promoting more careful use of agrochemicals and improved pest management is farmer training and improved agricultural extension. Alternatives to agrochemicals for pest and soil fertility management draw heavily on site-specific information and on problem-solving at the field level. Economic thresholds need to be designed, which farmers can understand and implement. For improved fertility management, much greater

emphasis should be placed on promoting application practices to reduce loss of fertilizers and on incentive structures to encourage integrated approaches, which not only may improve fertility but may also reduce soil erosion and runoff.

Extension programs need to build on existing farmer knowledge of local conditions and pest behavior by training them to conduct pest diagnostics, evaluate infestation levels, calculate economic thresholds, and use chemicals safely. Emphasis should be placed on implementing improved pest management where pesticide use is high. This may focus on private sector initiatives. Farmers on marginal lands, however, would also benefit from improved crop protection, given the expense of agricultural chemicals.

After Indonesia banned pesticides on rice, it essentially staked the future of its rice crop on intensive training in IPM for farmers. Since the program began in 1986, at least 31,000 farmers have been trained in IPM techniques, and pesticide use has fallen from 4.5 to 0.5 applications per season.

d. Research

Research on biological control as an alternative to chemical control needs greater attention in all ANE countries. It should include research on cropping practices to maintain and encourage natural enemies. There are also a number of relatively unexplored and promising opportunities for introducing beneficial insects, diseases, and pathogens on all major crops. Another research opportunity is the control of post-harvest losses, which can be considerable. Soil fertility research should focus on the combined use of inorganic and organic fertilizers, and mechanisms to increase efficiency and complementarity. Interactions between the use of fertilizers and pest dynamics should also be explored. Adaptive use of crop rotations and intercropping to improve soil fertility, soil quality, and soil conservation is also needed.

Finally, the appropriate balance between applied research and implementary research deserves closer attention to ensure that improved management systems, as they are developed, do not languish in isolated experimental sites.

C. MEETING WATER RESOURCE NEEDS

Water is needed for domestic uses, for growing crops, and for running industry. Water is also required to support fish, other aquatic animals and plants, and natural processes. Water taken from rivers, streams, reservoirs, or from groundwater aquifers varies in quality, depending on local geologic conditions which determine the amount of salts, sediments, and organic matter suspended instream. Increasingly, however, water quality and the amount of water available for use depend on what humans do to it. Because water is renewable it can be used and reused many times. When misused, wasted, or polluted, its uses downstream are limited, costs go up, and conflicts increase.

For the water-poor countries (with per capita availability less than 1,000 cubic meters per year) of the Near East – Egypt, Tunisia, Yemen, Jordan – securing adequate supplies of clean water for human and livestock consumption, irrigated agriculture, and industry and electric power generation is a constant and costly struggle. For the water-rich countries (with per capita availability greater than 5,000 cubic meters per year), particularly Bangladesh, Burma, the Philippines, Indonesia, Sri Lanka, and parts of India, water is abundant, and during monsoons it is in excess. However, because of rapid deforestation, inappropriate agricultural practices, and the lack of industrial and municipal pollution controls abundant supplies of clean water cannot be taken for granted.

The three basic goals of ANE countries are to develop dependable and safe supplies for people, protect and manage the environmental systems through which water moves, and increase efficiency in energy, industry, agriculture, and human uses. Two opportunities for addressing water quantity and quality problems in the region – planning for multiple use and improving people's access to clean water -- are outlined below. Other opportunities dealing with watershed management and urban water quality problems are addressed in other sections.

Opportunity 14: Sustaining Water Supplies for Multiple Use

In a world of increasing competition for water, sustainable water resources management can only be achieved through significant strengthening of the institutional and policy structures through which water is obtained, distributed, and utilized. There are four strategies for moving in this direction in the ANE region: (a) policy reform; (b) institutional reforms for planning and management at both national and local levels; (c) training, research, and information systems; and (d) increased international cooperation.

a. Policy Reform

While a variety of good technologies and management strategies exist for improving the efficiency and sustainability of water systems, they are unlikely to be adopted without significant changes in the framework governing watersheds and other sources, and the conveyance and use of irrigation water.

Irrigation Policy. Almost all countries in the ANE region subsidize water for irrigation (and other uses) and in many cases supply it free of charge, regardless of the degree of scarcity. In Thailand, for example, irrigation water is provided without any attempt to recover costs or to charge a price reflecting its increasing scarcity.⁴³ Virtually all Near Eastern countries, but particularly Egypt, Yemen, Jordan, and Tunisia, face severe water shortages; yet water continues to be subsidized throughout the region, and water efficiency is unacceptably low.⁴⁴ In Egypt, where 30 percent of the irrigated lands suffer from salinization and waterlogging caused by over-irrigation, water use efficiency will have to increase by 60 percent over the next ten years to meet the needs of a population projected to reach 70 million by 2000.⁴⁵ This state of affairs represents the culmination of centuries of cultural attitudes toward water, as well as the interplay of powerful political forces; changing these factors is not easy.

The goal of irrigation policy reform is to have the price of water reflect its true cost and have irrigation-water users pay that cost. In reality, this is hard to achieve, and the more immediate goal may be to have users pay for the operation and maintenance of the system. Irrigation reform calls for overhauling irrigation policy to provide incentives for efficient water use; to increase cost recovery; and to generate funds for rehabilitation, maintenance, and improvement of existing irrigation systems. The first step should be to strengthen capabilities for research and comprehensive planning in order to identify priority needs and tradeoffs; to assess salinization and waterlogging problems; and to provide the data needed to identify the most cost-effective policy reforms. Improved information is essential for comprehensive planning, but it can also help to highlight the seriousness of water problems and to build consensus for policy change.

Next, there is a need to strengthen water users' associations and to make structural modifications in existing irrigation systems such as intermediate storage at the head of distributor channels, and installation of meters in secondary channels. Such modifications would make possible bulk water sales through contract with water users' associations and cooperatives. This is already done in India; in Gujarat State, for example, the irrigation agency sells water volumetrically in bulk to cooperatives, which distribute it and collect fees from their members.⁴⁶

Where volumetric pricing is not feasible or is prohibitively costly, low-cost approximations such as area-based irrigation charges and land taxes could be introduced. The sacrifice of efficiency in this case may be justified by the savings in metering and collection costs. The evidence suggests that farmers are prepared to pay for reliable irrigation services.

Aside from increasing efficiency, policy reforms can also help to increase the supply of water. In Bangladesh, for example, the vast and relatively shallow aquifer provides extensive opportunities for increasing groundwater irrigation supplies through tubewell development.⁴⁷ The primary impediments are policy-driven – because the supply of irrigation credit has been drastically decreased in the past three years, the rate of tubewell installations has slowed dramatically. Although the government allows import of small engines (used for tubewells) duty-free for agricultural uses, farmers are unlikely to be able to invest in tubewell development without a revision of credit policies. In exploiting groundwater for irrigation, however, it is crucial that adequate data be developed on hydrological processes and the environmental impact of altering them. Aquifer data are generally scanty throughout the region.

Urban and Industrial Water Supply Policy. The demand for water by industry, steam electric generation, and growing urban populations puts additional requirements on the need for policy reform. Water can be used and reused many times before it evaporates, percolates into the ground, or reaches the sea. However, current policies do not support water as a renewable resource.

The goal of urban and industrial water supply policy should be to institute incentives that will minimize the use of water and maintain its quality at the lowest cost. Minimization policies include charging industry and municipal water authorities for water withdrawn from surface and groundwater supplies. Users should be metered and charged by volume and quality of water received. Industries, including municipal wastewater treatment plants, should be taxed on pollution in excess of established standards. Training programs and demonstration projects can be used to develop and implement industrial technologies that recycle process water rather than release it into rivers or to municipal sewage systems.

b. Institutional Reform

Sustainable water management depends on institutional as well as policy reforms, particularly with respect to water resources planning, institutional arrangements for watershed management, and development of effective local water organizations.

National Level Reforms. In countries facing serious water shortages and escalating conflicts between water users, greater commitment is needed to strategic planning at the national level. Water planning should anticipate the growth in demand by the entire range of water users, and weigh the costs and benefits of different investments to meet those demands (e.g., investments in infrastructural supply development versus efficiency and demand reduction). The Bangladesh National Water Plan provides an example of how integrated water planning can be done.⁴⁸

With the support of major donors, the government of Bangladesh has completed a National Water Plan and devised a strategy for developing a viable and enduring water resources planning capability. The plan calls for a series of investment programs – flood control, drainage works, tubewell irrigation – totalling \$6 billion over 20 years, endorsed by the multisectoral National Water Council, chaired by the president. It incorporates the interests of all the major water-using sectors including agriculture, industries, transportation, health, and housing, in an integrated planning process.

Even with a balanced and strategically sound plan in hand, implementation of sustainable water policy requires close coordination among sectoral agencies, particularly in the case of watersheds. Because watersheds rarely coincide with jurisdictional boundaries, an integrated approach requires a strong authority to mediate sectoral and jurisdictional conflicts and to set overall priorities for the watershed.

In general, however, it is unwise to create new "watershed management institutions." Because they do not displace existing political authorities and sectoral agencies, such institutions tend to further diminish chances of integrated planning and action, rather than to promote it. More useful is establishment of clear lines of authority and coordination among existing agencies and units of government. Procedures for negotiation and consensus building should be encouraged, but it is crucial that one agency or unit of government ultimately possess authority to rule on major policy and planning decisions. Donors financing watershed projects tend to evade these tough authority issues and shift that support from one agency to another over the years. The frequent result is different donors backing different agencies as the watershed agency, while agencies play donors off against each other. Institutional reforms that clarify ambiguous authority relationships would provide the basis for better coordination of both government and donor efforts.

Local Level Reforms. Institutional reform and development at the local level is as important as at the national level. Sustainable development of water supplies depends in large part on the willingness and ability of local communities to manage water supplies and maintain the infrastructure on which they depend. There is a good deal of well-documented experience with institutions for local

participation in water management in the ANE region. In the area of rural water use – particularly irrigation – a variety of workable models, and opportunities for implementing them exist.

Water users' associations, built around a common interest in acquiring and sharing water, in maintaining the system, and in resolving conflicts have existed throughout the ANE region for centuries. Researchers have long been impressed with the efficiency and stability of traditional local water organizations. The system at Daudzai, in Pakistan's Northwest Frontier province, has operated since the 16th century.⁴⁹ In Daudzai, a complex system of rotational irrigation, with schedules specified in units of time per unit of land, is managed by farmers, who also clean and operate all channels. All members of the village participate in discussions, but the village elders, who function as the local government, make the major decisions. Supervisors are appointed from and paid by the community to supervise water deliveries on its behalf. The government irrigation department provides assistance in managing conflicts that the elders cannot handle and in constructing and operating large control structures.

The zanjeras system in the Philippines encompasses many local organizations united in federations which operate diversion dams and common main canals. Members contribute labor and materials for construction and maintenance of the system in proportion to the amount of land they cultivate under it. Land is divided into parcels to ensure that locational advantages and disadvantages are shared. At the tail end of each system, a parcel of land is set aside for the elected leader, providing both compensation for his duties and an incentive to ensure that water reaches the lower end of the system.⁵⁰

In other parts of the Philippines, the National Irrigation Administration (NIA) has introduced a modern analogue to the zanjeras system, with a good deal of success.⁵¹ In the NIA system, farmers who are to benefit from proposed physical improvements to small-scale communal irrigation structures are expected to repay the capital cost. With the help of community organizers, irrigators' service associations are set up to negotiate from the farmers' side about improvements, to mobilize labor and materials, and to be responsible for repayment. The organizers also serve as mediators between the association and the NIA. Engineers assigned to the projects are obliged to accept farmers' inputs, since farmers can refuse improvements for which they will have to pay. This bureaucratic change has helped alter the way that technical personnel deal with rural communities.

While conflicting interests in irrigation water can be successfully resolved through users' associations, non-irrigation uses – particularly those controlled by women – are rarely represented in the associations. Other non-irrigation users – water-driven mills, river transport, fisheries – may also go unrepresented, giving

rise to potential conflicts. In such cases, local governments with broader jurisdiction may be more viable, if they have the necessary authority and capability to deal with the problem.

In summary, local communities often have considerable capacity to deal with the technical and organizational tasks of water management, although technical assistance from government can augment their capabilities. Where traditional organizations are working well, it is best to work with them, making accommodations to government procedures as necessary. Governments and donor agencies should therefore assess local institutional capability before introducing new programs, to determine how best to relate to the local community and utilize its capacities.

c. Training, Research, and Information Needs

Basic and applied research needs to be increased throughout the region. Support is required for understanding how hydrological systems function and are changing, especially the relationship between vegetative cover in critical catchment areas and downstream water flows, the processes leading to waterlogging and salinization, and the function of mangroves and coral reefs in mitigating the effects of flooding and storm surges.

Where there are very high sedimentation rates, the pattern of sediment delivery within a drainage basin is important to document in order to clarify the options for managing sediment and water flow downstream. Particularly valuable is the experience of Southeast Asian countries such as Indonesia, where soil conservation programs in upper watershed areas have apparently had little impact on controlling the volume and distribution of water and sediments. Downstream investments such as levees and canals, on the other hand, have significantly reduced flooding problems.⁵²

Increased research on waterlogging and salinity is also a priority. This need is being partially addressed through the establishment in Pakistan of an International Institute for Waterlogging and Salinity, with UNDP support.⁵³ This institute will develop a comprehensive multi-disciplinary basic and applied research program on waterlogging and salinity, carry out basic research on problems related to ground and surface water development, and establish linkages with national and international organizations dealing with related problems.

Training programs for water resources management within the region can also be expanded and strengthened. The capabilities of many ANE institutions are already considerable and can serve as the basis for training efforts in countries with less developed capabilities. Egypt and India, for example, have had

considerable success in training water resource managers. In general, ANE countries should develop capacities and share skills and experience for: (a) policy making and management skills for multiple use of water resources; (b) institutional reforms for promoting intersectoral coordination; (c) socioeconomic techniques for evaluating water and watershed management practices (including local, traditional arrangements); and (d) training techniques for better problem-solving skills in local-level planners and extension agents.

d. The International Dimension

Because many significant ANE river systems are shared by more than one country, it is important that mechanisms for international cooperation on water resources management be further developed. The extent to which regional cooperation is feasible or desirable varies throughout the region.

The situation in the Ganges-Brahmaputra System of South Asia (home to one-tenth of the world's population) illustrates the difficulties of the international problem. The diplomatic fiction of a number of equal, sovereign states sharing the system's waters obfuscates India's effective control over what Nepal and Bangladesh may do to more effectively manage their water resources. The Indian government, for example, classifies some of the most elementary information about the hydrology, climatology, and power-generating capacity of north India as military secrets. Efforts to convene multilateral negotiations on management of the system have been rebuffed by India, which prefers to deal with each country bilaterally. The recent AID-supported Eastern Waters Study notes that the quest for an overarching cooperative regional initiative is likely to retard rather than speed agreement on the specific water arrangements that will benefit the basin population. Opportunities exist, however, for cooperative studies, and for exchanges and discussions of the results of nationally-based research work.⁵⁴

The situation in the three major river systems of the Near East (the Nile, Tigris-Euphrates, and Jordan) is, if anything, more intractable. A recent report by the Washington-based Center for Strategic and International Studies notes that almost all major water sources in the region are shared by two or more states, necessitating far-reaching cooperation for maximum utilization of all supplies. In a region beset by ethnic, religious, and political hostility, however, neighborly goodwill has seldom existed in the past and may become even more elusive. Egypt's Minister of State for Foreign Affairs warned that "the next war in the region will be over the waters of the Nile, not politics."⁵⁵

In Southeast Asia, the Mekong Committee, composed of Thailand, Laos, and Vietnam, shows that politically divided countries may be able to cooperate -- at least to some degree -- to work out joint water management strategies. With

assistance from UNDP and other donors, these three countries have embarked on a program to make optimal and equitable use of the Mekong's waters for agricultural, industrial, and energy development. The committee's work plan comprises 100 projects totalling \$300 million, including significant data gathering and training components.⁵⁶ It is possible that the countries of South Asia and the Near East can come closer to agreement on regional riparian management through a similar approach, building cooperation around specific development objectives that benefit all parties.

Opportunity 15: Improving Rural People's Access to Clean Water

Improving access to water is often the most effective entry point for promoting development activities in a community. Why, then, when everyone agrees on its importance, have countries been unable to expand water supply and sanitation services to rural communities more rapidly? Based on considerable experience and evaluation, four approaches are basic to improving access to water in rural areas: supporting community control, strengthening the role of women, assessing water needs and wants, and covering costs.

a. Supporting Community Control

One of the most important lessons of experience is that rural people want improved water services, but only if these services meet their perceived needs.⁵⁷ Water and sanitation projects are frequently promoted for their presumed health benefits, but villages may have other ideas.

In the past, governments and donors developed plans for water and sanitation projects and took them to villagers, who were asked to provide labor to drill wells, and lay pipes to help construct buildings and water-retaining structures; and, later, to assist with maintenance and to participate on water boards. (The community was encouraged to participate, but not control the process.)

Ultimately, it became apparent that the main problem with these projects was not the technical abilities of villagers but the fact that the services being developed were not those they wanted. Determining what people want, and what they are able and willing to pay for, is the starting point for establishing community control. Improving health is often identified as an important benefit by villagers, but convenience and reliability and the economic benefits that come from having larger quantities of water, often receive higher ratings from villagers. Thus, in one Egyptian project, villagers were willing to pay 1 percent of income for public standpipes, but 3 percent for yardtaps. In Thailand, when water projects were modified to provide individual yardtaps, operation of the system

rose from less than 50 percent to nearly 90 percent, and substantial economic benefits were received. Also, because of the economic benefits, demand increased and the systems were extended to other households and nearby villages.⁵⁸

As a rule, poor people are willing to pay a higher proportion of their incomes for improved, reliable water supplies than are their more affluent neighbors. Getting the perceived needs down on paper, which often requires training and the help of a facilitator, helps the community to decide on the level and cost of service it wants. The decision may be to make no improvements, particularly if the village is very poor and water is abundant. The UNDP-World Bank Handpump Project has developed methods for assessing the level of service desired under various conditions, which can be used by governments and communities to choose appropriate technologies to meet their needs.

In principle, rural communities should be expected to build, manage, operate, and own their water supply and sanitation systems. As part of promoting and developing support, communities – working closely with local NGOs or government promoters – should participate in water availability surveys, provide environmental data needed for project preparation, and participate in the election of administrative boards. They should provide materials, labor, cash, transport, and other requirements for construction and should support administrative boards in the operation, maintenance, and regulation of the system. Government responsibilities include promoting the development of systems, training and educating local technicians, developing and communicating standard regulations, and sometimes becoming a financial intermediary.

The private sector should be looked to as an efficient provider of technical support in design, supplier of technical services (drilling) and materials (pipes and pumps), and contractor. Rural water projects in Bangladesh, Egypt, Philippines, and India have been designed to use private firms for technical maintenance, greatly improving services at lower cost. In Pakistan, studies have shown that private contractors drill wells at considerably less cost than the government.

b. Strengthening the Role of Women

Surveys show that women are usually the most reliable sources of information about community needs and because they are the ones who benefit the most, are often willing to pay more than men for increased water supplies. Overcoming barriers to women's participation in project development and maintenance should thus be high among the priorities of project promoters. In Bangladesh and India, women have been trained to service hand pumps, and in Sri Lanka, women's cooperatives have been established to manufacture hand pumps. In some Philippine villages, it is the women's cooperative that manages

communal standpipes, including collecting fees and maintaining service.⁵⁹ Research has also shown that women are the ones who have to be convinced of the value of adding sanitation facilities to water projects because they determine whether or not the children will use these facilities.⁶⁰

c. Covering Costs

Government policies on cost recovery vary by country, type of service, community needs and wealth, and donor support. But, the basic approach should be to recover as much of the cost as possible of both capital investments and operations and maintenance. The objective is to have the community develop a system that meets its social and economic needs and can be maintained. Recovering costs has another benefit – reduction in waste. Community ownership and control, rather than government, is more likely to result in timely service, capital improvements made when needed, and cost recovery. Also, the water will not be wasted by the community because they will recognize what it costs, thus reducing the likelihood of other environmental problems and conflicts over the same resource. The amount the user pays should be as close as possible to the marginal cost of providing the water. This, of course, is a long-term goal and cannot always be met for the poorest households in a community.⁶¹

Costs can be recovered through labor and other in-kind contributions and taxes on service. Collecting fees from users of public taps and handpumps is difficult because it is hard to monitor use. In the Philippines, standpipes in some projects are metered, and user groups collect fees from participating families. House and yard taps can be metered and families billed for service.⁶²

Recovering costs for sanitation facilities is more difficult than for water use, and the initial construction of sanitation facilities is often subsidized by the government. A better approach is to subsidize hygiene education as part of the water supply program for a region or community, and thereby stimulate demand for better sanitation, which can then be developed and maintained by the community. This can mean the difference between success and failure of a project in terms of public health.⁶³

D. ENERGY MANAGEMENT AND CONSERVATION

Economic growth in the ANE region is being driven, in part, by rapid increases in the use of energy. While the short-term growth in the economy is welcome, the environmental impacts and damages are beginning to place real constraints on the capacity of these countries to continue to grow. The challenge in the next decade will be to sustain economic growth, while reducing and limiting the environmental and other social impacts of energy use. There are three important opportunities for addressing energy/environment problems: incorporating environmental considerations in all major energy decisions; improving energy efficiency, thereby reducing waste and limiting environmental degradation; and shifting production to cleaner fuels.

Opportunity 16: Incorporating Environmental Considerations in All Major Energy Decisions

The next decade will require the building of many new electric power plants, dams, and hydropower facilities, and facilities in the transport, industrial, commercial, and residential sectors, which use considerable amounts of fossil fuels. Equally important in much of the region, the rural demand for fuelwood and other biomass energy sources will continue to grow, and must be addressed if the rural search for energy is not to overwhelm the capacity of forests and other supply sources.

The goal is to develop and institutionalize the process whereby the environmental impacts are carefully measured and weighed before energy decisions are made. This requires expanded awareness of the environmental impacts of energy use, public policy reforms to create an investment climate conducive to sustainable energy decisions, and development of institutional mechanisms and capacities for planning and environmental impact assessment.

a. Clarifying the Implications of Different Energy Choices

Energy planners and policy makers in both the government and private sector need to develop a heightened awareness of the true economic, environmental, and social costs and benefits of different energy choices. More informed and active public participation in making and implementing sustainable and efficient energy policies, through both private enterprise and non-governmental research, advocacy, and community development groups, can help in this regard. Factors that require fuller consideration include effects on natural ecosystems, communities in project areas, public health, level of external debt, and the

distributive effects as between regions and economic strata of society. The tremendous savings available from increased energy efficiency and conservation (See Opportunity #17) must be documented and brought to policy makers' attention.

In addition, the central importance of rural energy needs – and their environmental impacts – must be convincingly impressed on energy policy makers. The biomass energy sources and systems upon which the rural poor rely have been largely ignored by policy makers (and donors), who tend to focus on large-scale fossil fuel and hydroelectric projects to generate electric power. The environmental impacts of under-investment in rural biomass energy (e.g., fuelwood) and other renewable sources (low-head hydropower, solar) are considerable, and the economic costs of not responding to them (loss of forests, soils, and manure fertilizer) are enormous.

Raising policy makers' awareness of these dimensions of energy policy can be accomplished through a variety of means. Seminars and workshops to discuss analytical techniques, results of in-country research, and experiences in other countries can be helpful. Establishment of intersectoral and public-private sector working groups can contribute, if interest and awareness are already beginning to develop. Selective overseas training and observation tours can also help, if those trained are strategically reintegrated into their institutions upon returning home. Energy assessments and audits can help to provide the hard data to support arguments for energy planning and improved efficiency and conservation. Thus, in Indonesia, a French-supported energy audit of several plants in 1983 indicated that about 23 percent of current energy consumption could be saved through conservation measures. This kind of data is a powerful educative tool.⁶⁴

Finally, the costs to local communities of large energy projects are rarely perceived or accounted for by policy makers' decisions, and this needs to change. The costs of public takings of land for projects, inundation of resource-rich ecosystems by dams, and the despoiling of coastal and marine resources from oil spills are disproportionately borne by local communities, which in effect must subsidize the more energy-intensive economies and lifestyles of urban areas and elite groups. Policy makers' awareness of these costs will only be raised to the level of meaningful response when local communities are empowered to participate in energy decisions through effective political processes and non-governmental advocacy groups. The political climate for this kind of participation varies among countries, but it is on the upswing in much of the region, particularly in India, Bangladesh, and the countries of Southeast Asia.

b. Supporting Policy Reforms

If policy tools were ranked in terms of their effectiveness in promoting efficient and dynamic energy investments, correct pricing signals would undoubtedly top the list. At present, in virtually all ANE countries, the price of gasoline and electricity is controlled by the government. Ideally, energy prices should reflect their real economic opportunity costs. However, experience has shown that real world economic, political, and social constraints often prevent governments from pricing energy efficiently. Energy subsidies are a long-established fixture in many ANE countries, and are usually politically sensitive. Nevertheless, by eliminating or reducing remaining subsidies in the near future, while inflation rates and oil prices are reasonably stable, countries can minimize the transition costs to more rational energy pricing and reap significant benefits.

It should be noted that efficient energy pricing is a necessary, but not sufficient condition for solving the problems of the energy sector. Substantial impediments remain, such as lack of information, trained manpower, availability of technologies, and adequate and attractive financing. Thus, pricing reforms generally need to be complemented with training, institution-building, technical assistance, information dissemination, and often some form of financial assistance. In particular, policies to align energy prices with long-run marginal cost must be coordinated with compensating efforts to relieve the burden of high energy prices on the poor.

Along with pricing reforms, development of an economic and regulatory climate amenable to increased private sector participation in power generation is another important policy opportunity with good prospects in many countries of the region. Recent AID assessments in a number of ANE countries indicate that a minimum of 15-40 percent of future generation needs over the next decade could be met through the private sector, if appropriate policy reforms are undertaken.⁶⁵ Pakistan, India, Thailand, the Philippines, and Indonesia have already moved in this direction. Care must be taken, however, to ensure that privatization does not simply transfer existing inefficiencies to a private, politically controlled monopoly.

c. Developing Institutional Capacities for Energy Planning and for Assessing Environmental Impacts of Energy Decisions

Ministries of planning, energy, industry, and in some cases, environment exist throughout the ANE region, and deal with energy issues in various ways. What is generally lacking are integrated energy planning mechanisms, and regulations and procedures to ensure that the environmental implications of specific energy decisions are taken into account, and that alternatives are considered.

Energy planning should consider the true costs of planned energy production and use alternatives, including distributional aspects; it should incorporate needs and input from all relevant government sectors and the private sector; and it should directly address the energy supply and production needs of the rural economy. All of this requires new energy planning skills. Donors can definitely assist in training and institution-building in this area, provided that the right policy environment is being established at the same time, and that there is sufficient awareness and political will in the country in question.

Many ANE countries have begun to develop legal and institutional frameworks for environmental impact assessment of specific energy projects. But a great deal still needs to be done in developing necessary technical and enforcement capacities. Indonesia provides a good example.

The country's Basic Environmental Law came into force in 1982 and was followed by supporting regulations. In 1988, the Ministry of Mines and Energy promulgated a whole series of technical guidelines for the assessment of energy-related projects including electric power stations, hydropower systems, oil and natural gas production, and utilization of geothermal resources.⁶⁶ The regulations are detailed, covering social as well as environmental impacts, and providing an excellent, though as yet largely unrealized, basis for a meaningful system of analysis.

Given Indonesia's vast and diversified energy resources, and its role as an oil exporter, it is clear that full enforcement will require development of institutional capacities and human resources much greater than those currently available. There is a large potential role for the private sector in providing technical assessment services, and donors can play an important role in strengthening both government and private sector capacities. A decision of the Indonesian Supreme Court for the first time acknowledged the legal right of environmental NGOs to bring civil lawsuits for the enforcement of EIA laws and regulations on behalf of the public.⁶⁷ This important development should provide a strengthened voice for environmental groups and affected local interests, thus spurring faster development of implementation and enforcement mechanisms.

While techniques exist for measuring costs, benefits, and technical aspects of energy projects, these techniques rarely account adequately for the environmental impacts of alternative choices. Overcoming this problem will require the development of analytical techniques to measure the non-economic costs and benefits of alternative energy scenarios in a consistent and comparative manner. ANE countries, particularly India and Pakistan, which are in the process of developing indigenous coal and natural gas, need to mount a major effort to collect existing research and studies on ways to quantify environmental impacts; sponsor research into ways to improve the quality and effectiveness of these

measurements; and conduct case studies to adapt known techniques to the economic, ecological, and cultural conditions of the country.

Ideally, all major energy projects should account for three types of impacts: health (loss of life, incidence of disease, and lost workdays); loss of natural productivity (air, water, and toxic pollution impacts on agriculture, forestry, fisheries, biological diversity, and climate); and direct economic impacts from damage to materials, buildings, disruption of local economies, loss of land, etc. It is essential that indicators for environmental assessment focus on who is affected. Which groups are likely to be displaced during construction or burdened with pollution once a facility is in operation? How will they be compensated?

Opportunity 17: Conserving Energy through Greater Efficiency in Production and Use

Given the negative environmental impacts of the rapid growth in energy consumption in the ANE region as well as the drain of foreign exchange to pay for oil imports, the implementation of a large-scale energy efficiency program is imperative. Experience in both industrialized and developing countries reveals that significant improvements in energy efficiency can be made that have attractive economic returns, which means that such investments are justified on their economic merits alone, independent of the additional environmental benefits.⁶⁸ A conservation program should consist of the following five components.

a. Information and Awareness

Top industry and government officials need to be made aware of energy conservation because they can give energy conservation visibility and a sense of national importance. Energy users, on the other hand, need promotional and technical information so they can actually identify and implement energy conservation measures. Potential information and awareness activities include:

- o Conferences on energy efficiency and the environment targeted to high-level government officials in the region, with the goal of generating commitment to energy conservation at the highest levels of government. A key underlying theme of this workshop would be to emphasize the "capital constraint" argument for energy conservation and efficiency.
- o National-level (e.g., mass media) and targeted, sector-specific promotional campaigns, including seminars, workshops, and promotional and technical materials tailored to meet the needs of

specific groups of energy users (e.g., hotels, cement industry, agro-industry).

- o Region-wide information networks for government officials, private sector industrial associations, and industrial energy managers to promote the sharing of information on energy conservation technologies and experiences.

b. Policy Development and Regulatory Reform

The success of an energy conservation program at the national level depends in large part on the policy and regulatory environment within which it is implemented. The promotion of energy conservation should focus on developing and implementing rational energy pricing policies. ANE countries should also design and implement legislation that supports energy conservation, energy efficiency standards and labeling for energy-consuming equipment, and other energy efficiency requirements and regulations.

Experience in both industrialized and developing countries has shown that energy policies, which rely on rational pricing, generally need to be complemented with policy research, training, technical support, and information dissemination. An initial research task is to understand how conservation is being implemented and what policy initiatives are working.

c. Training and Institution-Building

Energy conservation skills must be developed for personnel at all levels, from technicians and engineers to the highest levels of management and government policy makers. Training should be provided through short-term courses, study tours, and internships in industrialized countries, which expose managers and engineers to the latest energy conservation strategies, techniques, and technologies. The development of regional conservation training institutes should focus on developing curricula on energy efficiency and its environmental linkages.

Conservation and efficiency programs should also provide technical, management, and financial support for the development of institutions, such as national energy conservation agencies or the energy managers' associations that are already in existence in the Philippines and Sri Lanka. In addition, support should be provided to encourage the development of local industries to produce energy conservation equipment and services.

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d. Technical Support and Technology Transfer

ANE countries should identify, implement, and monitor a spectrum of energy conservation and efficiency projects. Energy conservation activities range from simple "housekeeping" measures which require little or no investment and can be implemented immediately to more expensive, capital-intensive projects which require significant financial investment and can take several months or years to implement. Therefore, two types of technical support are needed: assistance to capture no-cost and low-cost measures (e.g., boiler/furnace tune-ups in Pakistan) and detailed audits, feasibility studies, and demonstration projects to promote capital investments in energy conservation technologies.

e. Financial Assistance and Investment Promotion

The final component of the conservation and efficiency program is the mobilization of both local currency and foreign exchange resources to support energy conservation investments. Financial resources will be used to support grants/cost-sharing for technology demonstrations, grants/no-risk loans for audits and preliminary engineering studies, subsidized-interest loans, loan guarantees, special credit funds for energy conservation, and other types of innovative financing schemes (e.g., shared-savings arrangements, joint-venture arrangements, energy service agreements).

Financial incentives, or at least the removal of energy subsidies, are usually required to encourage energy-consuming enterprises to invest in energy efficiency technologies, at least in the early stages of a program, when the new technologies are still perceived as risky. In the United States, France, the United Kingdom, Germany, and Japan, for example, grants of 50 to 100 percent of energy conservation investments have been common.

f. Target Sectors

Because the goal is to capture large and immediate energy savings, the priority sectors for conservation are power, industry, buildings, and transportation. Priorities for investment in conservation will vary by country.⁶⁹

Power. A target for conservation should be improving efficiency in the power sector, from supply (electric power generation, transmission, and distribution) to end use. Experience in the United States indicates that electric utility-sponsored programs in the areas of power plant rehabilitation, load management, and end-use energy conservation offer potential capital savings of 10 to 30 percent.

In addition, given the very high transmission and distribution (T&D) losses in many ANE countries, which range from 8 percent in Jordan to more than 30 percent in Bangladesh, conservation programs in T&D loss reduction would also achieve large energy savings. Private investment in power generation is a useful strategy for improving efficiency, through cogeneration and least-cost power generation.

Industry. In the industry sector, energy conservation programs can reduce consumption by 15 to 25 percent. Conservation should focus on large, energy-intensive industries. Activities would include information programs, management and technical training, technology transfer and demonstration programs, and technical assistance such as energy audits and feasibility studies. In particular, greater emphasis should be placed on promoting the development of cogeneration systems, especially those using indigenous natural gas resources. Cogeneration is an economically viable strategy for meeting power and heat requirements in industry and often produces extra electricity for the central grid. In addition, the impact of gas-fueled cogeneration (vs. coal-fueled) on CO₂ emissions is significant.

The concept of the energy audit should be expanded to include optimization of energy use as well as other production factors, by-products, and waste disposal. The idea of waste minimization will be key in this effort, and the output will be an energy-environment audit that can be applied to entities at various levels of complexity (e.g., an industrial process, a building, an industrial park, or an urban industrial zone). In addition, energy conservation technology transfer and demonstration projects might be expanded to include industrial pollution control technologies.

Buildings. Buildings are the fastest growing consumers of electricity in ANE countries, and energy use tends to be very inefficient. Energy saving of at least 20 percent is possible using technically and economically proven measures and technologies. In addition, more efficient lighting, refrigerators, and water-heating technologies can significantly reduce CO₂ emissions. The most serious obstacles to improved energy efficiency in this sector are the lack of data on energy use in buildings, lack of awareness of the need and potential for energy conservation, lack of knowledge about energy-efficient building design and energy-efficient technologies, and lack of codes and standards that ensure energy efficiency.

Transport. Transport is the largest consumer of petroleum products in the region, and transport energy use is extremely inefficient. The transport sector is also the principal source of NO_x emissions in the region. Transportation energy conservation programs have been implemented in most industrialized countries, but there has been little activity in this sector in ANE countries. Among the measures that have proven to be cost-effective, from both a fuel-saving and environmental point of view, are fuel pricing policies, vehicle import restrictions,

vehicle tune-ups, and driver training programs. However, because the transport sector is comprised of many small, dispersed energy users, it has been extremely difficult to implement effective and lasting energy conservation measures in developing countries. Therefore, although transport is clearly a priority sector, studies are needed before embarking on specific activities.

Opportunity 18: Increasing Production and Use of Cleaner Fuels

Increasing energy efficiency alone cannot meet the future energy demands of ANE countries. In fact, a 15 percent improvement in energy efficiency fully realized, translates only to about two years of expected growth in energy consumption. Therefore, another essential element of an environmentally benign energy program is the production and use of clean fuels.⁷⁰

a. Promoting the Use of Cleaner Fuels and More Efficient Technologies

ANE countries should invest in environmentally sound energy resources, which means promoting the use of "clean" fossil fuels (especially indigenous natural gas and low sulfur coal) and technologies that reduce sulfur and nitrogen oxide emissions. Accelerated natural gas use is justified on both economic and environmental grounds. With high efficiency, gas-fired power systems are as much as twice as efficient as comparable commercial fossil-fired systems and are much cheaper to build.

More energy efficient technologies such as combined-cycle units and cogeneration systems, as well as more complete combustion systems such as fluidized bed technology, can greatly reduce the emissions per unit of energy produced. A number of combined cycle and waste-heat recovery systems are being installed in India at industrial sites with captive power generation. The government of Pakistan has stated its intent to introduce fluidized bed combustors for the power sector with the support of U.S. technology. The results of these efforts should be documented and disseminated to other ANE countries.

ANE countries will need outside assistance to accelerate the development of indigenous natural gas resources. Natural gas exploration, development, processing, transportation, and distribution require large capital investments and should be viewed as infrastructure as well as energy projects. In areas where transportation will be prohibitively expensive or associated gas from oil production is being flared, power projects can be set up in proximity to the gas resource and the electricity can be transmitted.

ANE countries will also need technical assistance in developing pricing and investment policies to attract international capital. For example, Pakistan is considering offering the private sector the opportunity to combine gas production and power generation at its low-quality natural gas fields near Khaipur in Upper Sind. The government of Pakistan will need help in structuring the incentives for private sector development. Egypt has substantial gas reserves but lacks a pricing policy that would stimulate investment in their development.

b. Assessing the Availability of Renewable Energy Sources

The nature of many renewable resource options (e.g., wind, hydropower, geothermal, and to a lesser extent, solar and biomass) is such that their technical and economic feasibility is determined by the availability of the resource. A number of efforts have been made to introduce technologies prior to obtaining reliable resource data. Such experiences can only lead to more expensive, or in some cases, inoperable installation and reluctance to consider the technology again in the future.

Prior to any widespread development of these renewable energy options, ANE countries must collect resource data at various geographical locations, using natural evidence as primary indications of good resource areas (such as bent trees for wind and fumaroles for geothermal resources). For variable resources such as wind and hydropower, several years of data will be needed to accurately determine the potential for energy production. ANE countries will need assistance in acquiring sophisticated exploration and measurement technologies. Once collected, this information should be centrally located and disseminated to interested developers.

c. Identifying Cost-Effective Applications for Renewable Energy Technologies

Renewable energy technologies are inherently part of a decentralized energy strategy, and the appropriate decision makers are frequently end-users rather than central government officials. However, governments can greatly assist individual decision makers through development of manuals and design tools that clearly identify cost-effective applications of renewable energy technologies. Where possible, documentation of successful case studies for various end-use applications should be disseminated. For example, in Thailand, solar photovoltaic systems are being used to power remote communication stations. The Centre des Energies Renouvelables (CDER), an agency of the Kingdom of Morocco with AID funding, recently sponsored a wind electric water pumping system serving 6,000 people and their livestock at the Naima Commune. The 10 kW wind system replaced diesel

powered pumps, which were frequently not operating due to maintenance problems and high fuel costs. U.S. experience at commercial wind farms may also be relevant in both Morocco and Egypt. In Nepal, micro-hydro power systems are being used widely in rice milling operations, generating income for rural villages. The 5-15 kW systems are manufactured in-country, financed by the local Agricultural Development Bank, and repaid in approximately seven years. These and other decentralized systems may be able to provide electricity to rural village years before the conventional grid would be extended, especially if local countries are willing to pay for part of the system.

E. IMPROVING ENVIRONMENTAL QUALITY IN URBAN AREAS

With rapid growth in urban population and industrial pollution, the goal of a livable urban environment – with clean water, clean air, and adequate shelter – is becoming more and more difficult to achieve. In fact, in many cities in the ANE region, particularly the largest, the quality of life is declining. Urban areas continue to be centers of economic growth, but the costs of neglecting urban sprawl, industrial pollution, and basic water, sanitation, and waste disposal services are growing and have begun to threaten the sustainability of development by limiting economic growth and increasing health problems. The challenge of coping with these problems is formidable, but opportunities do exist.

Opportunity 19: Providing the Urban Poor with Basic and Affordable Environmental Services

The poor make up 37-50 percent of the urban population in ANE countries. They live in squatter settlements, shantytowns, and slums, disposing of their waste in canals, rivers, roads, or sewers. Water comes from public standpipes, water vendors, wells, or directly from canals and ditches; sanitation facilities of any sort are rare. These are the people in greatest need of basic services – clean water, sanitation, solid waste removal, drainage, and adequate housing – and this is where the emphasis on improvements should be.⁷¹

Technologies for supplying clean water and collecting and disposing of wastes are available. Many have been tested and are affordable, but they are not being adapted for use in poor urban areas. The sheer size of the job (an investment estimated by the World Bank to be more than \$100 billion) is the most obvious problem.⁷² Others include the lack of policies, institutions, and incentives to support the development of low-cost, affordable services. To make a difference in the quality of the urban environment, five approaches are needed.

a. Pollution Control Policies and Regulations

It is essential that national governments establish basic pollution control legislation and regulations and that these rules cover the collection and treatment of wastewater, solid waste disposal, industrial and hazardous wastes, and other major sources of air and water pollution. The principal goal of national policies should be to minimize waste generation and, where wastes are generated, to treat the collection, treatment, recycling, and disposal of wastes simultaneously. Policies to manage wastes, particularly household wastes, should be based on community participation and appropriate, affordable technologies and should be labor-intensive.

Instead of imitating the industrialized nations, environmental quality standards and regulations should be based on environmental and economic sustainability and the financial and administrative capacity of the country. Regulations can then be upgraded as basic levels of service are attained. Also, enforcement procedures should be geared to the level of damage caused by failure to comply. They should be easy to understand and based on simple non-discretionary rules. Legislation should ensure that Environmental Impact Assessments will be used to analyze effects of water supply and wastewater service, so that discharge into watercourses or into the ground does not lower water quality downstream.⁷³

It will be virtually impossible to develop sound long-term approaches to supplying the urban poor with water, sanitation, and other basic services if urban population growth continues at current or even higher rates. A number of ANE countries are attempting to improve environmental quality in the most polluted cities by requiring that new industrial growth be located in secondary cities. In India, the government has adopted a restrictive industrial location policy that bans large- and medium-scale industrial development from its five largest metropolitan centers. The Philippines has identified 346 settlements as potential growth centers and restricts industrial development within a 50-kilometer radius of the center of Manila. Egyptian National Urban Policy calls for decentralization in Cairo by providing employment opportunities in Tanta and Mansoura and the Canal Zone cities of Suez, Ismailia, and Port Said. These policies will only be effective if the direct and indirect subsidies that encourage migration to the largest and most polluted cities are eliminated.⁷⁴

b. Strengthening Municipal Governments

Most of the cities in the ANE region operate at very low levels of efficiency. A contributing factor is that their services are often hostage to central government decisions, regulations, and financing. In Indonesia, for example, the central

government allocates funds for the construction of off-site sanitation facilities, but leaves investments in private, on-site facilities to the responsibility of local governments. Thus, the incentive is to initiate large, expensive projects that are controlled by the central government, are often underfunded, and do not bring benefits to residents for many years, if at all.

The goal should be to decentralize the decision making process and place the responsibility for urban management as close to the people involved as possible. In most cases, this will mean changing the roles of the central and municipal governments.

Central governments should set national goals, policies, and regulatory frameworks. They should develop the incentives and policies that will make municipalities more autonomous, including access to credit, support for intersectoral planning, and provision of technical assistance and training. In some cases, state and provincial authorities may be called on to enforce environmental regulations and to operate treatment and disposal facilities if municipalities cannot.

Municipalities should be responsible for developing urban land management strategies that consider land use, infrastructure, and environmental issues simultaneously. Better urban planning will help direct residential and industrial development and allow for more efficient delivery of services. Municipalities should also be involved in developing the information to manage and regulate local land uses and to determine taxes. They need to develop the financial base and manpower to build infrastructure, maintain and operate facilities, and deliver services. They can generate additional revenues internally through user charges and taxes. The private sector can often provide quality services at lower cost than government, particularly local water distribution, solid waste collection, and drainage maintenance. However, it is important that local governments have the technical competence to prepare and oversee contracts.⁷⁵

Neighborhoods and local communities can become the building blocks for developing improved sanitation systems. In Pakistan, the Orangi Pilot Project (OPP), located in a Karachi slum and containing about 43,000 housing units along 3,200 lanes, showed that local groups, organized by lane, were able to construct in-home sanitary latrines and underground sewage pipes when provided with useful information and simple plans. Ninety percent of the cost (about Rs. 1000, or U.S. \$65 per home) was supplied by lane residents in the form of labor, management, and organization. OPP technical experts, with the support of the municipal government, provided the remainder.

In Patan City, India, a local PVO, Safai Vidyalaya, was instrumental in developing a low-cost pour-flush toilet sanitation program that improved the health of residents and the living and working conditions of street sweepers and

scavengers. Safai Vidyalaya did the training and organizing, the municipal government supplied materials, and residents, with the aid of skilled craftsmen, provided the labor.⁷⁶

c. Making Use of Market Forces and Incentives

There are a number of ways that market forces can be employed to improve the quality of the urban environment. Charging consumers for water and sanitation services is one. Fair pricing can reduce the demand for water, cut down on wastewater loads, and encourage recycling. In addition, reducing or eliminating subsidies for fertilizers and irrigation water would make composting of solid wastes and effluent irrigation more attractive and cost-effective.

Squatters are a special urban group. They put together their housing with local materials and their own labor, but they rarely have clear title to the land they use. In the past, slums and squatter settlements were targets of destruction and clearance. Governments are finding that it is more effective to support existing sites and offer services to projects and self-help housing. As the experience of the OPP showed, urban squatters will make investments (particularly in-kind) in water, sanitation, and structural improvements in housing if they believe their property rights are secure. To offer that security, squatters' rights must be recognized in law.

d. Expanding Public Awareness of Sanitation Problems

Public awareness is a crucial part of the problem of poor sanitary conditions in Asian cities. In many countries, officials do not want to talk about, or even acknowledge, the problems of managing human wastes. When it is the poor who are affected most, the problems receive even less attention.

Countries should bring together the top-level policy makers with technicians to openly discuss these problems. A two-tiered training course on water and sanitation sponsored by the World Bank and held in-country -- one week for policy makers, after one week of preparation by technicians -- has proven successful in identifying problems, constraints, and opportunities for addressing these issues.

Another way to improve understanding would be to carry out simple cost-benefit studies that show the level and impact of water pollution on human health, including days lost from work, costs of health services to treat water-borne diseases, and the costs of cleaning up polluted canals, rivers, and drainage ditches. These studies, using "rapid environmental assessment" techniques developed by

UNEP, can reveal the amount of pollution reduction required to meet desired quality standards and costs and offer a realistic basis for planning and funding. Extending environmental quality assessments to the larger metropolitan region and publishing results as Urban Environmental Profiles would support citizen involvement in developing policies.

Local sanitation districts should also be encouraged to provide households with information on why sanitation practices are essential in maintaining good health, and what they can do to make sure local systems are working.

e. **Selecting Appropriate Technologies**

Criteria based on population density, water use, soil type, height of water table, and other factors should be identified and used in choosing appropriate sanitation technologies. Conventional water-borne sewerage is often the technology of choice for cities with more than 500,000 people, but because of its high cost (more than \$200 per household), most ANE countries have fallen far behind in providing service. Less than 15 percent of the \$5.5 billion loaned by the World Bank over the past five years in this sector went to sewerage and drainage projects; over 85 percent went to water supply.⁷⁷

For alternative systems to be effective, three conditions must be met: community education and input, delivery of clean water, and removal of waste water. In areas where incomes are very low, intermediate technologies may reduce costs and provide adequate service. In squatter areas, temporary on-site techniques may be the only affordable solution, until density levels and incomes increase enough to support more conventional systems. In low-income peri-urban communities and small towns, non-sewered sanitation may be an important option. One strategy is to support technologies that can be upgraded as the area undergoes development. As a matter of policy, World Bank and other donors should require that all urban (and rural) water supply projects contain adequate sanitation and community education and training.

Opportunity 20: Controlling Toxic Chemicals and Hazardous Wastes

Environmentally sound management of hazardous chemicals and hazardous wastes involves reducing the amount of toxic material used and released in production, reducing wastes being disposed of into the environment, controlling the wastes that are disposed of, and cleaning up the most potentially damaging sites. Waste minimization, the preferred approach to controlling hazardous chemicals, implies more efficient use of chemical inputs, increased in-plant recycling, and enhanced recovery and reuse, both within industrial plants and as

part of collection and disposal activities.⁷⁸

There are many activities that governments, in cooperation with local industry, multinational corporations, and other organizations, can undertake to improve the management of hazardous chemicals and derivative wastes. These include: expanding and improving inventories; adopting policy goals and strategies; enacting and strengthening regulations and enforcement; and increasing education, training, and technical assistance programs. Although the costs of these efforts are considerable, they are likely to be much less than the cost of cleaning up hazardous waste sites, spills, and accidents after they happen.

a. Improving Inventories

Preliminary estimates of the kinds, locations, and amounts of hazardous wastes being generated, even if rudimentary, are essential for developing effective management regulations and enforcement procedures. In some instances, estimates can be derived from existing economic data. The World Bank has developed an industrial waste prediction model, INVENT, which can be used to correlate hazardous waste generation in a given industry with employment.⁷⁹

Estimates can also be made using information on industrial chemical imports. Because such a large proportion of their industrial chemicals are imported, most ANE countries should begin by monitoring the amount and type of toxic chemicals coming into their countries. Additional research and data collection can identify the types of industries that use toxic chemicals; the amounts and types of hazardous wastes they generate and dispose of; the location and condition of disposal sites; and the impacts of these wastes on society, particularly human health.

The Central Labour Institute in Bombay, India, has begun to collect and to computerize this kind of data. Thailand is using industrial reporting requirements to help in planning. The Thai Ministry of Industry requires industrial plants using and disposing of toxic chemicals to register with its Industrial Control Division. The rapid increase in registrations in the 1980s, particularly in the Bangkok area, provided the data needed to identify the type of industry and type of waste that needed treatment. This information was used to determine the need for government assistance, which resulted in the decision to locate a pilot central collection and treatment facility in the Bangkhuntien district outside Bangkok to treat wastes from the electroplating and textile-dyeing industries there. The treated wastes will then be disposed in a secure landfill.⁸⁰

Through environmental profile activities, donors can assist in the development of hazardous waste inventories. Analyses of the sources of chemicals and wastes – storage, transport, use, and disposal – can be included in updates of country environmental profiles. This would not only be of use to decision makers, but would also reach a more general audience and could be used to raise public awareness.

Industry, both as individual firms and trade associations, must be involved in the development of hazardous waste survey and inventories. Their involvement can simplify the data collection efforts and ensure that basic assumptions on industrial operations are based on reality. Industrial involvement can also create an awareness among industry of the size and extent of the hazardous waste problem and cooperative actions to address that problem.

Segregation of toxic wastes for collection and treatment is becoming a new responsibility of local governments, industries, and consumers. Accurate information obtained by surveys and industrial record keeping is essential for the task.

b. Adopting Policy Goals and Strategies

Once the hazardous waste problem is identified and described, countries must decide on policy goals and strategies for implementing those goals. Hazardous waste management should be based on an objective assessment of alternatives, such as zero discharge or allowable (de minimus risk) releases and an explicit balancing of costs and benefits applied to human health and ecosystems. In general, waste minimization (or source reduction) is the preferred response, followed in order of preference by destruction (which eliminates future problems), treatment, and disposal. Each country will need to determine its own goals depending on its environmental, social, economic, and political situation.

Countries will also need to determine who should pay for hazardous waste management. One approach is to make the polluter pay. This puts pressure on industry (and municipalities) to find solutions to waste problems and pay the cost of environmentally safe control. In the past, developing countries have been reluctant to require industry to adopt effective pollution control technology for fear that the costs of control would make the firms less competitive. In some cases, governments may opt to share the costs of hazardous waste management with industry through subsidies or direct operation of some activities, such as the Bangkhuntien treatment facility outside Bangkok. This approach may be necessary in the early stages to draw industry into solutions that might be avoided otherwise.

Another critical policy issue is who will regulate hazardous waste. Development and enforcement of environmental regulations is often hindered by the problem of determining which agency or ministry within government should take the lead (or whether a new cross-ministerial council or board should be established). The central ministries of public works, environment, public health, industrial development, and river basin and coastal development as well as municipal and regional governments all need to be involved in making the control of wastes an integral part of planning industrial development and urban growth.

Central and municipal planning is needed to establish regulations and enforcement procedures; to identify, and in some cases, establish central treatment and disposal sites; to monitor hazardous waste management in industry; and to develop rules for waste transport, treatment, and disposal.

Finally, as with inventories, industry has a critical role to play in the development of goals and strategies. Individual firms, industry associations, and trade unions, in cooperation with government, can prepare strategies for hazardous waste management. These can be used to identify the needs and technologies applicable to treating and disposing of wastes on an industry-by-industry basis.

c. Enacting or Strengthening Regulations and Enforcement

ANE countries can put in place during the next five years the basic regulatory and enforcement procedures needed to manage hazardous wastes. These include controls on chemicals (identification of critical chemicals and health and environmental standards) and controls on operation (regulations for waste generation, transport, treatment, disposal, and clean up of existing dump sites). Each country will need to follow its own regulatory path, depending on the presence of certain industries and other activities. Indonesia, Malaysia, the Philippines, and Thailand, for example, have developed extensive environmental and health standards but have only just begun to address the difficult process of licensing hazardous waste transport, treatment, disposal, and clean up.⁶¹

The ANE countries should also look at the creation of non-regulatory incentives for waste management. This could involve the development of training programs, provision of technical assistance and subsidies, or the imposition of taxes and fees. Opportunities may also exist for some limited use of deposit/return strategies for special categories of wastes. In some cases, the redefinition of liability for health or environmental damage resulting from improper disposal may create incentives for better industrial management of hazardous wastes.

Regulations governing the imports of hazardous wastes may also need to be developed or strengthened.⁸² Most ANE countries have begun to regulate the import of hazardous chemicals and wastes by using one or more of the following procedures:

- o Preparing lists of highly restricted chemicals that can be imported;
- o Placing import bans on chemicals that are restricted or banned elsewhere;
- o Securing commitments from multinational corporations to maintain environmental protection standards; and
- o Negotiating treaties with other countries on Prior Informed Consent. (Under recently signed international agreements, all transfers of wastes between countries are banned in the absence of bilateral agreements that include PIC.)

The list of regulations guiding international behavior is growing and will continue to grow. The 1989 Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal supports the development of regulations and provides for a common definition of hazardous wastes that all ANE countries can use for the control of trade in chemicals and wastes with neighboring countries and among industries within the country.⁸³

d. Increasing Education, Training, and Technical Assistance Programs

Training is needed for government policy makers and regulatory and enforcement personnel as well as for industrial scientists and managers.

Small workshops, organized and led by technical experts from both developed and developing countries, can provide a mix of technical, economic, and environmental information. Such programs have a growing body of material to draw on: studies by the World Bank, the International Program on Chemical Safety (a joint effort of UNEP, ILO, and WHO), and workshops supported by AID, the East/West Center, and the World Environment Center, plus case studies documenting the development and application of environmentally sound technologies and management practices.⁸⁴

Local industries can also play a critical role in developing educational materials. The Indonesian Chamber of Commerce and Industry, for example, is developing an environmental information data center that will provide detailed information on treatment and disposal technologies to member firms.⁸⁵

Education and training is particularly effective in encouraging waste minimization. Experience in the United States is beginning to show that waste minimization can be profitable. Industry will make investments in new plant and equipment because of gains in production efficiency, savings in raw materials, improved quality control, and reduced losses from spill and personal injuries. Often, however, individual firms are not aware of the economic benefits from waste minimization. Education programs can help fill this information gap.

Technical assistance can also be quite effective in improving waste management, including the identification of opportunities for minimizing or avoiding waste. Government agencies can improve industrial waste management by making technical experts available to individual firms for consultations on waste management and waste auditing.

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CHAPTER V

PRINCIPLES AND CRITERIA FOR SHAPING AN ENVIRONMENTAL AND NATURAL RESOURCES MANAGEMENT STRATEGY FOR ANE COUNTRIES

PRINCIPLES AND CRITERIA FOR SHAPING AN ENVIRONMENTAL AND NATURAL RESOURCES MANAGEMENT STRATEGY FOR ANE COUNTRIES

Previous chapters have laid out an analytical framework and a wide range of complex issues and opportunities for addressing the environmental and natural resources management challenge in the ANE region. AID cannot possibly address all of these issues in every ANE country, but there is much they can do. By choosing carefully, AID can help to sustain economic growth in the region by supporting activities that will protect tropical forests and biological diversity; will manage land, water, and living resources for agricultural sustainability; and will improve energy management and urban environmental quality. To successfully pursue such initiatives, AID will need:

- (a) To strengthen ANE institutions capable of analyzing, developing, and reforming policies that affect environmental management; and
- (b) To promote an expanded role for the private sector in natural resources management.

There are several principles to keep in mind when considering a natural resources strategy.

A. PRINCIPLES FOR ENVIRONMENTAL AND NATURAL RESOURCES MANAGEMENT IN ECONOMIC DEVELOPMENT

First, sustainable economic development is based on the wise management and efficient use of natural resources as well as the preservation and restoration of basic environmental systems. Likewise, preservation of the environment is only feasible when accompanied by economic growth and rising standards of living.

Wise management of the natural resource base in the ANE region presents great opportunities for economic growth. If that growth is to be sustainable, it must be based on the maintenance of the resource base and not principally on its consumption. Experience has shown, however, that the resource base is vulnerable to mismanagement. The resulting degradation of resources and environmental systems has important negative impacts on prospects for continued economic growth.

Yet, important environmental assets cannot be preserved in the face of continuing pressures from growing populations of rural and urban poor. Sustained and equitable economic growth is, therefore, essential to provide sources of livelihood other than environmental destruction to meet pressing short-term needs.

Second, reconciliation of economic growth and its environmental underpinnings require the merging of environmental management and economics in decision making.

For this merger to occur, a full accounting of environmental costs and benefits must be factored into economic measurements, including national income accounts. Management strategies must be designed on the basis of ecological units such as watersheds and coastal systems as a complement to sectoral and jurisdictional approaches. In addition, the environmental dimensions of policy must be considered at the same time as the economic, trade, and other dimensions -- on the same agendas and in the same institutions. At the national level, natural resource plans must be fully integrated with plans for national development.

Third, environmental and natural resources strategies require action at local, national, and international levels.

Environmental issues in the ANE region, such as water resources management, can only be fully understood and addressed when local, national, and international dimensions are taken into account. To do so, a range of actions are needed, including a combination of national and international policy reforms, institutional strengthening, education and training, and on-the-ground initiatives.

An effective strategy for the "eastern waters" of South Asia, for example, will require strengthened international cooperation, changes in water pricing and other national economic policies, strengthened water management institutions, expanded training of water managers, and a range of on-the-ground initiatives that take full advantage of local capabilities and participation. These elements are interrelated, and the effectiveness of one is in large part determined by the effectiveness of others.

Fourth, the full range of human and institutional resources must be mobilized to work on environmental issues. This includes the private business sector, NGOs, local communities, and international organizations as well as national governments.

For nations to take advantage of the full range of resources that can be mobilized to face environmental challenges, governments may have to transform their relationships to their economies and societies. This may mean moving toward a freer market to mobilize the private business sector, allowing more political space for participation and cooperation with NGOs, facilitating full participation and equity for women, and opening up to more substantive international cooperation.

Fifth, to achieve sustainable growth, development assistance must place environmental concerns in the mainstream of economic development.

To help ensure that economic gains can be sustained, environmental objectives must be built into all sectors of development assistance, including agriculture, industry, energy, education, health, and communications.

Assessing environmental impacts of development programs and projects and increasing the amount of development assistance that goes into conservation projects are essential steps in building an effective natural resources management strategy. But, they should go hand-in-hand with activities to promote sustainability in all sectors.

B. CRITERIA FOR CHOOSING ACTIVITIES IN THE ANE REGION

With so many possibilities for addressing natural resource issues, it makes sense to have a set of criteria for making choices to ensure that AID's relatively scarce resources are used effectively. This process of strategic evaluation can be utilized both by Mission personnel designing projects, programs, and country development strategies and by ANE/Washington personnel evaluating those plans.

The criteria presented here fall into three broad categories. First, there are those factors relating directly to the economies and natural resource bases of particular ANE countries or subregions. The resource endowments and environmental situations of the ANE countries vary widely, as do their levels of economic growth. Careful examination of these factors in a particular country can establish a fairly clear set of priorities. Second, there are institutional criteria that

apply directly to ANE countries and their commitment and capability to address resource issues. Third, there is a set of criteria that apply to AID and takes into consideration its goals and mandates as well as its institutional strengths at working within a country, with other donors, and drawing on the talents and expertise of individuals and organizations throughout the United States.

To make the criteria easier to apply, they have been phrased as questions as they might be used for developing or evaluating a country environmental and natural resources strategy.

First, the economic and environmental criteria:

(1) **Which resources occupy the most direct, strategic position in present and future economic development?**

This analysis should address the percentage in GDP, employment, and exports directly accounted for by natural resources. The future potential of natural resource-based sectors and activities should be assessed as well as the past and present situation. Examples of areas that should be considered include energy, food and other agricultural production, forestry, fisheries, and other marine resources.

(2) **Which resources and environmental services are most important in their linkages to the growth and sustainability of industrial and service sectors?**

The purpose of this question is to capture the direct economic dependency on the resource base of sectors and activities apart from the primary resource-based sectors such as agriculture examined in the previous criterion. Agroprocessing, for example, is dependent on the health of agriculture, which is dependent on soils, water, watersheds, and the like. A secure and stable water supply is indeed often directly required for agroprocessing activities such as tanning.

Indonesia's plywood industry (the largest in the region) is dependent on a stable and sustainable supply of raw materials. Tourism is dependent on environmental services such as clean beaches and natural forests and on the protection of traditional cultures. The main point is to elaborate those linkages that are less obvious than links to primary resource-based production but are, nonetheless, essential to sustain the transition to a less agriculture-based economy.

(3) Which resources and environmental systems are most critically and irreversibly threatened in a national or global context?

This criterion focuses on threatened resources and systems and the human and economic consequences of those threats. This analysis should include the extent and effects of urbanization, industrialization, pollution, and the like, and indicate those ecosystems and areas where urgent action is required to prevent irreversible damage. The watersheds of the Near East countries are a good example of resources that might receive a high priority in this analysis.

This criterion is in part intended to balance criteria #1 and #2. The forests of Palawan in the Philippines, for example, are unlikely to be a major factor in the country's economic growth, but they represent its last existing undisturbed rainforests. Similarly, Bangladesh is a forest-poor country, but its remaining forests and fuelwood cycle is critically threatened.

(4) What are the most serious environmental threats to human health and other factors that help determine worker production and the quality of life?

Clean air and water are basic necessities because they are essential for public health and social welfare. To what extent are the patterns of development, particularly in urban areas, straining the natural and managed systems that supply these amenities? What are the costs, how are they being paid, and by whom?

The point of this criterion is to capture those linkages that are often indirect but are nevertheless crucial to sustainable development. Will pursuit of rapid growth lead to such deterioration in environmental quality that workers will be forced to move for health reasons or spend considerable sums overcoming damaging air, water, and toxic pollution?

Next, the institutional criteria which apply to ANE countries:

(5) How strong is host-country policy commitment and awareness?

This analysis should cover not only policy pronouncements and legal enactments, but also progress toward removing economically inefficient and environmentally destructive subsidies, promotion of constructive private sector activity (including freedom of action for environmental and development NGOs), and other concrete actions. Evidence might include institutional strengthening and reforms directed toward environmental objectives, trends in public spending on the environment, and demonstrated willingness to follow up on policy dialogue

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commitments made to donors.

(6) What is the extent of in-country institutional capacities to manage resources and what interventions are most strategic in strengthening that capacity?

This analysis should cover not only laws and regulations, but also institutional capacities, including financial and human resources in government, private business, and the NGO community. It should examine the capacities directed specifically at environmental objectives (e.g., environmental ministries, environmental impact analysis processes and capabilities), and then look at the sectoral, economic, and planning units of government, educational institutions, local institutions, private business, and NGOs beyond those that are explicitly "environmental." Particular emphasis should be put on assessing data gathering, management, and analysis capabilities.

(7) Are there specific current events or circumstances that provide an especially useful window of opportunity?

Specific political or economic developments can often provide a special opportunity for AID to initiate a strategic environmental intervention that rides a wave of change and strengthened commitment. Elections and other changes of regime are one such window of opportunity. Others include structural adjustment programs, natural disasters, and international events. For example, the World Forestry Congress (1978) and World Parks Conference (1982) in Indonesia greatly improved opportunities for social forestry and protected areas projects in that country.

Finally, the criteria that apply to AID:

(8) How does the proposed initiative fit with Bureau and Mission priorities and programs?

This analysis should provide justification in terms of existing country or centrally-funded projects, CDSS, congressional mandates, AID policy guidelines and statements, and other ANE strategies in agriculture, population, health, science and technology, energy, and education. One aspect of this criterion should be to ensure that AID-country strategies and projects integrate a mix of field projects, training, and policy development activities. It should be noted that existing programs or strategies should not be a straitjacket; a major point of developing a Strategy is, presumably, that new directions are needed in many cases.

Another aspect should be to assess the need for additional AID personnel and staff training, to plan and implement country and regional programs, and to develop management information systems and other data required to monitor and guide strategy implementation, while reducing the burden of paperwork.

(9) What is the U.S. comparative advantage for addressing the issue?

The purpose of this criterion is to assess the "fit" between the needs of the proposed strategy, project, or activity, and the resources available in U.S. society in areas such as technology, expertise in government, universities, private sector, NGOs, relevant U.S. experience with similar problems, etc. Can land grant universities, for example, be called upon to develop training programs for natural resource managers and economists that will complement current AID programs in agronomy, soil science, and animal husbandry?

(10) Will AID assistance help to implement or leverage other donor support?

The point here is to relate the proposed AID strategy, program, or project within the constellation of donor activities, taking AID's special strengths and characteristics into account. AID is well-placed, for example, to leverage other donors and lenders through its granting authority, its extensive in-country presence and contacts, and its ability to catalyze joint donor action. Can AID adapt its CDSS process to help other donors focus and coordinate activities on the most critical resource problems?

APPENDIX 1

CHECKLIST OF OPPORTUNITIES FOR ENVIRONMENT AND NATURAL RESOURCE MANAGEMENT IN THE ANE REGION

Opportunity 1: Incorporating Environmental Considerations into Economic Policy Reform

- a. Policy Research and Analysis
- b. Promoting Policy Dialogue
- c. Complementary Measures to Reinforce the Environmental
Sustainability of Economic Policy Reforms
- d. Incorporating Environmental Sustainability into Multilateral
Adjustment Lending: A Special Opportunity for the 1990s

Opportunity 2: Strengthening Environmental Policies

- a. Elaborating Environmental Law
- b. Establishing Effective Environmental Agencies and Councils
- c. Developing Environmental Assessments and Strategies
- d. Instituting Effective Environmental Impact Assessment Procedures

Opportunity 3: Integrating Environmental Concerns into Sectoral Programs

- a. Strengthening the Environmental Mandate
- b. Promoting Coordination Among Sectors
- c. Strengthening Provincial Authority and Effectiveness
- d. Improving Information for Natural Resources Management

Opportunity 4: Clarifying Ownership and Control of Land

- a. Policy Research and Analysis
- b. Reforming Land Law
- c. Strengthening the State Apparatus for the Administration of Land Law

Opportunity 5: Mobilizing Private Energies for Environmental and Natural Resources Management

- a. Encouraging Private Enterprise
- b. Strengthening the NGO Sector
 - Institutional Assessments
 - Political Space for Independent Sector Growth
 - Managerial and Technical Capacity
 - Supporting NGO Expansion
- c. Enhancing the Role of Women
 - National Policies and Programs
 - Research
 - Women's Organizations

Opportunity 6: Strengthening Public Awareness and Education

- a. Informing the General Public
- b. Informing Leaders in Government and Industry

Opportunity 7: Training for Natural Resources Management

- a. Needs Assessment
- b. Professional Training
- c. On-the-Job Training

Opportunity 8: Sustainable and Equitable Management of Tropical Forests

- a. Policy Reform in the Forestry Sector
- b. Forest Tenures and Community Access
- c. Research, Assessment, and Monitoring
- d. Managing Forests for Multiple Products and Services
- e. Developing Timber Plantations for Diversity and Sustainability
- f. Promoting Social Forestry Strategies and Technologies
- g. Retraining Foresters in the Ministry and the Field

Opportunity 9: Managing Coastal Resources

- a. Profiling Coastal Issues
- b. Developing Legal and Institutional Frameworks
- c. Implementing Coastal Zone Management Programs
- d. Training Coastal Managers

Opportunity 10: Conserving Biological Diversity

- a. Rapid Assessments and Basic Research
- b. Increasing the Economic Value of Biological Resources
- c. Strengthening Management of Parks and Protected Areas
- d. Conserving Genetic Diversity for Agriculture and Forestry

Opportunity 11: Developing Policies and Programs for Sustainable Agriculture

- a. Policy Review and Reform
- b. Research for Agricultural Sustainability
- c. Models of Sustainability: Field Testing
- d. Scaling Up: Extension for Sustainability

Opportunity 12: Restoring the Productivity of Degraded Agricultural Lands

- a. Restoring Degraded Uplands
- b. Rehabilitating Salinized and Waterlogged Lands

Opportunity 13: Making Greater Use of Integrated Pest and Soil Fertility Management

- a. Policies to Support Integrated Pest and Soil Fertility Management
- b. Regulation of Agrochemicals
- c. Training Farmers
- d. Research

Opportunity 14: Sustaining Water Supplies for Multiple Use

- a. Policy Reform
 - Irrigation Policy
 - Urban and Industrial Water Supply Policy
- b. Institutional Reform
 - National Level Reforms
 - Local Level Reforms
- c. Training, Research, and Information Needs
- d. The International Dimension

Opportunity 15: Improving Rural People's Access to Clean Water

- a. Supporting Community Control
- b. Strengthening the Role of Women
- c. Covering Costs

Opportunity 16: Incorporating Environmental Considerations in All Major Energy Decisions

- a. Clarifying the Implications of Different Energy Choices
- b. Supporting Policy Reforms
- c. Developing Institutional Capacities for Energy Planning and for Assessing Environmental Impacts of Energy Decisions

Opportunity 17: Conserving Energy through Greater Efficiency in Production and Use

- a. Information and Awareness
- b. Policy Development and Regulatory Reform
- c. Training and Institution-Building
- d. Technical Support and Technology Transfer
- e. Financial Assistance and Investment Promotion
- f. Target Sectors
 - Power
 - Industry
 - Buildings
 - Transport

Opportunity 18: Increasing Production and Use of Cleaner Fuels

- a. Promoting the Use of Cleaner Fuels and More Efficient Technologies
- b. Assessing the Availability of Renewable Energy Sources
- c. Identifying Cost-Effective Applications for Renewable Energy Technologies

Opportunity 19: Providing the Urban Poor with Basic and Affordable Environmental Services

- a. Pollution Control Policies and Regulations
- b. Strengthening Municipal Governments
- c. Making Use of Market Forces and Incentives
- d. Expanding Public Awareness of Sanitation Problems
- e. Selecting Appropriate Technologies

Opportunity 20: Controlling Toxic Chemicals and Hazardous Wastes

- a. Improving Inventories
- b. Adopting Policy Goals and Strategies
- c. Enacting or Strengthening Regulations and Enforcement
- d. Increasing Education, Training, and Technical Assistance Programs

APPENDIX 2

STATISTICAL TABLES AND INDICATORS FOR ANE COUNTRIES

Table	1.	Gross National Product and Gross Domestic Product
	2.	GDP Growth Rates: Labor Force by Sector; Prices
	3.	Trade and Foreign Exchange; Official Development Assistance
	4.	Debt (Public and Private)
	5.	Commodity Price Indexes
	6.	Population
	7.	Population Growth; Labor Force
	8.	Age of Population
	9.	Rural and Urban Populations
	10.	Vital Statistics; Nutrition
	11.	Disease Immunization; Water Utilities
	12.	Literacy and Education
	13.	Land Distribution
	14.	Agriculture
	15.	Agricultural Inputs
	16.	Agricultural Holdings
	17.	Soil Erosion
	18.	Forest Sizes and Types
	19.	Forest Production
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	21.	Energy Production and Consumption I
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	30.	Floods and Cyclones, 1960-81
	31.	Coastline Activity
	32.	Tropical Coastal Resources
	33.	Air Pollution I
	34.	Air Pollution II
	35.	ANE Bureau: U.S. Assistance
	36.	Environment and Natural Resource Projects
	*	Technical Notes

**TABLE
1**

**GROSS NATIONAL PRODUCT
and GROSS DOMESTIC PRODUCT**

	GROSS NATIONAL PRODUCT			COMPARISON OF RELATIVE SIZES			GROSS DOMESTIC PRODUCT								
	GNP Total	GNP Growth Rate		GNP per capita	% OF A/NE POP	% OF A/NE GNP	% OF REGION GNP	Total #		Distribution (%)					
		1986	1965-73					1973-86	1986	(millions \$ US)		Agriculture		Industry		Services, etc.
								1965	1986	1965	1986	1965	1986	1965	1986
(arithmetic mean) (GNP weighted)		6.2	5.5	1174						40	27	20	26	40	47
ANE BUREAU (pop wtd)	519036	4.4	4.9	362				82860	495150	45	30	20	27	34	41
(GNP wtd)		5.7	6.2												
ANE NEAR EAST (pop)	74370	4.0	6.0	827	6	14		8440	79480	24	20	24	28	41	50
Egypt	37700	3.3	7.0	760	3	7	51	4550	40850	29	20	27	29	45	51
Jordan	4220	..	8.6	1540	0	1	6	..	4000	..	8	..	28	..	63
Morocco	13160	5.5	3.6	590	2	3	18	2950	14760	23	21	28	30	49	49
Oman	6440	18.6	7.0	4990	0	1	9	60	7320	61	..	23	..	16	..
Tunisia	8340	7.1	5.1	1140	1	2	11	880	7790	22	16	24	33	54	52
Yemen	4510	..	6.0	550	1	1	6	..	4760	..	34	..	16	..	50
ANE SOUTH ASIA	273300	4.1	4.7	267	71	53		58590	257410	47	32	20	27	33	39
Bangladesh	16070	0.0	4.4	160	7	3	6	4380	15460	53	47	11	14	36	39
India	213440	4.1	4.5	270	54	41	78	46260	203790	47	32	22	29	31	39
Nepal	2640	..	..	160	1	1	1	730	2200	65	..	11	..	23	..
Pakistan	34690	5.5	6.3	350	7	7	13	5450	30080	40	24	20	28	40	47
Sri Lanka	6460	4.5	4.9	400	1	1	2	1770	5880	28	26	21	27	51	47
							0								
ANE SOUTHEAST ASIA	163820	7.2	5.5	577	22	32		15490	155730	45	27	17	29	38	43
Burma	7450	2.8	5.7	200	3	1	5	1600	8180	35	48	13	13	52	39
Indonesia	82110	8.0	6.1	500	12	16	50	3830	75230	56	26	13	32	31	42
Philippines	31820	5.5	3.1	570	4	6	19	6010	30540	26	26	28	32	46	42
Thailand	42440	7.7	6.0	810	4	8	26	4050	41780	35	17	23	30	42	53
					0	0									
ANE OCEANIA	7546	..	..	772	0.4	1		340	2530						
Fiji	1280	8.1	2.7	1810	0.0	0.2	26.3								
Papua New Guinea	2470	..	..	690	0.3	0.5	50.7	340	2530	42	34	18	26	41	40
Solomon Islands	150	..	7.1	530	0.0	0.0	3.1								
Cook Islands	● 21			● 1170	0.0	0.0	0.4								
Kiribati	● 20	..	..	● 310	0.0	0.0	0.4								
Niue	● 3	..	..	● 1080	0.0	0.0	0.1								
Tonga	\$ 725	..	..	\$ 740	0.0	0.1	14.9								
Tuvalu	● 4	..	..	● 450	0.0	0.0	0.1								
Vanuatu	● 84	..	..	● 580	0.0	0.0	1.7								
Western Samoa	\$ 112	..	..	\$ 680	0.0	0.0	2.3								
	Source: WRI WRR 88-89 Table 14.1 Original sources: IBRD and OECD exc: \$ from IBRD WDR 88 Box A ● from World Fact Book 88 (Cook Islands=1983; Kiribati=1985; Niue=1984; Tuvalu=1984; all=GDP)							Source: IBRD WDR 1988 Table 3 Note: \$ = GDP at purchaser values Note: Italicized figures (Yemen, Nepal) are for years other than those specified.							

TABLE 2	GDP GROWTH RATES								LABOR FORCE BY SECTOR						PRICES	
	GDP GROWTH RATES BY SECTOR								PERCENTAGE OF LABOR FORCE BY SECTOR						Average annual inflation (GDP deflator)	
	Average annual growth rate (%)															
	GDP		Agriculture		Industry		Services, etc.		Agriculture		Industry		Services, etc.		1980-86	
65-80	80-86	65-80	80-86	65-80	80-86	65-80	80-86	1965	1980	1965	1980	1965	1980			
(arithmetic mean) (GDP weighted) (Pop weighted) A/NE BUREAU	5.6	4.0	3.3	2.9	6.7	4.6	5.9	4.8	67	57	13	16	21	27	mean	8.7
	4.5	4.5	3.0	2.4	5.5	5.6	5.1	5.4	71	65	12	13	17	22	gdp	8.6
															pop	8.5
ANE NEAR EAST	6.4	4.3	2.9	2.4	6.7	4.9	8.3	4.5	57	45	15	22	27	33	gdp	9.9
															pop	10.5
Egypt	6.7	4.7	2.8	1.9	7.0	6.3	9.5	4.4	55	46	15	20	30	34		12.4
Jordan	..	5.1	..	1.8	..	5.8	..	5.1	37	10	26	26	37	64		3.2
Morocco	5.4	3.3	2.2	3.9	6.1	1.1	6.5	4.4	61	46	15	25	24	29		7.7
Oman	12.5	5.7	..	..	..	..	..	..	62	50	15	22	23	28		3.6
Tunisia	6.6	3.7	5.5	3.3	7.4	3.3	6.5	4.1	49	35	21	36	29	29		8.9
Yemen	..	4.3	..	0.2	..	8.3	..	5.2	79	69	7	9	14	22		13.1
ANE SOUTH ASIA	3.7	4.9	2.7	2.2	4.3	7.0	4.6	6.0	73	69	12	12	15	19	gdp	8.1
															pop	8.2
Bangladesh	2.4	3.7	1.5	2.7	3.8	4.6	3.4	4.7	84	75	5	6	11	19		11.2
India	3.7	4.9	2.8	1.9	4.0	7.1	4.6	6.0	73	70	12	13	15	17		7.8
Nepal	2.4	3.5	1.1	4.8	..	..	..	..	94	93	2	1	4	7		8.8
Pakistan	5.1	6.7	3.3	3.3	6.4	9.3	5.9	7.2	60	55	18	16	22	30		7.5
Sri Lanka	4.0	4.9	2.7	3.9	5.1	4.5	4.3	5.7	56	53	14	14	30	33		13.5
ANE SOUTHEAST ASIA	7.0	3.0	4.4	3.0	9.9	1.9	6.6	4.4	70	58	10	14	21	28	gdp	8.9
															pop	8.8
Burma	3.9	4.9	3.7	4.7	4.4	6.3	4.0	4.8	64	53	14	19	23	28		2.1
Indonesia	7.9	3.4	4.3	3.0	11.9	1.8	7.3	5.6	71	57	9	13	21	30		8.9
Philippines	5.9	-1.0	4.6	2.0	8.0	-3.5	5.2	-0.6	58	52	16	16	26	33		18.2
Thailand	7.4	4.8	4.9	2.9	9.5	5.0	8.0	5.6	82	71	5	10	13	19		3.0
ANE OCEANIA			..	..	..	..	..	..							gdp	7.4
															pop	5.7
Fiji																4.9
Papua New Guinea	4.1	1.8	..	..	..	..	..	..	87	76	6	10	7	14		5.1
Solomon Islands																6.9
Cook Islands																5.6
Kiribati																9.6 a
Niue																19.6 b
Tonga																
Tuvalu																
Vanuatu																4.6
Western Samoa																12.8
	Source: IBRD WDR 88 Table 2								Source: IBRD WDR 88 Table 31						Source: IBRD WDR 88 Table 1 or Box A exc. a & b from World Fact Book 88 a = 1984; b = 1985 both are Consumer Prices	
	Note: italicized figures (Oman, Yemen) are for years other than those specified.															

TABLE 4	DEBT (PUBLIC AND PRIVATE)											
	LONG-TERM DEBT (millions \$US)								SHORT- TERM DEBT (millions \$ US)	TOTAL EXTERNAL DEBT (millions \$ US)		
	Public and publicly guaranteed		Private non- guaranteed	Use of IMF credit		TOTAL Long- Term	TOTAL As % of GNP	Interest Payments			Service as % of:	
	1970	1986	1986	1970	1986	1986	1986	1986	1986	1986	1986	
(arithmetic mean) (GNP wtd)						52			6	29		
ANE BUREAU (Pop wtd)	18037.8	173138.7	13848	449	9669	186919	31	8137	3	27	27458	223062.2
ANE NEAR EAST	3089	50031	* 1197	90	1318	51228	71	1464	* 6	* 28	9262	60781
Egypt	1,713	22,788	947	49	31	23,735	59	766	5	24	4,790	28,556
Jordan	119	3,079	0	0	70	3,079	69	180	12	29	985	4,134
Morocco	712	14,610	74	28	1,026	14,610	..	..	..	..	2,189	16,799
Oman	0	2,501	0	0	0	2,501	38	172	6	11	496	2,997
Tunisia	541	5,001	250	13	183	5,251	62	304	10	31	553	5,987
Yemen	4	2,052	0	0	8	2,052	41	42	2	60	249	2,308
ANE SOUTH ASIA	11402	55118	2724	134	6072	57842	22	1950	2	19	3528	67442
Bangladesh	0	7,282	0	0	461	7,282	48	108	2	25	125	7,865
India	8,018	31,913	2,598	10	4,274	34,511	15	1359	2	25	2,303	41,088
Nepal	3	711	0	0	15	711	28	13	1	9	21	747
Pakistan	3,064	11,764	30	45	1,036	11,794	36	358	3	27	790	13,620
Sri Lanka	317	3,448	96	79	286	3,544	55	121	5	18	289	4,119
ANE SOUTHEAST ASIA	3498	66416	8730	225	2259	75145	51	4574	6	20	14582	91987
Burma	106	3,664	0	17	47	3,664	45	88	3	55	55	3,766
Indonesia	2,443	31,901	3,828	139	51	35,729	50	2363	7	33	6,309	42,090
Philippines	625	19,828	1,794	69	1,173	21,622	72	1092	6	21	5,378	28,172
Thailand	324	11,023	3,108	0	948	14,130	35	1031	8	25	2,840	17,959
ANE OCEANIA	49	1574	1197	0	20	2705	80	140			862520	2852
Fiji	10	293	102	0	8	395	31				20	415
Papua New Guinea	36	1147	1095	0	0	2242	93	140	18	36	62	2304
Solomon Islands	0	68		0	4	68	45				3	68
Cook Islands												
Kiribati												
Niue												
Tonga												
Tuvalu												
Vanuatu												
Western Samoa	3	66		0	9	58					1	66

Source: IBRD WDR 88 Table 18

Note: Italicized figures
(Morocco, Fiji, Solomon Islands, Western Samoa)
from IBRD World Tables 1987.

Note: * = does
not include Morocco.

Note: @ = Morocco
total does not
include private debt

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**TABLE
5**

COMMODITY PRICE INDEXES

Individual Commodity Price Indexes
(in constant 1980 \$US per metric ton except as otherwise marked)

	1972	1977	1982	1986		1972	1977	1982	1986
Cocoa (kg)	1.61	5.41	1.75	1.83	Burlap (meter)	0.56	0.31	0.27	0.22
Coffee (kg)	2.81	9.70	3.20	4.50	Jute	747.5	458.4	288.4	238.2
Tea (kg)	2.63	3.84	1.95	1.70	Sisal	600	753	598	453
Rice	367.5	388.9	295.6	185.6	Natural Rubber (kg)	10.03	13.10	101.10	83.30
Grain Sorghum	140.0	126.3	109.5	72.8	Logs	94.0	128.3	146.5	X
Maize	140.0	136.1	110.3	77.2	Sawnwood (cubic meter)	265.0	220.1	304.7	234.7
Wheat	178.3	165.4	168.0	141.6	Tobacco	2,405	2,386	2,432	1,787
Sugar (kg)	0.40	0.26	0.19	0.12	Coal	47.9	77.5	56.9	46.6
Bananas (kg)	0.41	0.39	0.38	0.34	Petroleum (barrel)	4.8	18.3	33.5	X
Black Pepper (kg)	2.55	3.59	1.57	4.26	Aluminum	1,080	1,416	1,071	1,112
Copra	352.3	574.7	317.1	174.6	Bauxite	30.00	44.00	36.33	24.69
Coconut Oil	585.5	826.0	468.6	261.9	Copper	2,678	1,870	1,493	1,212
Groundnut Meal	305.0	311.4	190.8	145.5	Lead	755	883	551	358
Groundnut Oil	1,064.8	1,217.6	590.2	501.8	Tin	9,425	15,310	12,913	X
Linseed	362.5	388.4	300.7	183.4	Zinc	978	1,083	856	739
Linseed Oil	516.0	659.9	523.3	369.5	Iron Ore	32.0	30.9	26.1	19.4
Palm Kernels	290.3	466.1	267.4	125.2	Manganese Ore (10kg Mn)	1.59	2.11	1.66	1.22
Palm Oil	543.3	757.1	449.1	226.6	Nickel	7,700	7,433	4,881	3,422
Soybeans	350	400	247	183	Steel	449.3	460.9	539.5	354.8
Soybean Oil	675	823	451	302	Phosphate Rock	28.8	43.6	42.8	30.2
Soybean Meal	323	329	220	163	Diammonium Phosphate (DAP)	227.5	190.0	184.5	136
Fish Meal	598	649	356	283	Potassium Chloride	83.8	72.9	82.3	60.7
Cotton (kg)	1.98	2.22	1.61	0.93	Triple Superphosphate (TSP)	170	139	139	107
					Urea	148.3	182.0	160.2	94.4

Commodity Group Price Indexes

(index numbers based on constant prices with 1979-81 = 100)

	1972	1977	1982	1987
33 Nonfuel Commodities	94	123	82	62
Total Agriculture	92	134	81	59
Total Food	93	143	81	57
Beverages	80	205	85	58
Cereals	97	96	79	46
Fats and Oils	104	124	76	52
Other Foods	103	78	79	65
Nonfood Agriculturals	91	102	82	66
Timber	53	74	88	99
Metals and Minerals	106	103	83	64

Source: WRR 88-89 Table 14.3

Original Data from The World Bank.

X = not available.

a = data refer to January through July 1986.

TABLE 6	POPULATION												
	Percent of A/NE Region 1986	Percent of Sub- Region 1986	TOTAL POPULATION (millions)				Average Annual Population Change (percent)			Average Annual Increment to the Population (1000s)			
			1960	1989	2000	2025	1965-70	1985-90	2005-10	1965-70	1975-80	1985-90	
(arithmetic mean)								2.3	2.1	1.5			
ANE BUREAU (Pop wtd)	100%		786	1,506	1,821	2,434		2.4	1.9	1.3	22,549	26,691	27,787
ANE NEAR EAST	6%		48.0	96.4	122.2	181.2		2.4	2.4	1.7	1382	1866	2236
Egypt	3%	53%	25.9	51.4	63.9	90.4		2.4	2.3	1.6	733	1,046	1,125
Jordan	0%	4%	1.7	4.1	6.4	13.6		3.2	4.0	3.4	67	65	155
Morocco	2%	25%	11.6	24.1	29.5	40.1		2.8	2.3	1.3	397	415	535
Oman	0%	1%	0.5	1.4	2.0	3.5		2.7	3.2	2.5	17	44	43
Tunisia	1%	8%	4.2	7.7	9.4	12.9		2.0	2.2	1.3	99	156	163
Yemen	1%	8%	4.0	7.7	10.9	20.8		1.5	2.9	2.9	69	140	215
ANE SOUTH ASIA	71%		563.3	1070.8	1293.5	1716.6		2.4	1.9	1.3	15808	18817	19479
Bangladesh	7%	10%	51.6	112.3	145.8	219.4		2.7	2.6	1.9	1,659	2,328	2,819
India	54%	76%	442.3	813.4	964.1	1228.8		2.3	1.7	1.1	11,951	13,631	13,645
Nepal	1%	2%	9.4	18.1	23.0	33.9		2.1	2.3	1.7	229	333	397
Pakistan	7%	10%	50.1	109.7	141.0	210.0		2.8	2.2	1.8	1,699	2,282	2,369
Sri Lanka	1%	2%	9.9	17.2	19.6	24.4		2.3	1.5	1.1	270	243	249
ANE SOUTHEAST ASIA	22%		172.7	333.1	399.4	527.4		2.5	1.8	1.2	5271	5888	5913
Burma	3%	12%	21.7	40.1	48.5	66.0		2.3	1.9	1.3	587	654	738
Indonesia	12%	54%	96.2	178.5	211.4	272.7		2.3	1.7	1.1	2,648	3,058	3,020
Philippines	4%	18%	27.9	59.7	74.1	102.8		2.9	2.3	1.5	1,010	1,150	1,295
Thailand	4%	16%	26.9	54.8	65.5	85.9		3.0	1.6	1.2	1,026	1,026	860
ANE OCEANIA	0%		2.4	5.4	6.2	9.2		2.2	2.2	1.6	88	120	159
Fiji	0%	14%	0.4	0.74	0.8	1.0		2.3	1.6	0.7	11	11	11
Papua New Guinea	0%	71%	1.9	3.86	4.9	7.5		2.4	2.4	1.8	55	78	89
Solomon Islands	0%	6%	0.1	0.32	0.4	0.8		2.8	4.0	2.4	22	31	59
Cook Islands	0%	0%		0.02				1.6	0.0	0.0			
Kiribati	0%	1%		0.07				2.2	1.2	0.8			
Niue	0%	0%		0.00				0.0	0.0	0.0			
Tonga	0%	2%		0.10				2.4	1.9	1.3			
Tuvalu	0%	0%		0.01				0.5	1.2	0.7			
Vanuatu	0%	3%		0.15				2.3	2.9	2.2			
Western Samoa	0%	3%		0.18				2.2	0.8	0.4			
			Source: WRI WRR 88-89 Table 15. exc. 7 smaller island groups: World Fact Book 1988				Source: Prospects of World Urbanization as Assessed in 1984			Source: WRI WRR 88-89 Table 15.1			

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TABLE 7	POPULATION GROWTH								LABOR FORCE								
	Hypothetical size of stationary population (millions)	Assumed Year of Reaching Net Reproduction Rate of 1	Crude Birth Rate (births per thousand population)		Crude Death Rate (deaths per thousand population)		Total Fertility Rate		GROWTH Average annual growth of labor force (percent)			SECTOR EMPLOYMENT Percentage of labor force in					
			65-70	85-90	65-70	85-90	65-70	85-90	1965-80	1980-85	85-2000	Agriculture		Industry		Services	
			1965-80	1980-85	85-2000	1965	1980	1965	1980	1965	1980	1965	1980				
(arithmetic mean)	2020	42.9	34.3	17.2	10.6	6.3	4.7	2.2	2.8	2.5	67	57	13	16	21	27	
ANE BUREAU (Pop wtd)	3505	41.8	30.5	17.7	11.2	6.0	4.0	2.0	2.3	2.1	71	65	12	13	17	22	
ANE NEAR EAST	266	44.4	34.5	18.5	10.1	6.8	4.6	2.3	2.9	2.9	57	43	17	23	26	34	
Egypt	132	2020	41.8	32.8	18.3	9.8	6.6	4.3	2.2	2.6	2.7	55	46	15	20	30	34
Jordan	13	2020	48.0	46.4	16.3	6.6	7.2	7.3	1.7	4.4	4.2	37	10	26	26	37	64
Morocco	59	2020	48.2	32.5	17.4	9.5	7.1	4.3	2.9	3.3	3.1	61	46	15	25	24	29
Oman	5	2030	50.0	44.3	22.7	12.5	7.2	6.9	3.8	5.2	2.7	62	50	15	22	23	28
Tunisia	18	2015	41.8	30.4	15.5	8.7	6.8	4.1	2.8	3.1	2.8	49	35	21	36	29	29
Yemen	39	2040	48.8	47.4	26.6	16.4	7.0	6.8	0.7	2.6	3.4	79	69	7	9	14	22
ANE SOUTH ASIA	2556	41.7	30.9	18.1	11.7	6.0	4.1	1.8	2.2	2.0	73	69	10	10	16	21	
Bangladesh	342	2030	47.5	41.7	21.0	15.6	6.9	5.5	1.9	2.8	3.0	84	75	5	6	11	19
India	1,698	2010	40.2	28.1	17.5	10.9	5.7	3.7	1.7	2.0	1.8	73	70	12	13	15	17
Nepal	63	2035	45.5	39.4	23.5	16.7	6.2	5.8	1.6	2.3	2.3	94	93	2	1	4	7
Pakistan	423	2035	47.8	40.4	20.2	13.8	7.2	5.3	2.6	3.2	2.8	60	55	18	16	22	30
Sri Lanka	30	2005	31.5	24.2	8.3	6.1	4.7	2.9	2.2	1.6	1.6	56	53	14	14	30	33
ANE SOUTHEAST ASIA	673	41.6	28.2	16.1	9.8	5.8	3.5	2.3	2.4	2.1	69	58	11	12	21	28	
Burma	102	2020	39.1	28.8	16.2	9.9	5.7	3.7	2.2	1.9	1.8	64	53	14	19	23	28
Indonesia	335	2005	42.6	28.6	19.3	11.3	5.6	3.5	2.1	2.4	2.2	71	57	9	13	21	30
Philippines	137	2015	40.2	30.8	10.7	7.6	6.0	3.9	2.5	2.5	2.4	58	52	16	16	26	33
Thailand	99	2000	41.8	23.5	11.4	7.4	6.1	2.7	2.8	2.5	1.7	82	71	5	10	13	19
ANE OCEANIA	34.7	29.4	14.7	9.3	5.0	4.2	1.9	2.2	2.0	87	76	6	10	7	14		
Fiji	32.0	27.3	7.6	5.0	4.6	3.2	1.9	2.2	2.0	87	76	6	10	7	14		
Papua New Guinea	10	2025	42.4	35.9	19.1	12.1	6.2	5.3	1.9	2.2	2.0	87	76	6	10	7	14
Solomon Islands	X	X	X	X	X	X	X	X									
Cook Islands																	
Kiribati																	
Niue																	
Tonga																	
Tuvalu																	
Vanuatu																	
Western Samoa																	
	Source: IBRD WDR 88 Table 27	Source: WRI WRR 88-89 Table 15.2 Original source: United Nations Population Division	Source: IBRD WDR 88 Table 31														

**TABLE
8**

AGE OF POPULATION

	Percentage of the Population In Specific Age Groups									Percentage of the Population 15-24 Years of Age															
	1960			1990			2020			1960		1970		1975		1980		1990		2000		2010		2020	
	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+																
(arithmetic mean)	43	54	3	40	57	4	28	66	6																
ANE BUREAU (Pop wtd)	41	55	4	37	59	4	24	68	7	18.1	18.2	19.2	19.7	20.2	19.5	18.2	16.3								
ANE NEAR EAST	43	54	3	40	56	4	27	67	6	18.0	18.5	19.9	19.9	19.7	20.2	19.1	17.3								
Egypt	43	54	3	39	57	4	26	67	7	17.3	19.6	21.1	20.1	18.6	20.5	18.9	17.1								
Jordan	44	52	4	48	49	3	39	58	3	19.9	19.0	18.0	19.4	20.6	18.5	20.7	22.1								
Morocco	45	53	3	38	58	4	24	70	6	19.2	16.7	19.2	20.3	21.7	20.1	19.0	15.7								
Oman	43	54	3	45	52	3	35	61	5	19.2	19.0	18.8	18.0	16.9	19.9	20.4	20.7								
Tunisia	43	52	4	37	58	4	24	70	6	16.3	17.6	19.9	20.5	21.0	20.0	18.6	16.0								
Yemen	42	54	3	47	53	3	38	59	3	18.9	17.4	14.8	17.3	19.7	19.8	20.1	21.6								
ANE SOUTH ASIA	40	56	4	37	59	4	24	68	7	18.0	18.0	18.9	19.5	20.0	19.5	18.3	16.5								
Bangladesh	41	55	4	45	53	3	31	66	4	17.6	17.0	18.4	19.5	20.4	21.2	20.8	19.5								
India	40	57	3	35	61	5	23	69	8	18.2	18.1	18.8	19.4	20.0	19.1	17.6	15.7								
Nepal	38	58	4	42	55	3	31	65	4	19.9	17.6	17.5	18.3	20.0	20.2	20.2	19.8								
Pakistan	44	52	4	43	54	3	30	66	4	17.0	18.4	20.2	20.5	20.1	20.6	20.7	18.9								
Sri Lanka	42	54	4	34	61	5	22	68	10	18.1	18.1	20.0	21.0	18.5	19.4	16.8	14.6								
ANE SOUTHEAST ASIA	42	54	3	36	60	4	24	69	7	18.5	18.7	19.7	20.1	21.0	19.4	17.9	16.5								
Burma	41	56	3	35	60	4	25	68	7	16.9	19.0	19.3	19.8	20.6	18.9	18.3	16.8								
Indonesia	40	57	3	36	61	4	24	69	7	19.3	17.7	19.1	19.7	21.0	19.5	17.9	16.3								
Philippines	47	50	4	39	58	4	26	68	6	17.8	20.1	21.5	20.5	20.3	20.2	19.1	17.0								
Thailand	46	51	3	33	64	4	24	69	8	17.6	20.0	20.3	21.2	22.0	18.4	16.3	16.5								
ANE OCEANIA	36	47	2	34	49	3	29	65	6	16.1	16.0	16.5	16.4	17.2	16.8	16.3	15.8								
Fiji	48	50	3	37	59	4	23	68	9	19.0	21.0	22.6	22.6	17.8	19.9	17.5	15.0								
Papua New Guinea	41	57	3	40	57	3	30	65	5	18.8	18.3	18.8	18.7	20.6	19.6	19.5	19.2								
Solomon Islands	X	X	X	X	X	X	X	X	X																
Cook Islands																									
Kiribati																									
Niue																									
Tonga																									
Tuvalu																									
Vanuatu																									
Western Samoa																									
	Source: WRR 88-89 Table 15.2 Original source: United Nations Population Division									Source: World Population Prospects As Assessed in 1984															

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**TABLE
9**

RURAL AND URBAN POPULATIONS

	Population Density Persons/ 1000 ha 1989	Average Annual Change in Population (percent)						Urban Population as % of Total Population								Percentage of urban population			
		Urban			Rural											In largest city		In cities of 500,000+	
		65-70	75-80	85-90	65-70	75-80	85-90	1960	1970	1980	1990	2000	2010	2020	1960	1980	1960	1980	
(arithmetic mean)	1216	4.6	4.0	4.0	1.8	1.5	1.2	18	21	25	30	36	43	51	24	27	21	31	
ANE BUREAU (Pop wtd)	2537	3.8	4.1	3.8	2.1	1.8	1.2	18	20	24	29	35	42	53	16	17	28	42	
ANE NEAR EAST	500	3.8	4.0	3.9	1.9	1.8	1.2	35	38	42	48	54	62	67	29	33	35	45	
Egypt	516	2.4	3.1	3.3	2.3	2.4	1.4	43	44	45	49	55	62	68	38	39	53	53	
Jordan	424	4.9	4.0	5.1	1.5	0.1	1.8	43	51	60	68	74	78	82	31	37	0	37	
Morocco	540	4.4	4.0	3.9	2.0	1.1	0.9	29	35	41	49	55	65	68	16	26	16	50	
Oman	67	6.4	8.7	6.8	2.5	4.7	2.8	4	5	7	11	15	21	28	..	..	..	..
Tunisia	497	4.0	4.5	3.6	0.7	0.7	0.2	36	44	52	61	68	75	77	40	30	40	30	
Yemen	394	9.3	9.0	7.3	1.0	1.5	1.7	3	8	15	25	33	41	49	..	25	0	0	
ANE SOUTH ASIA	3169	3.7	4.0	3.8	2.1	1.8	1.2	17	19	22	26	32	40	51	11	11	25	40	
Bangladesh	8389	6.7	5.5	5.4	2.4	2.5	2.2	5	8	10	14	18	25	36	20	30	20	51	
India	2736	3.3	3.8	3.6	2.0	1.6	1.0	18	20	23	28	34	42	54	7	6	26	39	
Nepal	1320	4.3	7.1	6.7	2.0	2.1	1.9	3	4	6	10	10	14	23	41	27	0	0	
Pakistan	1424	3.9	4.1	3.7	2.4	2.4	1.6	22	25	28	32	38	45	57	20	21	33	51	
Sri Lanka	2659	4.2	1.3	1.7	1.8	1.8	1.4	18	22	22	21	24	31	43	28	16	0	16	
ANE SOUTHEAST ASIA	1136	3.8	4.3	3.9	2.2	1.7	1.0	18	20	24	30	37	45	56	29	32	37	47	
Burma	610	4.0	2.0	2.5	1.8	2.0	1.7	19	23	24	25	41	49	60	23	23	23	23	
Indonesia	985	3.9	4.9	4.3	2.0	1.4	0.8	15	17	22	29	36	44	56	20	23	34	50	
Philippines	2001	5.7	3.5	3.6	2.5	2.0	1.3	30	33	37	42	49	56	66	27	30	27	34	
Thailand	1071	3.7	5.0	4.3	2.9	1.8	0.9	13	13	17	23	23	30	42	65	69	65	69	
ANE OCEANIA	124	11.9	4.2	4.3	1.5	2.2	1.8	8	14	17	21	26	32	40	..	25	0	0	
Fiji	404	3.6	2.8	2.9	1.6	1.1	0.6	30	35	39	44	51	58	64	..	..	..	..
Papua New Guinea	86	15.1	4.5	4.5	1.4	2.5	2.0	3	10	13	16	20	27	34	..	25	0	0	
Solomon Islands	115	3.2	3.4	5.7	2.8	3.0	3.8	9	9	9	11	14	19	26	..	..	..	..
Cook Islands		1.4	1.3	2.4	1.7	0.9	0.4	31	30	30	33	40	48	56	..	..	..	..
Kiribati	* 650	6.7	5.0	3.5	0.8	-0.5	-0.8	16	26	38	49	57	64	69	..	..	..	..
Niue		-0.5	0.2	1.6	0.2	0.0	-0.5	22	21	21	23	30	38	46	..	..	..	..
Tonga		5.2	4.3	4.1	1.5	0.6	0.6	18	24	32	40	48	56	62	..	..	..	..
Tuvalu		X	X	X	X	X	X	X	X	X	X	X	X	X	..	..	..	..
Vanuatu	* 90	7.7	7.4	6.8	2.4	2.1	2.1	8	14	21	30	39	47	55	..	..	..	..
Western Samoa	* 550	3.2	1.4	2.3	2.0	0.8	0.4	19	20	21	24	30	37	45	..	..	..	..
Source: WRI WRR 88-89 Table 16.1 except ** WDR 88 Box A 1984 figures		Source: WRI WRR 88-89 Table 16.2 exc. 2000, 2010, 2020 and all 7 smaller island groups from: Estimates and Projections of Urban, Rural and City Populations 1950-2025: The 1982 Assessment												Source: IBRD WDR88 Table 32					

TABLE 10	VITAL STATISTICS						NUTRITION				
	Life Expectancy at Birth (years)		INFANT MORTALITY (infant deaths per 1000 live births)		CHILD MORTALITY (deaths of children <5 per 1000 live births)		MATERNAL MORTALITY (deaths from pregnancy per 100,000 live births)	Minimum Daily Caloric Requirement	Daily Caloric Supply as Percentage of Requirement		
	1965-70	1985-90	1965-70	1985-90	1965-70	1985-90	1980-84	1964-66	1974-76	1983-85	
ANE BUREAU (Pop wtd)	48.0	57.3	135	91	222	138		2228	87	90	101
ANE NEAR EAST	49.4	60.3	158	84	258	124		2433	93	103	119
Egypt	49.7	60.6	170	85	280	124	80	2,510	97	107	130
Jordan	51.7	66.0	102	44	150	57	X	2,460	93	96	a 121
Morocco	50.4	60.8	138	82	220	118	327	2,420	92	106	111
Oman	43.8	55.4	186	100	325	157	X	X	X	X	X
Tunisia	52.1	63.1	138	71	210	99	X	2,390	94	109	118
Yemen	40.9	50.9	186	120	325	196	X	2,420	80	84	93
ANE SOUTH ASIA	47.4	56.5	143	102	236	153	520	2220	88	87	96
Bangladesh	43.3	49.6	140	119	228	188	600	2,210	91	83	84
India	48.0	57.9	145	99	239	148	500	2,210	89	87	98
Nepal	40.6	47.9	164	128	260	196	850	2,200	87	86	93
Pakistan	45.5	52.1	145	107	239	165	600	2,310	76	91	95
Sri Lanka	64.2	70.0	61	33	87	43	92	2,220	100	93	109
ANE SOUTHEAST ASIA	49.5	59.2	104	62	167	94	504	2188	85	97	113
Burma	49.5	60.0	110	63	160	85	135	2,160	89	99	117
Indonesia	45.1	56.0	120	74	201	117	800	2,160	81	95	116
Philippines	56.2	63.5	70	45	114	72	80	2,260	82	94	102
Thailand	56.7	64.2	84	39	118	49	270	2,220	95	102	110
ANE OCEANIA	47.5	57.5	117	56	172	75		2,660	80	86	87
Fiji	62.7	70.4	55	26	73	31	X	2,660	93	99	110
Papua New Guinea	45.1	54.0	130	62	193	84	1000	2,660	72	78	# 82
Solomon Islands	X	58	X	X	X	X	X	2,660	84	77	78
Cook Islands								2,660 *			
Kiribati		52						2,660 *			98
Niue								2,660 *			
Tonga		64						2,660 *			108
Tuvalu								2,660 *			
Vanuatu		63						2,660 *			88
Western Samoa		65						2,660 *			89

Note: ● = 1986
Source: IBRD
WDR Box A

Source: WRR 88-89 Table 15.3
Original sources: United Nations Population Division,
United Nations Children's Fund,
and U.N. Food and Agriculture Organization
Note: X = not available

Note: * = same mdr
assumed for all
Oceania

Note: # = '82-84
Note: a = from IBRD
WDR 88

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**TABLE
11**

DISEASE IMMUNIZATION

WATER UTILITIES

	Percentage of One-year-olds Fully Immunized Against:								Percentage of Population with Access to Safe Drinking Water						Percentage of Population with Access to Sanitation Services					
	TUBER-CULOSIS		DPT		POLIO		MEASLES		Total		Urban		Rural		Total		Urban		Rural	
	1981	1986	1981	1986	1981	1986	1981	1986	1980	1985	1980	1985	1980	1985	1980	1985	1980	1985	1980	1985
ANE BUREAU (Pop wtd)	23	42	26	50	12	44		19	39	49	65	64	31	44	14	17	32	37	9	12
ANE NEAR EAST		73	63	70	65	70		67												
Egypt	71	84	82	87	84	86	65	85	75	X	88	X	64	X	X	X	X	X	10	X
Jordan	0	2	81	52	87	54	40	39	86	96	100	100	65	88	70	X	94	92	34	X
Morocco	X	71	43	53	45	53	X	48	X	59	X	100	X	25	X	X	X	62	X	16
Oman	49	90	9	84	9	84	6	76	X	53	X	90	X	49	X	31	X	88	X	25
Tunisia	65	80	36	70	37	70	65	65	60	70	100	100	17	31	X	55	100	84	X	16
Yemen	15	28	25	16	25	16	40	19	31	40	100	100	18	25	X	X	60	83	X	X
ANE SOUTH ASIA	12	32	25	48	6	42		7	40	53	71	71	30	47	8	10	29	33	2	3
Bangladesh	1	5	1	5	1	4	X	3	39	46	26	24	40	49	3	5	21	24	1	3
India	12	29	31	53	7	45	X	1	42	57	77	76	31	50	7	9	27	31	1	2
Nepal	32	67	16	38	1	31	2	66	12	28	83	70	7	25	2	X	16	17	1	1
Pakistan	11	68	3	55	3	55	2	40	35	44	72	83	20	27	13	19	42	51	2	6
Sri Lanka	58	76	45	77	46	77	X	47	28	40	65	82	18	29	67	44	80	65	63	39
ANE SOUTHEAST ASIA	54	66		48		45		41	33	43	43	45	30	43	35	43	45	49	32	40
Burma	15	32	5	20	X	4	X	3	20	27	38	36	15	24	20	24	38	33	15	21
Indonesia	55	67	5	48	X	46	X	47	23	38	35	43	19	36	23	37	29	33	21	38
Philippines	61	72	51	55	44	55	X	53	45	52	49	49	43	54	72	67	81	83	67	56
Thailand	71	83	52	62	31	62	X	39	63	64	65	56	63	66	45	52	64	78	41	46
ANE OCEANIA									25	32	65	95	25	21	24	46	93	98	18	37
Fiji	X	X	X	X	X	X	X	X	77	X	94	X	66	X	70	X	85	X	60	X
Papua New Guinea	64	78	31	43	31	37	X	29	16	26	55	95	10	15	15	44	96	99	3	35
Solomon Islands	X	X	X	X	X	X	X	X	X	X	96	X	45	X	X	X	80	X	21	X
Cook Islands									X	92	100	99	X	88	X	99	100	100	76	99
Kiribati									X	X	X	X	X	X	X	X	X	X	X	X
Niue									X	X	X	X	X	100	X	X	X	X	X	X
Tonga									17	99	86	99	70	99	19	52	97	99	94	40
Tuvalu									X	X	X	100	X	100	X	X	100	81	80	73
Vanuatu									X	64	65	95	53	54	X	40	95	86	68	25
Western Samoa									X	69	97	75	94	67	X	84	86	88	83	83

Source: WRI WRR Table 15.5
Original sources: United Nations Children's Fund
0 = zero or less than one-half of one percent;
X = not available

Source: WRI WRR Table 15.4
Original sources: World Health Organization;
(when no calculation is made)
0 = zero or less than one-half of one percent;
X = not available

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**TABLE
12**

LITERACY AND EDUCATION

	LITERACY		PRIMARY				SECONDARY		TERTIARY		EXPENDITURE				
	Adult Literacy Rate		Primary School Enrollment as % of Age Group		Percentage of First Grade Enrollment Completing Primary School		Secondary School Enrollment as % of Age Group 1983-85		Number of Third Level Students per 100,000 in 1980		Current Educational Expenditure (1980)				
	Female	Male	Female	Male	Female	Male	Female	Male	Male	Female	as % of GNP	as % of Current Government Expenditure			
	1970	1985	1970	1985	1960	1986	1960	1986	1980-86	Female	Male	Male	Female		
ANE BUREAU (Pop wtd)	27	36	51	59	43	75	76	98	45	26	42				
ANE NEAR EAST	16	28	42	55	40	72	72	99	64	41	58				
Egypt	20	30	50	59	52	76	80	94	64	52	73	1799	860	3.5 d	10.1 d
Jordan	29	63	64	87	59	99	94	98	97	78	80	1200	1050	4.2	10.5
Morocco	10	22	34	45	27	63	67	98	70	25	38	819	255	4.9	23.3
Oman	X	12	X	47		80		97	60	21	43			1.1 a	2 a
Tunisia	17	41	44	68	43	108	88	127	78	33	46	695	301	4.6	23.5
Yemca	1	3	9	27	X	22	14	112	15	3	17	146	17	3.1	x
ANE SOUTH ASIA	19	28	44	54	36	69	74	98	36	21	41				
Bangladesh	12	22	36	43	26	50	66	70	20	10	26	455	78	1.1	15.4
India	20	29	47	57	40	76	80	107	38	24	45	1107 a	359 a	3 d	13.7 d
Nepal	3	12	23	39	1	44	19	80	27	19	51	426	105	1.6 f	8.3 f
Pakistan	11	19	30	40	13	33	46	66	34	8	21	250 a	83 a	1.3	5.2
Sri Lanka	69	83	85	91	90	102	100	105	91	67	60	318	257	2.6	15.3
ANE SOUTHEAST ASIA	56	65	75	75	67	96	85	99	68	36	41				
Burma	57	X	85	X	52	X	61	X	27	X	X	180 e		1.6 b	14.6 b
Indonesia	42	65	66	83	58	116	86	121	83	34	45	579 d	232 d	2.3 a	x a
Philippines	80	85	83	86	93	106	98	105	54	66	63	2395	2795	1.5 a	13.8 a
Thailand	72	88	86	94	79	93	88	93	64	35	35	1275 e		2.4	19.1
ANE OCEANIA															
Fiji	X	X	X	X	X	X	X	X	X	X	X	403 d	219 d	5.4 d	22.4 d
Papua New Guinea	24	35	39	55	7	55	59	68	67	8	15	240	73	6.3 a	19.9 a
Solomon Islands	X	X	X	X	X	X	X	X	X	X	X	x	x	3.2 e	15.6 c
Cook Islands															
Kiribati														12.3	17.4
Niue															
Tonga														4.3 c	20.5 c
Tuvalu															
Vanuatu															
Western Samoa															

Source: WRR 88-89 Table 15.6
Original source: United Nations Children's Fund

Source: UNESCO Statistical Yearbook
1984, Tables 3.10 and 4.1
Notes: a = 1975; b = 1977;
c = 1979; d = 1981;
e = Male and Female combined;
f = Total Educational Expenditures

**TABLE
13**

LAND DISTRIBUTION

	TOTAL		DISTRIBUTION (percentage of land area)								CHANGES			
	Total land area 1985 (1000km ²)	% of region	Cropland		Permanent meadows and pastures		Forest and woodland		Other land		Major changes in distribution (3+ percentage points change) 1964-66 to 1984-86			
			64-66	84-86	64-66	84-86	64-66	84-86	64-66	84-86	Cropland	Pastures	Forest	Other
(Arithmetic mean)	586	6%	20	22	8	10	35	32	43	43				
ANE BUREAU (Land wtd)	9978		26	28	6	7	32	31	36	15				
ANE NEAR EAST	2102	21%	8	8	11	16	3	4	78	73				
Egypt	995	10%	47%	3	3	0	0	0	0	97	97			
Jordan	97	1%	5%	4	4	1	8	0	1	95	87			
Morocco	446	4%	21%	16	19	28	47	12	12	44	23	3	7	-8
Oman	212	2%	10%	0	0	5	5	0	0	95	95		19	-21
Tunisia	155	2%	7%	28	31	16	20	3	4	53	46	3	3	-7
Yemen	195	2%	9%	7	7	36	36	8	8	49	49			
ANE SOUTH ASIA	4080	41%	48	50	5	5	17	19	30	27				
Bangladesh	134	1%	3%	67	68	4	4	17	16	12	12			
India	2973	30%	73%	55	57	5	4	20	23	20	17			-3
Nepal	137	1%	3%	13	17	12	14	18	17	57	52	4		-5
Pakistan	771	8%	19%	25	27	6	6	3	4	66	63			-3
Sri Lanka	65	1%	2%	28	29	4	7	49	27	19	37		3	-22
ANE SOUTHEAST ASIA	3279	33%	15	18	4	4	61	55	20	23				
Burma	658	7%	20%	16	15	1	1	49	49	35	35			
Indonesia	1812	18%	55%	10	12	7	7	68	68	15	15			
Philippines	298	3%	9%	31	26	3	4	57	38	10	32	-4		-19
Thailand	512	5%	16%	25	38	1	1	51	29	24	31	14		-22
ANE OCEANIA	517	5%	1	2	0	0	82	81	15	16				
Fiji	18	0%	4%	11	13	4	3	65	65	20	19			
Papua New Guinea	452	5%	87%	1	1	0	0	86	85	14	14			
Solomon Islands	28	0%	5%	2	2	1	1	93	93	4	4			
Cook Islands	0	0%	0%	26	26	0	0	0	0	74	74			
Kiribati	1	0%	0%	58	52	0	0	3	3	39	45	-6		6
Niue	0	0%	0%	77	65	0	4	19	19	4	12	-12	4	8
Tonga	1	0%	0%	75	81	3	6	16	12	6	1	6	3	-4
Tuvalu	0	0%	0%	0	0	0	0	0	0	100	100			
Vanuatu	15	0%	3%	6	10	2	2	1	1	91	87	4		-4
Western Samoa	3	0%	1%											

Source: WRR 88-89
Table 16.1
Orig. source: Food and
Agricultural Organization

Source: WRR Unpublished Data
based on FAO statistics

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**TABLE
14**

AGRICULTURE

	Index of Agricultural Production (1979-81 = 100)				Index of Food Production (1979-81 = 100)				Cereals			Roots and Tubers		
	Total		Per Capita		Total		Per Capita		Kilogra per Hectare	Percentage Change Over		Kilogra per Hectare	Percentage Change Over	
	64-66	84-86	64-66	84-86	64-66	84-86	64-66	84-86	84-86	64-66	74-76	84-86	64-66	74-76
ANE BUREAU (see note)	66	121	94	109	65	121	93	109	2296	67	28	12064	47	17
ANE NEAR EAST	74	115	106	101	73	117	104	103	2677	27	9	14047	24	4
Egypt	73	113	102	100	70	117	98	104	4471	26	14	18572	7	4
Jordan	128	122	191	102	129	122	193	102	542	-47	-16	19082	115	62
Morocco	73	120	110	106	73	120	110	105	1145	58	9	5420	-48	-53
Oman	X	X	X	X	X	X	X	X	1787	60	40	4032	X	X
Tunisia	69	119	96	107	70	119	96	107	808	17	-2	11262	37	19
Yemen	78	124	102	108	78	125	101	109	543	-27	-34	21312	245	94
ANE SOUTH ASIA	68	120	97	108	67	121	95	108	1648	74	31	13040	49	17
Bangladesh	80	114	121	99	79	114	119	99	2227	35	26	10566	29	6
India	67	122	94	111	66	123	93	111	1590	76	35	14268	61	21
Nepal	82	113	116	101	82	114	116	102	1651	-10	-6	5676	-1	0
Pakistan	60	121	91	104	59	118	90	101	1668	91	20	10199	10	-5
Sri Lanka	63	97	84	89	51	95	68	87	2850	60	56	11141	81	151
ANE SOUTHEAST ASIA	57	124	82	112	57	125	82	113	2989	97	45	10338	66	28
Burma	66	135	95	123	66	136	95	124	2925	91	68	9805	189	74
Indonesia	57	128	81	117	57	130	80	118	3458	126	48	10304	48	23
Philippines	53	106	78	94	53	106	79	94	1852	77	39	5895	5	11
Thailand	56	120	83	109	55	120	82	108	2075	14	10	13731	5	-4
ANE OCEANIA	64	111	95	98	69	112	103	99	1523	-30	-20	7533	4	1
Fiji	69	110	94	100	70	110	95	101	2,157	24	-1	9,139	2	-3
Papua New Guinea	64	111	96	97	71	112	106	99	1,428	-35	-24	6,973	3	1
Solomon Islands	55	128	89	107	55	128	89	107	2,673	27	34	15,702	23	19
Cook Islands														
Kiribati														
Niue														
Tonga														
Tuvalu														
Vanuatu														
Western Samoa														

Source: WRR 88-89 Table 17.1

Original source: U.N. Food and Agricultural Organization

Note: Production indices weighted by population; per hectare yields weighted by land area.

**TABLE
15**

AGRICULTURAL INPUTS

	CROPLAND		Irrigated Land as a Percentage of Arable and Permanent Cropland				Percentage Crop Area Planted in				Average Annual Total Pesticide Use (metric tons of active ingredient)		Tractors per 1000 ha						
	Total (1000 hectares)	Per Capita (hectares per person)	Fertilizer Use (kilograms per ha cropland)		74-76		High Yielding Varieties		Improved Varieties	Maize	1976-80	1981-85	64-66						
			74-76	83-85	Rice	Wheat	64-66	74-76					83-85						
	1985	64-66	74-76	83-85	74-76	84-86	1970	1983	1970	1984	1986	1976-80	1981-85	64-66	74-76	83-85			
ANE BUREAU (cropland wt)	279,880	0.23	6	20	47	23	28							0.5	1.4	3.6			
ANE NEAR EAST	17,626	0.4	22	38	72	22	24							2.4	4.0	6.0			
Egypt	2,486	0.05	117	170	357	100	100	X	X	X	X	64	22,073	a	17,157	5.5	8.7	16.9	
Jordan	418	0.12	12	16	39	9	10	X	X	X	X	X	X	X	X	5.4	9.1	12.2	
Morocco	8,401	0.38	7	22	31	14	15	X	X	X	30	X	X	X	X	1.1	2.4	3.6	
Oman	47	0.04	X	9	74	92	87	X	X	X	100	X	X	X	X	0.3	1.6	2.3	
Tunisia	4,923	0.70	5	11	17	3	5	X	X	5	36	X	X	X	X	3.3	5.0	5.3	
Yemen	1,551	0.20	0	2	10	8	18	X	X	X	X	X	324	a	2,510	0.1	0.4	1.6	
ANE SOUTH ASIA	203,109	0.21	5	18	46	25	31	13	48	33	86			0.3	1.4	3.6			
Bangladesh	9,135	0.09	6	22	60	15	22	3	25	8	96	X	X	673		0.1	0.3	0.5	
India	168,950	0.22	5	17	43	20	26	12	49	30	76	36	57,957	*	49,144	0.3	1.3	3.3	
Nepal	2,319	0.14	1	6	17	10	28	4	36	34	92	X	X	X	X	0.2	0.2	1.2	
Pakistan	20,500	0.20	5	28	64	69	77	31	46	43	86	28	X	232		0.4	1.9	7.2	
Sri Lanka	2,205	0.14	51	44	80	23	26	5	87	X	X	X	195	*	210	4.1	7.2	12.1	
ANE SOUTHEAST ASIA	58,467	0.24	5	18	44	17	22	10	54			42				0.4	0.9	2.7	
Burma	10,067	0.27	1	5	17	10	11	3	51	X	X	34	X	X		0.3	0.8	0.9	
Indonesia	20,880	0.13	6	25	81	25	33	10	83	X	X	25	4,740	*	8,328	0.4	0.5	0.5	
Philippines	7,900	0.14	11	27	33	11	18	44	85	X	X	26	3,097	*	4,571	0.6	1.1	2.4	
Thailand	19,620	0.38	3	12	23	14	19	0	13	X	X	70	3,081	*	2,787	0.3	1.3	6.1	
ANE OCEANIA	678	0.20	13	32	29	X	X									4.4	3.9	8.7	
Fiji	240	0.35	32	53	43	0	0	X	X	X	X	X	X	X	X	5.5	6.0	19.5	
Papua New Guinea	383	0.11	1	19	20	X	X	X	X	X	X	X	X	X	X	3.8	3.2	3.1	
Solomon Islands	55	0.20	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0.0	0.0	
Cook Islands																			
Kiribati																			
Niue																			
Tonga																			
Tuvalu																			
Vanuatu																			
Western Samoa																			

Source: WRR 88-89 Table 17.2

Original sources: U.N. Food and Agricultural Organization, United Nations Population Division, and other sources.

Note: a = may not be active ingredients

Note: * = one

Note: 0 = zero or less than one half the unit of measure; X = not available

year of data

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**TABLE
16**

AGRICULTURAL HOLDINGS

	Agricultural Holdings: Distribution by Size of Holding (percent)									Agricultural Area: Distribution by Size of Holding (percent)								
	1960			1970			1980			1960			1970			1980		
	<5 ha	5-50 ha	50+ ha	<5 ha	5-50 ha	50+ ha	<5 ha	5-50 ha	50+ ha	<5 ha	5-50 ha	50+ ha	<5 ha	5-50 ha	50+ ha	<5 ha	5-50 ha	50+ ha
ANE BUREAU																		
ANE NEAR EAST																		
Egypt	90	10	0	X	X	X	X	X	X	51	34	16	X	X	X	X	X	X
Jordan	X	X	X	X	X	X	70	29	1	X	X	X	X	X	X	19	53	28
Morocco	75	25	0	X	X	X	X	X	X	38	62	0	X	X	X	X	X	X
Oman	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tunisia	41	55	4	X	X	X	X	X	X	6	54	40	X	X	X	X	X	X
Yemen	X	X	X	X	X	X	89	11	0	X	X	X	X	X	X	44	52	5
ANE SOUTH ASIA																		
Bangladesh	X	X	X	X	X	X	100	0	0	X	X	X	X	X	X	100	0	0
India	87	13	0	89	11	0	91	9	0	47	51	3	47	50	4	51	46	3
Nepal	X	X	X	97	3	0	97	3	0	X	X	X	72	27	1	71	29	0
Pakistan	80	20	0	68	31	1	73	26	1	32	68	0	30	58	11	34	57	9
Sri Lanka	97	3	0	98	2	0	98	2	0	53	20	28	58	42	0	62	38	0
ANE SOUTHEAST ASIA																		
Burma	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Indonesia	98	3	0	98	2	0	X	X	X	67	21	12	69	18	14	X	X	X
Philippines	81	19	0	85	15	0	86	14	0	43	45	12	48	38	14	51	37	12
Thailand	72	28	0	X	X	X	74	26	0	43	57	0	X	X	X	42	58	0
ANE OCEANIA																		
Fiji	X	X	X	58	42	0	85	14	1	X	X	X	13	87	0	17	41	42
Papua New Guinea	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Solomon Islands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cook Islands																		
Kiribati																		
Niue																		
Tonga																		
Tuvalu																		
Vanuatu																		
Western Samoa																		

Source: WRR 88-89 Table 17.3

Original source: U.N. Food and Agricultural Organization

X = not available

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TABLE
17

SOIL EROSION

	Country	Extent and Location	Affected Area as % of National Area	Amount of Erosion (metric tons per year)	Rate of Erosion (metric tons per hectare per year)	Year of Estimate
ANE BUREAU						
ANE NEAR EAST						
Egypt						
Jordan						
Morocco						
Oman						
Tunisia						
Yemen	Yemen	Abandoned terraces Serat Mountains (4,900 ha)	0.03	X	150-400	1984
ANE SOUTH ASIA						
Bangladesh	India	Seriously affected cropland (80 million ha)	27	6 billion	75	1975
India		Cultivated land Deccan Black Soil region	X	X	40-100	1980s
Nepal	Nepal	Entire country (13.7 million ha)	100	240 million	35-70	X
Pakistan						
Sri Lanka						
ANE SOUTHEAST ASIA						
Burma	Burma	Irrawaddy River basin (43,000 ha)	.07	X	139	1980s
Indonesia	Indonesia	Brantas River basin Java	X	X	43	
Philippines						
Thailand						
ANE OCEANIA						
Fiji						
Papua New Guinea						
Solomon Islands						
Cook Islands						
Kiribati						
Niue						
Tonga						
Tuvalu						
Vanuatu						
Western Samoa						

Source: World Resources Institute and International Institute for Environment and Development

Note: X = not available

**TABLE
18**

FOREST SIZES AND TYPES

	Extent of Forest and Woodland 1980 (1000 has)			Deforestation, 1980s		Reforestation 1980s	Managed Closed Forest 1980 (1000 has)	Protected Closed Forest 1980 (1000 has)
	Open	Closed	Total	Average Annual Extent	Percent	(1000 has per year)		
				(1000 has per year)	per Year			
ANE BUREAU (see note)	21403	262317	283720	1546	0.55	411	37805	24314
ANE NEAR EAST	1874	1719	3593	18	0.50	11	584	7
Egypt	X	X	0	X	0.0	2	X	X
Jordan	50	X	50	X	X	X	X	X
Morocco	1,703	1,533	3236	13	0.4	5	421	7
Oman	X	X	0	X	X	X	X	X
Tunisia	111	186	297	5	1.7	4	163	X
Yemen	10	X	10	X	X	X	X	X
ANE SOUTH ASIA	5868	58553	64421	306	0.52	148	33762	7342
Bangladesh	X	927	927	8	0.9	9	795	25
India	5,393	51,841	57234	147	0.3	120	32,557	6,779
Nepal	180	1,941	2121	84	4.0	2	X	330
Pakistan	295	2,185	2480	9	0.4	7	410	15
Sri Lanka	X	1,659	1659	58	3.5	10	X	193
ANE SOUTHEAST ASIA	9440	164581	174021	1196	0.68	244	3459	16829
Burma	X	31,941	31941	105	0.3	2	3,419	299
Indonesia	3,000	113,895	116895	620	0.5	187	40	13,620
Philippines	X	9,510	9510	92	1.0	42	X	690
Thailand	6,440	9,235	15675	379	2.4	13	X	2,220
ANE OCEANIA	3962	37464	41426	26	0.06	8	0	136
Fiji	0	811	811	2	0.2	4	X	X
Papua New Guinea	3,945	34,230	38175	23	0.1	2	0	136
Solomon Islands	17	2,423	2440	1	0.0	2	X	X
Cook Islands								
Kiribati								
Niue								
Toonga								
Tuvalu								
Vanuatu								
Western Samoa								

Source: WRR 88-89 Table 18.1

Original sources: U.N. Food and Agriculture Organization; U.N. Economic Commission for Europe; U.N. Environment Programme; and country data sources.

0 = zero or less than half the unit of measure; X = not available.

Note: Deforestation rate calculated with Land weights.

**TABLE
19**

FOREST PRODUCTION

Average Annual Production (thousand cubic meters)

	ROUNDWOOD		FUELWOOD AND CHARCOAL		INDUSTRIAL ROUNDWOOD		SAWNWOOD		PANELS		PAPER (1000 metric tons)	
	% Change Since		% Change Since		% Change Since		% Change Since		% Change Since		% Change Since	
	84-86	74-76	84-86	74-76	84-86	74-76	84-86	74-76	84-86	74-76	84-86	74-76
AFRICA BUREAU	1152935		1008904		143695		54321		12307		6368	
AFRICA NEAR EAST	6853		5868		985		149		149		294	
Egypt	2,010	29	1,917	29	93	29	X	X	44	16	145	33
Jordan	9	-10	5	25	4	-33	X	X	X	X	X	X
Morocco	2,043	58	1,274	63	769	50	149	84	105	184	106	116
Oman	X	X	X	X	X	X	X	X	X	X	X	X
Tunisia	2,791	26	2,672	26	119	35	X	X	X	X	43	139
Yemen	X	X	X	X	X	X	X	X	X	X	X	X
AFRICA SOUTH ASIA	318294		291325		26970		17350		517		1867	
Bangladesh	27,156	30	26,297	32	859	-15	111	-50	X	X	118	131
India	245,905	24	222,302	22	23,603	45	16,942	148	442	143	1,649	81
Nepal	15,779	25	15,219	27	560	0	220	0	X	X	X	X
Pakistan	20,833	38	19,564	34	1,269	165	55	-38	61	110	77	64
Sri Lanka	8,621	21	7,943	20	679	34	22	-39	14	-44	23	15
AFRICA SOUTHEAST ASIA	246071		204413		41657		9512		5543		1170	
Burma	18,714	24	15,852	22	2,861	34	504	25	15	25	X	X
Indonesia	155,570	22	127,279	23	28,291	22	6,921	186	4,656	3,914	505	931
Philippines	35,527	7	29,398	29	6,129	-41	1,080	-26	565	1	197	-24
Thailand	36,260	17	31,884	24	4,376	-16	1,007	-38	307	169	468	150
AFRICA OCEANIA	8676		5780		2727		224		19		0	
Fiji	235	42	37	311	198	27	86	4	X	X	X	X
Papua New Guinea	7,623	30	5,533	16	2,090	85	119	-17	19	-17	X	X
Solomon Islands	649	52	210	12	499	84	16	100	X	X	X	X
Cook Islands												
Kiribati												
Niue												
Tonga	4	100			4		1	100				
Tuvalu												
Vanuatu	38	19	24	9	14	280	3	50				
Western Samoa	131	18	70	17	61	20	21	50				

Source: WRR 88-89 Table 18.2

Original sources: United Nations Food and Agriculture Organization

0 = zero or less than one half of one percent; X = not available

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TABLE 20	PROTECTED AREAS										
	National Protection Systems					International Protection Systems					Total Land Area (hectares)
	Marine and Coastal Protected Areas		All Protected Areas		Percentage of National Land Area Protected	Biosphere Reserves	Natural World Heritage Sites	Wetlands of International Importance			
	Number	Area (hectares)	Number	Area (hectares)				Number	Area (hectares)		
(Arithmetic mean)	2.17										
ANE BUREAU (Land wild)	120	10,961,844	638	41,317,956	4.13	18	1,606,201	7	18	188,415	996,588,000
ANE NEAR EAST	12	658,005	26	1,055,289	0.50	5	33,425	1	6	30,552	210,175,000
Egypt	5	616,100	5	616,100	0.62	1	1,000	0	xxx	xxx	99,545,000
Jordan	0	0	2	34,300	0.35	0	0	0	1	7,372	9,718,000
Morocco	4	22,600	10	294,434	0.66	0	0	0	4	10,580	44,630,000
Oman	0	0	2	54,000	0.25	0	0	0	xxx	xxx	21,246,000
Tunisia	3	19,305	7	56,455	0.36	4	32,425	1	1	12,600	15,536,000
Yemen	0	0	0	0	0.00	0	0	0	xxx	xxx	19,500,000
ANE SOUTH ASIA	24	853,925	37	21,947,477	5.36	3	40,731	6	12	157,863	408,736,000
Bangladesh	3	32,386	9	94,961	0.71	0	0	0	xxx	xxx	13,391,000
India	14	473,802	267	12,910,021	4.34	0	0	4	2	119,373	297,319,000
Nepal	NA	NA	11	964,887	7.05	0	0	2	1	17,500	13,680,000
Pakistan	1	15,540	52	7,290,580	9.36	1	31,355	0	9	20,990	77,872,000
Sri Lanka	6	332,197	37	687,028	10.61	2	9,376	0	xxx	xxx	6,474,000
ANE SOUTHEAST ASIA	81	9,247,924	230	18,108,707	5.52	10	1,532,045	0	0	0	347,925,000
Burma	0	0	1	3,056	0.00	0	0	xxx	xxx	xxx	65,774,000
Indonesia	66	8,595,298	135	13,590,792	7.50	6	1,482,400	xxx	xxx	xxx	181,157,000
Philippines	5	30,722	29	498,947	1.67	1	23,545	0	xxx	xxx	29,817,000
Thailand	10	621,904	65	4,015,912	7.85	3	26,100	0	xxx	xxx	51,177,000
ANE OCEANIA	3	201,990	6	206,483	0.40	0	0	0	0	0	49,752,000
Fiji	1	4,000	2	5,350	0.29	0	0	xxx	xxx	xxx	1,827,000
Papua New Guinea	2	197,990	4	201,133	0.45	0	0	xxx	xxx	xxx	45,171,000
Solomon Islands	0	0	0	0	0.00	0	0	xxx	xxx	xxx	2,754,000
Cook Islands											
Kiribati											
Niue											
Tonga											
Tuvalu											
Vanuatu											
Western Samoa											
Source: WRR 88-89 Table 19.1 Original source: International Union for Conservation of Nature and Natural Resources											Source: WRR 88-89 Table 16.1
Notes: NA = not applicable. 0 = zero or less than half unit of measure;						Note: xxx = country not a full party to the convention					

TABLE
21

ENERGY PRODUCTION AND CONSUMPTION I

COUNTRY AND REGION COMPARISONS

	Average annual energy growth rate (percent)				Energy consumption per capita (kilograms of oil equivalent)		ENERGY PRODUCTION		ENERGY CONSUMPTION		POPULATION	
	Energy production		Energy consumption		1965-80		1980-86		1965		1986	
	1965-80	1980-86	1965-80	1980-86	1965	1986	% of ANE	% of SUBREG	% OF ANE	% OF SUBREG	% of A/NE	% of SUBREG
(Pop weighted)	9.6		6.1									
ANE BUREAU (See note)	8.8	7.2	7.0	6.1	118	304						
ANE NEAR EAST	13.3	8.7	11.3	7.5	216	807	0.25	<u>PRODUCER</u>	0.16		0.06	
Egypt	10.7	7.6	6.2	7.3	313	577	0.13	0.53	0.09	0.54	0.03	0.53
Jordan	..	..	9.3	9.2	226	767	0.00	0.00	0.01	0.06	0.00	0.04
Morocco	2.5	-2.5	7.9	2.7	124	246	0.00	0.01	0.02	0.12	0.02	0.25
Oman	16.0	11.9	30.5	10.4	14	2146	0.10	0.40	0.03	0.17	0.00	0.01
Tunisia	20.4	-0.5	8.5	6.5	170	499	0.02	0.06	0.01	0.08	0.01	0.08
Yemen	..	..	21.0	13.8	7	102	0.00	0.00	0.00	0.02	0.01	0.08
ANE SOUTH ASIA	5.6	8.9	5.5	6.5	102	203	0.44	<u>CONSUMER</u>	0.62		0.71	
Bangladesh	..	17.3	..	8.8	..	46	0.01	0.02	0.02	0.03	0.07	0.10
India	5.6	8.9	5.8	6.4	100	208	0.40	0.90	0.53	0.86	0.54	0.76
Nepal	18.4	14.6	6.2	11.6	6	23	0.00	0.00	0.00	0.00	0.01	0.02
Pakistan	6.5	7.4	3.5	6.9	135	205	0.03	0.08	0.06	0.10	0.07	0.10
Sri Lanka	10.4	10.7	2.2	4.1	107	139	0.00	0.00	0.00	0.01	0.01	0.02
ANE SOUTHEAST ASIA	9.8	4.2	8.3	4.2	97	233	0.31	<u>PRODUCER</u>	0.22		0.22	
Burma	8.4	5.3	4.9	5.8	39	76	0.01	0.02	0.01	0.04	0.03	0.12
Indonesia	9.9	0.9	8.4	3.9	91	213	0.28	0.90	0.12	0.54	0.12	0.54
Philippines	9.0	11.6	5.8	-1.9	160	180	0.01	0.02	0.03	0.16	0.04	0.18
Thailand	9.0	47.3	10.1	8.2	81	325	0.02	0.07	0.06	0.27	0.04	0.16
ANE OCEANIA							0.000	<u>CONSUMER</u>	0.005		0.004	
Fiji							0.00		0.06	0.15	0.00	0.14
Papua New Guinea	13.7	6.7	13.0	2.6	56	244	0.00		0.00	0.57	0.00	0.71
Solomon Islands									0.00	0.04	0.00	0.06
Cook Islands									0.00	0.17	0.00	0.00
Kiribati									0.00	0.00	0.00	0.01
Niue									0.00	0.00	0.00	0.00
Tonga									0.00	0.02	0.00	0.02
Tuvalu									0.00	0.00	0.00	0.00
Vanuatu									0.00	0.02	0.00	0.03
Western Samoa									0.00	0.04	0.00	0.03

Source: IBRD WDR 88 Table 10

* Prod. totals weighted by 1986 prod. percentages * Cons. totals weighted by 1986 cons. percentages

TABLE 22	ENERGY PRODUCTION AND CONSUMPTION II													
	PRODUCTION								CONSUMPTION					
	Total		Solid		Liquid		Gas		Total		Per Capita		per constant 1980\$US of GNP	
	Change 1986 (peta- joules)	over 1970 (%)	Change 1986 (peta- joules)	over 1970 (%)	Change 1986 (peta- joules)	over 1970 (%)	Change 1986 (peta- joules)	over 1970 (%)	Change 1986 (peta- joules)	over 1970 (%)	Change 1986 (giga- joules)	over 1970 (%)	Change 1986 (mega- joules)	over 1970 (%)
ANE BUREAU	14789		4313		7874		2194		11610		8		21.5	
ANE NEAR EAST	3655	132	23		3337		253		1814	2077	20		28.5	
Egypt	1,927	168	X	X	1,725	147	163	5,333	988	289	21	172	34.4	59
Jordan	1	X	X	X	1	X	X	X	111	517	30	283	26.5	128
Morocco	30	43	23	77	1	-50	3	50	213	154	9	64	10.4	35
Oman	1,445	104	X	X	1,375	94	70	X	316	10433	245	5,241	63.1	5,572
Tunisia	237	34	X	X	220	24	17	X	151	251	21	150	15.0	46
Yemen	15	X	X	X	15	X	X	X	35	1650	5	X	9.8	460
ANE SOUTH ASIA	6473	193	4152		1396		649		7168	170	7		24.3	
Bangladesh	122	X	X	X	4	X	117	X	188	X	2	X	11.7	X
India	5,844	194	4,111	161	1,312	352	210	1,005	6,160	175	8	97	26.3	47
Nepal	2	NM	0	X	X	X	X	X	13	160	1	X	5.3	69
Pakistan		204	41	11	80	300	322	235	751	133	7	42	21.7	1
Sri Lanka	10	233	X	X	X	X	X	X	56	24	3	-17	10.9	-37
ANE SOUTHEAST ASIA	4658	302	138		3141		1292		2581	208	8		14.2	
Burma	108	184	2	X	60	76	42	2,000	95	102	3	75	12.5	-3
Indonesia	4,169	123	51	920	2,973	64	1,120	2,283	1,392	243	8	137	14.3	29
Philippines	77	863	25	2,400	14	X	X	X	403	37	7	-11	12.2	-23
Thailand	304	2664	60	1,400	94	NM	130	NM	691	253	13	141	15.8	39
ANE OCEANIA									54	127	11			
Fiji	1	X	X	X	X	X	X	X	8	14	11	-18	5.9	-41
Papua New Guinea	2	NM	X	X	X	X	X	X	31	182	9	X	X	X
Solomon Islands	X	X	X	X	X	X	X	X	2	100	7	X	10.8	X
Cook Islands									9		450			
Kiribati									0		4			
Niue									0		14			
Tonga									1		9			
Tuvalu														
Vanuatu									1		7			
Western Samoa									2		12			

Source: WRR 88-89 Table 20.1

Original sources: United Nations Statistical office,

United Nations Population Division, and the World Bank

Note: 0 = zero or less than half the unit of measure; X = not available; NM = not meaningful

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**TABLE
23**

ENERGY SUPPLY POTENTIAL

	Bituminous Coal (million metric tons)			Lignite and Subbituminous Coal (million metric tons)			Crude Oil (million metric tons)	Natural Gas (billion cubic meters)	Hydroelectric (megawatts)		
	Year of Data	Proved Reserves in Place	Proved Recoverable Reserves	Year of Data	Proved Reserves in Place	Proved Recoverable Reserves	Proved Reserves (1984)	Recoverable Reserves (1984)	Technical Potential	Installed Capacity (1985)	% Capacity Installed
	A/NE BUREAU		28323	60		24413	2684	2783	3327	309354	26972	9%
A/NE NEAR EAST		159	58		44	40	1080	346	5740	3376	59%
Egypt	1965	25	13	1979	X	40	400	170	3210	2700	84%
Jordan	X	X	X	X	X	X	X	X	12	0	0%
Morocco	1981	134	45	1981	44	X	0	4	2453	612	25%
Oman	X	X	X	X	X	X	480	87	X	0	
Tunisia	X	X	X	X	X	X	200	85	65	64	98%
Yemen	X	X	X	X	X	X	X	X	X	0	
A/NE SOUTH ASIA		27385			1726	1683	484	992	139365	19050	14%
Bangladesh	1981	1054	X	X	X	X	X	192	800	130	16%
India	1981	26331	X	1981	1581	1581	471	350	100000	15115	15%
Nepal	X	X	X	X	X	X	X	X	18250	129	1%
Pakistan	X	X	X	1979	145	102	13	450	19600	2997	15%
Sri Lanka	X	X	X	X	X	X	X	X	715	679	95%
A/NE SOUTHEAST ASIA		779	2		22643	961	1219	1975	134850	4366	3%
Burma	1975	5	2	1975	X	X	4	X	30000	169	1%
Indonesia	1984	774	X	1984	22458	X	1200	1870	80936	534	1%
Philippines	X	X	X	1979	170	82	3	X	3766	1839	49%
Thailand	X	X	X	1984	15	879	12	105	20148	1824	9%
A/NE OCEANIA											
Fiji	X	X	X	X	X	X	X	X	400	80	20%
Papua New Guinea	X	X	X	X	X	X	X	14	29000	100	0%
Solomon Islands	X	X	X	X	X	X	X	X	X	0	
Cook Islands											
Kiribati											
Niue											
Tonga											
Tuvalu											
Vanuatu											
Western Samoa											

Source: Adapted from WRR 88-89 Table 2C.2
 Original sources: World Energy Conference; The World Bank;
 United Nations Statistical Office; and U.S. Federal Energy Regulatory Commission

Note: a = exploitable potential

Note: 0 = zero or less than half the unit of measure; X = not available

TABLE 24	ENERGY FROM TRADITIONAL FUELS (ALL SOURCES)									
	ESTIMATES									
	U.N. STATISTICS			POPULATION						
	TRADI- TIONAL FUELS (terajoules)	TOTAL REQUIREMENTS total (terajoules) per capita (gigajoules)	UN Energy Percentage traditional/ total	Hall Barnard Moos	Other Estimates in HBM	Percent of population in rural areas				
					1990	2000	2010	2020		
(GNP wtd)						70%	62%	57%	47%	
ANE BUREAU (Pop wtd)						71%	65%	58%	47%	
ANE NEAR EAST						52%	46%	38%	33%	
Egypt	41	1117	23	4%		51%	45%	38%	32%	14.5%
Jordan	0	111	30	0%		32%	26%	22%	18%	<1%
Morocco	13	231	10	6%	21%	52%	45%	35%	32%	
Oman	—	316	—			89%	85%	79%	72%	
Tunisia	27	177	24	15%		39%	32%	25%	23%	70%
Yemen	—	35	5			75%	67%	59%	51%	80+%
ANE SOUTH ASIA						74%	68%	60%	42%	
Bangladesh	261	264	3	99%	71%	86%	82%	75%	64%	
India	2402	9057	12	27%	54%	72%	66%	58%	46%	
Nepal	152	167	10	91%	98%	90%	90%	86%	77%	
Pakistan	224	1094	11	20%		68%	62%	55%	43%	
Sri Lanka	78	157	10	50%		79%	76%	69%	57%	54%
ANE SOUTHEAST ASIA						70%	63%	55%	44%	
Burma	160	264	7	61%		75%	59%	51%	40%	
Indonesia	1319	2771	16	48%		71%	64%	56%	44%	50%
Philippines	322	813	15	40%		58%	51%	44%	34%	
Thailand	566	1260	24	45%	63%	77%	77%	70%	58%	
ANE OCEANIA						80%	75%	68%	62%	
Fiji	11	20	28	55%		56%	49%	42%	36%	
Papua New Guinea	57	91	25	63%		84%	80%	73%	66%	
Solomon Islands	4	4	14	100%		89%	86%	81%	74%	
Cook Islands	—	—	450	0%		66%	60%	52%	44%	
Kiribati						64%	43%	36%	31%	
Niue						77%	70%	62%	54%	
Tonga	—	1	9	0%		80%	52%	44%	38%	
Tuvalu						X	X	X	X	
Vanuatu	0	1	7	0%		70%	61%	53%	45%	
Western Samoa	1	2	12	50%		79%	70%	63%	55%	
	Source: UN Energy Stat Yrbk 1986			Source: Biomass for Energy in the Developing Countries by Hall, Barnard, and Moos, 1982			Source: Estimates and Projections of Urban, Rural, and City Populations, 1950-2025, The 1982 Assessment			

**TABLE
25**

COMMERCIAL ENERGY CONSUMPTION AND PRODUCTION

	<u>CONSUMPTION</u>					<u>PRODUCTION</u>							
	TOTAL	TOTAL	TOTAL	TOTAL	/pc	TOTAL	TOTAL	TOTAL	TOTAL	SOLID	LIQUID	GAS	ELECTRIC
	COMMML	COMMML	COMMML	COMMML	COMMML	COMMML	COMMML	COMMML	COMMML	COMMML	COMMML	COMMML	COMMML
	ENERG	ENERG	ENERG	ENERG	ENERGY	ENERG	ENERG	ENERG	ENERG	ENERG	ENERG	ENERG	ENERGY
CONS	CONS	CONS	CONS	CONS	PROD	PROD	PROD	PROD	PROD	PROD	PROD	PROD	
1960	1970	1980	1986	1986	1960	1970	1980	1986	1986	1986	1986	1986	
ANE BUREAU	2376	3977	7846	11617	906	2392	5705	10022	14789	4313	7874	2194	407
ANE NEAR EAST	271	404	993	1814	331	163	1624	2231	3655	23	3337	253	40
Egypt	192	254	590	988	21	143	719	1,347	1,927	X	1,725	163	38
Jordan	9	18	59	111	30	X	X	X	1	X	1	X	0
Morocco	48	84	187	213	9	20	21	29	30	23	1	3	2
Oman	X	3	21	316	245	X	707	598	1,445	X	1,375	70	X
Tunisia	21	43	120	151	21	0	177	237	237	X	220	17	0
Yemen	1	2	16	35	5	X	X	X	15	X	15	X	X
ANE SOUTH ASIA	1,567	2,611	4,740	7,168	21	1,215	2,152	3,710	6,473	4,152	1,396	649	276
Bangladesh	X	X	113	188	2	X	X	47	122	X	4	117	2
India	1,356	2,238	4,085	6,160	8	1,149	1,986	3,327	5,844	4,111	1,312	210	212
Nepal	1	5	6	13	1	0	0	1	2	0	X	X	1
Pakistan	180	323	488	751	7	65	163	330	495	41	80	322	51
Sri Lanka	30	45	48	56	3	1	3	5	10	X	X	X	10
ANE SOUTHEAST ASIA	532	943	2076	2581	31	1014	1929	4080	4658	138	3141	1292	88
Burma	35	47	63	95	3	25	38	83	108	2	60	42	4
Indonesia	340	406	1,016	1,392	8	980	1,872	3,928	4,169	51	2,973	1,120	26
Philippines	110	294	490	403	7	8	8	50	77	25	14	X	38
Thailand	47	196	507	691	13	1	11	19	304	60	94	130	20
ANE OCEANIA	6	19	37	54	523	0	0	1	3	0	0	0	3
Fiji	3	7	10	8	11	X	X	X	1	X	X	X	1
Papua New Guinea	3	11	26	31	9	0	0	1	2	X	X	X	2
Solomon Islands	0	1	1	2	7	X	X	X	X	X	X	X	X
Cook Islands				9	450								
Kiribati				0	4								
Niue				0	14								
Tonga				1	9								
Tuvalu													
Vanuatu				1	7								
Western Samoa				2	12								

Source: WRR Unpublished data

TABLE
26

ELECTRICITY CAPACITY AND PRODUCTION

	TOTAL INSTALLED ELEC CAPACITY 1000kw 1960	TOTAL INSTALLED ELEC CAPACITY 1000kw 1970	TOTAL INSTALLED ELEC CAPACITY 1000kw 1980	TOTAL INSTALLED ELEC CAPACITY 1000kw 1984	TOTAL ELEC PROD mill. kwh 1960	TOTAL ELEC PROD mill. kwh 1970	TOTAL ELEC PROD mill. kwh 1980	TOTAL ELEC PROD mill. kwh 1984
	ANE BUREAU	8979	26715	61022	85356	31879	97943	218095	299362
ANE NEAR EAST	1662	5316	8261	9857	3967	10643	28872	37351
Egypt	1,167	4,357	4,886	5,409	2,639	7,591	18,939	22,870
Jordan	X	80	400	730	X	200	1,070	2,304
Morocco	366	582	1,593	1,919	1,012	1,935	4,924	6,617
Oman	X	33	392	664	X	105	957	1,675
Tunisia	129	258	928	985	316	794	2,797	3,590
Yemen	X	6	62	150	X	18	185	295
ANE SOUTH ASIA	5,684	16,598	38,323	54,979	22,642	70,831	139,071	194,216
Bangladesh	X	X	990	1,289	X	X	2,653	4,292
India	5,580	16,271	33,316	47,690	20,123	61,212	119,260	165,440
Nepal	10	46	78	178	11	76	213	350
Pakistan	X	X	3,518	5,010	2,206	8,727	15,277	21,873
Sri Lanka	94	281	421	812	302	816	1,668	2,261
ANE SOUTHEAST ASIA	1597	4675	14000	19883	5157	16111	48569	65885
Burma	250	256	636	741	432	600	1,340	1,726
Indonesia	391	907	4,876	6,700	1,400	2,300	14,234	21,330
Philippines	765	2,176	4,478	6,155	2,731	8,666	17,887	20,800
Thailand	191	1,336	4,010	6,287	594	4,545	15,112	22,029
ANE OCEANIA	36	126	438	637	113	358	1,583	1,910
Fiji	19	54	113	189	55	158	310	387
Papua New Guinea	16	69	313	435	57	191	1,252	1,495
Solomon Islands	1	3	12	13	1	9	21	28
Cook Islands								
Kiribati								
Niue								
Tonga								
Tuvalu								
Vanuatu								
Western Samoa								

Source: WRR Unpublished data

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**TABLE
27**

TRANSPORTATION SECTOR CONSUMPTION

	1973-1986 GROWTH			COUNTRY COMPARISON	
	1973 Transport Energy Consumption (000 TOE)	1986 Transport Energy Consumption (000 TOE)	1986 Consumption divided by 1973 Consumption	1986 Number of Cars per 1000 persons	1986 Number of Vehicles per 1000 persons
ANE BUREAU (Pop wtd)	28374	55351	195 %	4.18	18.24
ANE NEAR EAST	3193	8003	251 %	20.31	34.89
Egypt	1554	4348	280 %	15.25	27.69
Jordan	180	551	306 %	44.14	66.35
Morocco	842	1146	136 %	24.55	36.39
Oman	44	581	1320 %	—	—
Tunisia	496	817	165 %	37.14	63.85
Yemen	77	560	727 %	14.76	38.63
ANE SOUTH ASIA	15303	27889	182 %	1.76	9.50
Bangladesh	96	513	536 %	—	—
India	13332	22407	168 %	1.51	9.37
Nepal	28	76	271 %	—	—
Pakistan	1308	4117	315 %	2.50	7.82
Sri Lanka	539	776	144 %	9.23	27.45
ANE SOUTHEAST ASIA	9879	19460	197 %	7.18	43.15
Burma	443	705	159 %	—	—
Indonesia	3152	7666	243 %	6.37	43.92
Philippines	2997	3030	101 %	6.22	20.7
Thailand	3286	8059	245 %	10.88	65.18
ANE OCEANIA					
Fiji					
Papua New Guinea					
Solomon Islands					
Cook Islands					
Kiribati					
Niue					
Tonga					
Tuvalu					
Vanuatu					
Western Samoa					
	Source: International Energy Agency: Energy Balances			Source: World Road Statistics, 1983-87	

**TABLE
28**

WATER RESOURCES

	INTERNAL RENEWABLE										
	WATER RESOURCES		River Flows	River Flows	TOTAL WITHDRAWAL				SECTORAL WITHDRAWAL (%)		
	Total (cubic kilometers per year)	Per Capita 1989 (thousand cubic meters per year)	from Other Countries (cubic kilometers per year)	to Other Countries (cubic kilometers per year)	Year of Data	Total (cubic kilometers per year)	Percentage of Water Resources a	Per Capita (cubic meters per year)	Public Use b	Industry (self- supplied)	Agriculture (irrigation)
(Arithmetic mean)		5.40									
ANE BUREAU (Pop wtd)	7802.45	5.18									
ANE NEAR EAST	39.25	0.41									
Egypt	1.80	0.04	56.50	0.00	1985	56.40	97	1,202	7	5	88
Jordan	0.70	0.17	0.40	X	1975	0.45	41	173	3	0	97
Morocco	30.00	1.25	0.00	0.30	1985	11.00	37	501	6	3	91
Oman	2.00	1.42	0.00	X	1975	0.43	22	561	2	0	98
Tunisia	3.75	0.49	0.60	0.00	1985	2.30	53	325	10	0	90
Yemen	1.00	0.13	0.00	X	X	X	X	X	X	X	X
ANE SOUTH ASIA	3718.20	3.47									
Bangladesh	1,357.00	12.08	X	X	X	X	X	X	X	X	X
India	1,850.00	2.27	X	X	1975	380.00	21	612	3	4	93
Nepal	170.00	9.42	X	X	X	X	X	X	X	X	X
Pakistan	298.00	2.72	X	X	1975	153.40	51	2,053	X	X	X
Sri Lanka	43.20	2.51	0.00	0.00	1970	6.30	15	503	0	2	98
ANE SOUTHEAST ASIA	4045.00	12.14									
Burma	1,082.00	26.99	X	X	71	X	X	X	X	X	X
Indonesia	2,530.00	14.17	X	X	1971	X	X	X	X	X	X
Philippines	323.00	5.41	0.00	0.00	1975	29.50	9	693	X	X	X
Thailand	110.00	2.01	X	X	1975	X	X	X	1	0	99
ANE OCEANIA											
Fiji	X	X	0.00	0.00	X	X	X	X	X	X	X
Papua New Guinea	X	X	X	X	X	X	X	X	X	X	X
Solomon Islands	X	X	0.00	0.00	X	X	X	X	X	X	X
Cook Islands											
Kiribati											
Niue											
Tonga											
Tuvalu											
Vanuatu											
Western Samoa											

Source: WRR 88-89 Table 21.1

Original sources: Bureau of Geological and Mining Research, National Geological Survey, France; U.S. Geological Survey

Notes: a. Water resources includes both internal renewable resources and river flows from other countries.

b. Domestic, commercial, public services, and industry supplied by public facilities.

0 = zero or less than half the unit of measure; X = not available.

**TABLE
29**

**RIVER
QUALITY**

River	Site	Nitrate and Nitrite (mg of nitrogen/liter)			Biochemical Oxygen Demand (mg of oxygen/liter)			Fecal Coliform (number/100 milliliters)			Cadmium (mg/liter) a			Mercury (µg/liter) b			
		Number of Samples			Number of Samples			Number of Samples			Number of Samples			Number of Samples			
		Below Dete- ction Limit	Above Dete- ction Limit	Mean c	Below Dete- ction Limit	Above Dete- ction Limit	Mean c	Below Dete- ction Limit	Above Dete- ction Limit	Mean c	Below Dete- ction Limit	Above Dete- ction Limit	Mean c	Below Dete- ction Limit	Above Dete- ction Limit	Mean c	
		Limit	Limit	Mean c	Limit	Limit	Mean c	Limit	Limit	Mean c	Limit	Limit	Mean c	Limit	Limit	Mean c	
AFRICA																	
Egypt																	
	Nile	Aswan	0	24	0.00	0	24	2									
		Assiut	0	24	0.00	0	24	3									
		Center of Cairo	12	24	0.03	0	36	3									
		Edfina	0	24	1.18	0	24	7									
		El Kamater	12	24	0.03	0	36	3									
		Farskur	0	24	1.90	0	24	10									
		Shobak	12	24	0.03	0	36	3									
Tunisia																	
	De Zaghouan	35°d 35', 7°d 37'	0	3	0.10	0	7	4	0	12	208						
ASIA																	
Bangladesh																	
	Brahmaputra	Bahadurabad Ferryghat	0	7	0.88	0	26	3	0	20	2,606						
	Lower Ganges	Hardings Bridge	0	10	0.56	0	13	3	0	8	1,963						
	Meghna	90°d 59', 24°d 02'	0	14	0.84	0	34	3	0	38	3,193						
India																	
	Bhima	Takali	0	85	0.22	0	84	6	0	8	175						
	Canveri	Krishnaraja Sagar Dam	0	76	0.03	0	80	1	0	77	439						
	Chaliyar	Koolimadu	0	61	0.86	0	60	1	0	59	438						
	Godavari	Dhalegaon	0	83	0.21	0	84	5	0	8	144						
		Polevarum	0	65	0.55	0	61	2	0	48	7						
	Kallada	Narasimhattam Kad	0	14	1.93	0	14	4	0	13	578						
	Krishna	Godwal	0	11	0.25	0	11	4	0	8	21						
		Honnali Town	0	13	0.04	0	13	1	0	13	963						
		Karad	0	15	0.16	0	15	6	0	15	276						
		Vijayawada	0	70	0.75	0	67	3	0	46	57						
	Mahi	Savala	0	62	8.9c	0	57	2	7	49	550,000						
	Narmada	Garudachovar	0	60	0.56	0	59	3	4	43	260,000						
		Sethani Ghat	0	10	0.05	0	13	3	0	9	88						
	Periyar	Kaladi	0	62	0.96	0	62	1	0	61	767						
	Sabarnati	Dharid Dam	0	65	0.34	0	65	2	0	62	1,147						
	Subarnarekha	Mango Bridge	0	1	9.00	0	13	6	0	11	21,455						
	Tapti	Kathore	0	14	0.15	0	14	4	0	7	37,000						
		Napanagar	0	72	0.50	0	72	2	0	19	38						
	Wainganga	Ashi	0	80	0.35	0	78	6	0	8	3,699						
Indonesia																	
	Barito	South Kalimantan	1	21	0.26	0	22	5	0	18	220,000	21	0	0.003	17	2	0.001
Pakistan d																	
	Indus	Kotri	0	147	1.86	0	150	6	0	155	120	0	8	0.000	0	8	0.000
Philippines d																	
	Cagayan	Cagaya Da Oro				0	76	1	0	62	7,628				0	19	0.146
Thailand d																	
	Chao Phraya	Nakhon Sawan	0	26	0.27	7	46	1	3	49	2,211	0	20	0.001	0	25	0.380
OCEANIA																	
Fiji																	
	Wetumu	18°d 1', 178°d 26'	0	118	0.05	0	114	1	0	68	1,848						

Source: WRR 87 Table 23.3

Original source: Global Environmental Monitoring System.

Notes: a. Total cadmium (soluble and particulate) except where indicated.

b. Total mercury (soluble and particulate) except where indicated.

c. Samples outside detection limits were assigned the detection limit value for calculating the mean.

d. Cadmium and mercury data are for soluble forms only.

0 = zero or below the limit of detection; X = too few values to calculate statistic; mg = milligrams; µg = micrograms.

**TABLE
30**

FLOODS AND CYCLONES, 1960-81

	FLOODS		CYCLONES	
	Number of Events	Deaths	Number of Events	Deaths
ANE BUREAU	-----	-----	-----	-----
ANE NEAR EAST	-----	-----	-----	-----
Egypt				
Jordan				
Morocco	8	90		
Oman				
Tunisia				
Yemen				
ANE SOUTH ASIA	-----	-----	-----	-----
Bangladesh	17	39900	37	386200
India	28	14700	26	24930
Nepal	6	1500		
Pakistan	6	2600		
Sri Lanka	6	100		
ANE SOUTHEAST ASIA	-----	-----	-----	-----
Burma	7	140	7	1350
Indonesia	23	1200		
Philippines	13	1400	39	5650
Thailand				
ANE OCEANIA	-----	-----	-----	-----
Fiji				
Papua New Guinea				
Solomon Islands				
Cook Islands				
Kiribati				
Niue				
Tonga				
Tuvalu				
Vanuatu				
Western Samoa				

Source: WRR 86 Table 9.4

Original sources: League of Red Cross and Red Crescent Societies;
U.S. Office of Foreign Disaster Assistance.

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**TABLE
31**

COASTLINE ACTIVITY

	Length of Marine Coastline (kilometers)	Maritime Zones 1988 (nautical miles unless otherwise indicated)			Average Annual Marine Fish Catch *		Production from Artisanal Fisheries as % of Total Year	Importance of Fish as a Source of Protein Supply			
		Territorial Sea	Exclusive Economic Zone	Continental Shelf	1983-85 (thousand metric tons)	Percentage Change Over 1974-76		Total Animal Proteins	Total Proteins	per capita Consumption (kg per year)	
A/NE BUREAU	131619				8304						
A/NE NEAR EAST	8074				689						
Egypt	2,450	12	X	00m/EXP	26	-5					
Jordan	26	3	X	X	0	-71					
Morocco	1,835	12	200	X	463	75					
Oman	2,092	12	200	X	105	-45					
Tunisia	1,148	12	X	X	77	71					
Yemen	523	12	X	X	17	18	90	1975			
A/NE SOUTH ASIA	9966				2303						
Bangladesh	580	12	200	CM	169	78	95	1975	58.9	7.9	10.8
India	7,000	12	200	200/CM	1673	16	62	1977	22.4	2.3	3.4
Nepal											
Pakistan	1,046	12	200	200/CM	306	81	40	1987	1.9	0.5	1.4
Sri Lanka	1,340	12	200	200/CM	155	37	98	1979	54.7	8.4	10.9
A/NE SOUTHEAST ASIA	97284				5543						
Burma	3,060	12	200	200/CM	469	37	83	1972	55.3	7.5	13.6
Indonesia	54,716	12	200	X	1732	73	96	1978	63.6	8.3	10.4
Philippines	36,289	X	200	EXP	1330	14	61	1976	58.2	2.6	33.1
Thailand	3,219	12	200	00m/EXP	2012	42	30	1970	52.8	13.2	22.6
A/NE OCEANIA	16295				114						
Fiji	1,129	12	200	00m/EXP	26	423					
Papua New Guinea	5,152	12	X	00m/EXP	5	-90					
Solomon Islands	5,313	12	200	X	47	125					
Cook Islands	120	12	200	200/CM	1	-17					
Kiribati	1,143	12	200	X	27	63					
Niue	64	12	200	X	0	NM					
Tonga	419	12	200	00m/EXP	2	126					
Tuvalu	24	12	200	X	1	NM					
Vanuatu	2,528	12	200	200/CM	3	6					
Western Samoa a	403	12	200		4						

Source: WRR 88-89 Table 22.1

Original sources: U.S. Department of State; U.N. Office for Ocean Affairs and the Law of the Sea; U.N. Food and Agricultural Organization.

Note: 0 = zero or less than half the unit of measure; X = no claim made or information unavailable; CM = edge of continental margin; EXP = limits of exploitable resources; NM = not meaningful.

Note a = from World Fact Book 1988

Source: WRR 86 Table 9.5

Source: WRR 86 Table 9.4

Note: * = Marine catch includes marine fishes, molluscs, crustaceans, and miscellaneous aquatic animals. Marine Mammals and plants are excluded.

TABLE
32

TROPICAL COASTAL RESOURCES

(Early 1980's)

Area of survey	MANGROVE FORESTS			SEAGRASS BEDS			CORAL REEFS		
	Area (sq. kms)	Length (kms)	Length as % of Total Coastline	Area (sq. kms)	Length (kms)	Length as % of Total Coastline	Area (sq. kms)	Length (kms)	Length as % of Total Coastline
ANE BUREAU									
ANE NEAR EAST		P 84+		P	P		P	1738	
Egypt		P	P X	P	P	X	P	1100	80
Jordan		X	X X	P	P	X	P	13	50
Morocco									
Oman		P	84 4	P	P	X	P	625	30
Tunisia									
Yemen		X	X X	P	P	X	X	X	X
ANE SOUTH ASIA		10146	380+	P	P		P	725	
Bangladesh		4050	P X	P	P	X	0	0	0
India		3565	380 6.3	P	P	X	P	420	7
Nepal									
Pakistan		2495	P X	P	P	X	0	0	0
Sri Lanka		36	P X	P	P	X	P	305	23
ANE SOUTHEAST ASIA		44872	15510+	P	P		P	40850+	
Burma		5171	P X	P	P	X	P	P	X
Indonesia		36000	9696 12	P	P	X	P	17500	22
Philippines		1461	4009 18	P	P	X	P	22450	100
Thailand		2240	1805 56	P	P	X	P	900	28
ANE OCEANIA		5201+	P	P	P		P	15539+	a 150
Fiji	a,b	433	P X	P	P	X	P	5360	150
Papua New Guinea		4116	P X	P	P	X	P	3684	72
Solomon Islands		642	P X	P	P	X	P	P	X
Cook Islands	a	0	0 0	0	0	0	P	219	150
Kiribati	a	P	P X	0	0	0	P	1715	150
Niue	a	X	X X	X	X	X	P	105	150
Tonga	a	10	P X	X	X	X	P	628	150
Tuvalu	a	X	X X	X	X	X	P	36	150
Vanuatu	a	X	X X	P	P	X	P	3792	150
Western Samoa		P	P X	X	X	X	P	P	X

Source: WRR 86 Table 10.3

Original sources: World Resources Institute; International Institute for Environment and Development

Notes: Estimates for coastline length vary considerably depending on method employed.

a = estimate of a 1.5 to 1 ratio of coral reef length to total coastline length based on measurements of the 107 major islands of Fiji and 27 volcanic and coral islands in eastern Polynesia.

b = Mangrove data for Viti Levu and Vanua Levu.

0 = zero or less than one-half the unit of measure; X = data not available; P = resource present but not quantified.

TABLE
33

AIR POLLUTION I
Sulfur Dioxide Concentration in Urban Areas, 1973-85

City	Site Type	Average Number of Monitoring Days per Year				Mean of Daily Values (micrograms per cubic liter)				Peak Levels (98th Percentile of Daily Values) (micrograms per cubic liter)				
		1973-75	1976-78	1979-81	1982-85	1973-75	1976-78	1979-81	1982-85	1973-75	1976-78	1979-81	1982-85	
AFRICA														
Egypt	Cairo	CCC	340	294	51	X	61	54	5	X	163	150	78	X
	Cairo	SR	X	79	14	X	X	26	0	X	X	130	4	X
	Cairo	CCR	X	279	X	X	X	43	X	X	X	143	X	X
ASIA														
China														
Beijing	SI	X	X	104	147	X	X	38	100	X	X	146	298	
Beijing	CCC	X	X	113	153	X	X	66	167	X	X	290	459	
Beijing	SR	X	X	93	143	X	X	6	29	X	X	44	101	
Beijing	CCM	X	X	110	149	X	X	98	228	X	X	397	625	
Guangzhou	SR	X	X	93	163	X	X	140	71	X	X	372	170	
Guangzhou	CCR	X	X	97	171	X	X	66	90	X	X	270	212	
Guangzhou	CCC	X	X	76	171	X	X	117	81	X	X	340	206	
Guangzhou	CCI	X	X	55	163	X	X	12	64	X	X	38	157	
Shanghai	CCI	X	X	98	142	X	X	23	77	X	X	153	200	
Shanghai	CCR	X	X	87	177	X	X	32	77	X	X	176	207	
Shanghai	CCC	X	X	25	178	X	X	65	54	X	X	272	217	
Shanghai	SR	X	X	X	178	X	X	X	13	X	X	X	55	
Shenyang	CCR	X	X	73	144	X	X	29	133	X	X	390	682	
Shenyang	CCI	X	X	72	144	X	X	136	279	X	X	358	1119	
Shenyang	CCC	X	X	72	120	X	X	72	160	X	X	320	576	
Shenyang	SR	X	X	72	120	X	X	27	55	X	X	299	272	
Xian	SR	X	X	98	174	X	X	22	30	X	X	98	156	
Xian	CCR	X	X	119	180	X	X	108	109	X	X	349	372	
Xian	CCC	X	X	120	180	X	X	160	113	X	X	670	398	
Xian	SI	X	X	117	179	X	X	46	59	X	X	256	259	
India														
Bombay	CCC	X	40	30	17	X	26	23	8	X	123	97	38	
Bombay	SR	X	75	47	31	X	31	24	25	X	121	81	85	
Bombay	SI	X	75	48	28	X	96	66	35	X	253	188	85	
Bombay	CCC	X	X	34	28	X	X	57	11	X	X	195	63	
Calcutta	CCC	67	46	32	31	46	43	65	68	237	217	288	183	
Calcutta	SI	63	48	29	23	51	50	61	70	221	241	244	149	
Calcutta	SR	67	48	24	30	34	21	34	39	171	102	123	155	
Delhi	CCC	X	44	37	29	X	34	43	68	X	130	111	197	
Delhi	CCR	X	33	37	29	X	6	14	28	X	67	77	97	
Delhi	CCI	X	34	38	29	X	57	37	38	X	474	137	172	
Jakarta	CCR	X	X	29	31	X	X	0	1	X	X	0	6	
Jakarta	SI	X	X	26	20	X	X	0	0	X	X	0	0	
Malaysia														
Kuala Lumpur	SI	X	140	106	18	X	43	14	6	X	95	62	20	
Kuala Lumpur	SR	X	140	61	13	X	4	1	2	X	19	9	9	
Kuala Lumpur	SI	X	X	47	20	X	X	6	4	X	X	58	16	
Philippines														
Devoa	SR	X	X	17	25	X	X	9	7	X	X	27	38	
Devoa	SI	X	X	16	25	X	X	19	8	X	X	75	28	
Mangila	SR	348	255	225	224	68	53	58	61	141	94	147	112	
Mangila	CCC	353	239	156	94	90	67	73	83	193	170	137	161	
Mangila	SI	360	273	193	201	130	83	81	41	253	182	189	198	
Thailand														
Bangkok	SI	X	51	52	X	X	15	10	X	X	66	37	X	
Bangkok	SR	X	X	78	126	X	X	14	18	X	X	46	48	

Source: WHO 88-89 Table 23.4; Original sources: World Health Organization and United Nations Environment Programme.

Note: a. CCC = center city commercial; CCI = center city industrial; CCR = center city residential;

CCM = center city medium; SI = suburban industrial; SR = suburban residential;

0 = zero or less than half the unit of measure; X = not available; * = one year of data;

bold = site exceeded the level considered safe by the World Health Organization for the most recent monitoring period after 1978.

2085

TABLE
34

AIR POLLUTION II

Suspended Particulate Matter Concentrations in Urban Areas, 1973-85

City	Site Type a	Average Number of Monitoring Days per Year				Mean of Daily Values (micrograms per cubic meter)				Peak Levels (98th Percentile of Daily Values) (micrograms per cubic meter)					
		1973-75	1976-78	1979-81	1982-85	1973-75	1976-78	1979-81	1982-85	1973-75	1976-78	1979-81	1982-85		
		HIGH-VOLUME GRAVIMETRIC SAMPLING METHOD													
ASIA															
China	Shenyang	CCR	X	X	72	144	X	X	465	491	X	X	971	1,236	
	Shenyang	CCI	X	X	72	144	X	X	523	529	X	X	1,410	1,377	
	Shenyang	SR	X	X	72	120	X	X	225	238	X	X	389	663	
	Beijing	SI	X	X	75	132	X	X	479	462	X	X	1,254	307	
	Beijing	SR	X	X	62	131	X	X	252	268	X	X	844	632	
	Beijing	CCR	X	X	79	136	X	X	415	398	X	X	834	978	
	Guangzhou	CCR	X	X	39	154	X	X	117	194	X	X	321	476	
	Guangzhou	SR	X	X	38	149	X	X	375	248	X	X	611	611	
	Guangzhou	CCI	X	X	24	151	X	X	96	179	X	X	224	435	
	Shanghai	CCI	X	X	89	148	X	X	330	285	X	X	770	738	
	Shanghai	SR	X	X	X	177	X	X	X	152	X	X	X	359	
	Shanghai	CCR	X	X	87	178	X	X	225	224	X	X	449	480	
	Xian	CCR	X	X	120	180	X	X	387	443	X	X	986	1,269	
	Xian	SI	X	X	117	182	X	X	463	471	X	X	1,045	1,389	
	Xian	SR	X	X	97	177	X	X	235	328	X	X	552	901	
	India	Delhi	CCR	X	33	37	29	X	326	325	291	X	961	809	831
		Delhi	CCI	X	34	38	29	X	432	445	453	X	972	878	1,082
		Calcutta	SI	35	37	29	34	438	369	448	426	946	704	1,010	943
Calcutta		SR	36	37	24	30	353	324	499	333	833	1048	1,227	967	
Calcutta		CCC	38	37	30	31	477	799	428	381	951	739	905	946	
Bombay		SC	X	69	50	28	X	234	243	145	X	500	502	261	
Bombay		SR	X	X	32	30	X	X	303	267	X	X	323	468	
Bombay		SR	X	75	49	32	X	166	184	166	X	331	379	374	
Bombay		CCC	X	40	29	18	X	136	154	140	X	381	302	227	
Indonesia		Jakarta	SI	X	10	54	20	X	129	159	18	X	173	474	197
	Jakarta	CCR	X	10	54	43	X	210	267	243	X	438	722	531	
Philippines	Manila	SI	X	38	62	32	X	247	182	252	X	592	380	579	
	Manila	CCC	354	318	260	255	77	84	82	100	128	161	158	276	
	Manila	SR	341	354	209	247	71	85	86	66	164	177	159	123	
Thailand	Bangkok	SI	X	X	21	23	X	X	170	172	X	X	335	598	
	Bangkok	SR	X	27	68	106	X	137	214	198	X	286	404	386	
Bangkok	SI	X	40	103	106	X	281	195	243	X	429	482	741		
SMOKE SHADE SAMPLING METHOD															
AFRICA															
Egypt	Cairo	CCC	339	292	44	X	64	39	101	X	238	189	291	X	
	Cairo	SR	X	76	17	X	X	39	83	X	X	195	172	X	
NEPHELOMETER LIGHT SCATTER SAMPLING METHOD															
ASIA															
Philippines	Manila	SI	358	287	209	332	90	85	88	95	178	155	153	168	
<p>Sources: WRR 88-89 Table 23.5; Original sources: World Health Organization and United Nations Environment Programme.</p> <p>Notes: a - CCC = center city commercial; CCI = center city industrial; CCR = center city residential;</p> <p>CCM = center city mobile; SI = suburban industrial; SR = suburban residential</p> <p>X = not available; * = one year of data;</p> <p>bold = site exceeded the level considered safe by the World Health Organization for the most recent monitoring period after 1978.</p>															

7/2/86

TABLE
35

A/NE BUREAU: U.S. ASSISTANCE
(in Millions \$U.S.)

	Development Assistance			Economic Support Funds			PL 480			TOTALS		
	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	
	1988	1989	1990	1988	1989	1990	1988	1989	1990	1988	1989	1990
(Entire Bureau—see note)	388.5	357.9	370.1	2499.3	2938.4	2903.2	690.0	595.9	586.0	3577.9	3892.2	3859.2
A/NE BUREAU (below) (15 countries, Oceania)	364.9	319.9	312.7	1143.8	1519.3	1524.7	648.0	548.5	537.6	2156.7	2387.6	2375.0
A/NE NEAR EAST	62.6	33.5	33.7	779.8	991.3	897.5	272.5	250.0	230.7	1115.0	1274.7	1161.8
Egypt				717.8	930.0	815.0	182.1	171.3	160.0	899.9	1101.3	975.0
Jordan				18.2	15.0	35.0				18.2	15.0	35.0
Morocco	12.5	12.5	12.5	20.0	20.0	15.0	48.8	58.7	50.7	81.3	91.2	78.2
Oman				13.0	15.0	20.0				13.0	15.0	20.0
Tunisia	28.0			10.8	11.3	12.5	31.6	10.0	15.0	70.4	21.3	27.5
Yemen	22.1	21.0	21.2				10.0	10.0	5.0	32.1	31.0	26.2
A/NE SOUTH ASIA	172.3	174.1	160.0	334.0	215.0	250.0	293.1	265.6	260.6	799.3	654.6	670.6
Bangladesh	59.3	61.3	55.0				75.3	100.5	79.0	134.6	161.8	134.0
India	23.7	24.0	25.0				109.1	67.6	85.0	132.8	91.6	110.0
Nepal	12.5	12.0	12.0				1.8	1.4		14.3	13.4	12.0
Pakistan	50.0	50.0	50.0	334.0	215.0	250.0	80.0	80.0	80.0	464.0	345.0	380.0
Sri Lanka	26.8	26.8	18.0				26.9	16.0	16.6	53.7	42.8	34.6
A/NE SOUTHEAST ASIA	121.4	108.4	112.5	20.0	303.0	365.0	82.4	32.9	46.4	223.8	444.3	523.9
Burma	8.9	12.8								8.9	12.8	0.0
Indonesia	40.5	42.0	43.0				24.5	19.5	14.9	65.0	61.5	57.9
Philippines	55.0	40.0	55.0	15.0	298.0	360.0	57.9	13.4	31.5	128.0	351.4	446.5
Thailand	16.9	13.6	14.5	5.0	5.0	5.0				21.9	18.6	19.5
A/NE OCEANIA	8.7	4.0	6.5	10.0	10.0	11.2	0.0	0.0	0.0	18.7	14.0	17.7
Fiji						1.0						1.0
Papua New Guinea												
Solomon Islands												
Cook Islands												
Kiribati												
Niue												
Tonga												
Tuvalu												
Vanuatu												
Western Samoa												
A/NE Regional Projects*	24.8	19.4	18.2	10.4	22.4	17.5	0.0	0.0	0.0	35.2	41.7	35.7

Source: A.I.D. Congressional Presentation FY 1990

Note: Other countries receiving assistance through the A/NE Bureau include: Afghanistan (Assistance), Cambodia (Assistance), Cyprus, Israel, Northern Ireland and Ireland, Poland, Portugal, Spain, Turkey, and the Association of South East Asian States (ASEAN).
*A/NE OCEANIA is officially "South Pacific Regional" and comprises all the countries below it (incl. Fiji with separate 1990 allocation).
* Regional projects are active in various areas including the West Bank and Gaza Strip; funding not included in "A/NE Bureau (below)" line.

FY88 includes: \$20 million ESF carry-forward from FY87; \$3,384 million International Disaster Assistance; \$2,832 million no-year funds reobligated in FY88; \$99.63 million FY86 deobligated funds reobligated in FY88.
FY89 includes: \$3.75 million FY88 deobligated funds reobligated in FY89; \$296,355 million ESF carry-forward from FY88; \$3 million International Disaster Assistance transferred from DOD; \$23 million Emergency Relief and Migration funds transferred to Afghanistan.
FY90 includes: \$200 million for Multilateral Assistance Initiative for the Philippines from the Special Assistance Initiatives.

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ENVIRONMENT AND NATURAL RESOURCE PROJECTS

(in Millions \$US)

NUMBER PROJS IDEN- TIFIED BY PPC	Development Assistance and Economic Support Funds						PL 480			Reach % ENV or % NR				
	FY 1988			FY 1989			FY 1990							
	PPC			P PPC			P PPC							
	TOTAL OBLIGS DA + ESP	TOTAL % ENV ENV		TOTAL OBLIGS DA + ESP	TOTAL % ENV ENV		TOTAL OBLIGS DA + ESP	TOTAL % ENV ENV			FY 1988	FY 1989	FY 1990	
(Entire Bureau-see note)		2887845		3296294		3273273			690.0	595.9	586.0			
ANE BUREAU (below) 15 countries, Oceania, (& Regional Projects)	53	1510.8	146.2	10%	1868.1	153.4	8%	1873.0	151.0	8%	648.0	548.5	537.6	
ANE NEAR EAST	14	814.5	126.8	16%	1024.8	139.7	14%	931.2	107.8	12%	272.5	250.0	230.7	
Egypt	7	717.8	112.2	16%	930.0	121.4	13%	815.0	83.8	10%	182.1	171.3	160.0	substantial
Jordan		18.2	0.0	0%	15.0	0.0	0%	35.0	0.0	0%				
Morocco	2	32.5	0.4	1%	32.5	1.0	3%	27.5	2.0	7%	48.8	58.7	50.7	some
Oman	2	13.0	13.0	100%	15.0	15.0	100%	20.0	20.0	100%				
Tunisia	1	10.9	0.0	0%	11.3	1.8	16%	12.5	1.5	12%	31.6	10.0	15.0	much
Yemen	2	22.1	1.2	5%	21.0	0.5	3%	21.2	0.5	2%	10.0	10.0	5.0	
ANE SOUTH ASIA	18	506.3	6.5	1%	389.1	9.0	2%	410.0	25.5	6%	293.0	265.5	260.5	
Bangladesh	1	59.3	0.0	0%	61.3	1.0	2%	55.0	2.0	4%	75.3	100.5	79.0	negligible
India	3	23.7	1.3	5%	24.0	3.6	15%	25.0	8.1	32%	109.1	67.6	85.0	~1%
Nepal	6	12.5	2.5	20%	12.0	3.1	26%	12.0	3.5	29%	1.8	1.4		
Pakistan	7	384.0	2.7	1%	265.0	1.3	0%	300.0	4.9	2%	80.0	80.0	80.0	
Sri Lanka	1	26.8	0.0	0%	26.8	0.0	0%	18.0	7.1	39%	26.9	16.0	16.6	
ANE SOUTHEAST ASIA	12	136.1	10.2	7%	398.6	3.2	1%	477.5	15.9	3%	82.41	32.9	46.38	
Burma		3.7	0.0	0%	0.0	0.0	0%	0.0	0.0	0%				
Indonesia	4	40.5	0.2	0%	42.0	0.4	1%	43.0	4.0	9%	24.5	19.5	14.9	~66%*
Philippines	6	70.0	0.3	0%	338.0	1.3	0%	415.0	6.9	2%	57.9	13.4	31.5	
Thailand	2	21.9	9.8	45%	18.6	1.5	8%	19.5	5.0	26%				
ANE OCEANIA	3	18.7	0.8	4%	14.0	0.0	0%	17.7	0.5	3%	0.0	0.0	0.0	
Fiji								1.0						
Papua New Guinea														
Solomon Islands														
Cook Islands														
Kiribati														
Niue														
Tonga														
Tuvalu														
Vanuatu														
Western Samoa														
A/NE Regional Projects*	6	35.2	2.0	6%	41.7	1.6	4%	35.7	1.3	4%	0.0	0.0	0.0	

Source of Funding Information: A.I.D. Congressional Presentation FY 1990

Note: Other countries receiving assistance through the A/NE Bureau include: Afghanistan (Resistance), Cambodia (Resistance), Cyprus, Israel, Northern Ireland and Ireland, Poland, Portugal, Spain, Turkey, and the Association of South East Asian States (ASEAN).

A/NE OCEANIA is officially "South Pacific Regional" and comprises all the countries below it (incl. Fiji with separate 1990 allocation).

* Regional projects are active in various areas including the West Bank and Gaza Strip; funding IS included in "A/NE Bureau (below)" line.

PPC refers to the report "Asia Near East Environmental Activities" produced by AID/PPC.

Reach refers to the report "Non-project Assistance to the Natural Resources Sector of the Asia/Near East Region" produced by Timothy M. Reach of the USDA/Forestry Service, Forestry Support Program.

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An "arithmetic mean" is the simple average across countries. Essentially, it says that the "average" ANE country experiences these conditions. This value may not of itself be particularly useful in a region which contains both India and the Solomon Islands. Nevertheless, when used in conjunction and in comparison with other measures as it is in Table 1, it can show that, as both GNP weighted and "Population weighted" measures are below the mean value, then during these periods it was the smaller countries which grew faster. This measure is also useful in comparing ANE to the rest of the world and to other regions.

A "GNP-weighted" measure is used for calculating values in Tables 1-4 on economic indicators. It gives appropriate weight to larger economies such that when India and Nepal are "averaged" India's rate of growth, for example, will have an influence in the regional or subregional value approximately 100 times that of Nepal's.

A "population-weighted" measure is commonly used to demonstrate what the conditions are for the "average person" in these particular countries of the ANE Region or for its various subregions. Because India has over half of the population of the ANE regions and three-fourths of the South Asian Subregion, statistics for areas including India do not vary greatly from the Indian values.

"Land-weighted" and "cropland-weighted" measures are used in tables on land use and agriculture, particularly Tables 13, 14, 15, 18, and 20. When used in conjunction with fertilizer use per hectare, for example, they represent what the "average" hectare of cropland would receive, a much larger figure than the "average" of all land.

"Energy production-weighted" and "energy consumption-weighted" measures were determined from Table 22 and used only in Table 21. They convey each country or each subregion's share in the total production or consumption of the ANE region. Unlike cropland, for example, energy resources, particularly coal and oil, are very localized. Since all countries, even those for which fuelwood is important, are users of modern fuels such as refined petroleum, the profiles for energy production and consumption are very different.

IV. TABLE OF VALUES

Table A presents the actual values used in preparing the above calculations.

APPENDIX 2: TECHNICAL NOTES

I. SOURCES

The major sources of the data presented in this appendix are:

World Resources Report, 1988-89 from the World Resources Institute, denoted WRI WRR 88-89; and
World Development Report, 1988 from the World Bank, denoted IBRD WDR 88.

The World Resources Report utilizes data from a variety of original sources including international agencies (FAO, United Nations Statistical Office, World Bank), national governments, non-governmental organizations, and private authors and researchers. When other reports were utilized for specific sets of data, they were identified at the foot of the relevant columns or tables.

II. COVERAGE

This appendix brings together data on 15 major ANE countries and the ten countries of the Oceania region. Data were compiled for as many years as possible, generally between 1960 and 1986. In cases where a year other than that specified for the other countries was available, the datum presented is italicized and footnoted. Often, a series of representative periods has been selected to show how the statistic has changed over time.

III. ANALYSIS

Various kinds of calculations were performed in order to obtain subregional (e.g., South Asia) or regional (i.e., ANE Bureau) values. These calculations are "arithmetic mean," "GNP-weighted," "population-weighted," "land-weighted," "cropland-weighted," "energy production-weighted," and "energy consumption-weighted." Further discussion of each of these is presented below. Each has its particular value, though only the first three were used extensively.

No total for the given region or subregion was calculated when a particular column was missing more than 25 percent of the total for the subregion or region concerned. When only a few percent were missing (i.e., a single small country), then the total was recalculated to account for this. Thus, for example, in Table 1 there is no calculation for the growth rates for the Oceania subregion (only Fiji is present); however, there is a calculation for the ANE Bureau as a whole because the missing South Pacific countries are such a small part of the region's economy, geography, and population.

Appendix 2
Table
A

PERCENTAGES USED FOR WEIGHTING

	GNP		POP		LAND		CROPLAND		ENERGY PRODUCTION		ENERGY CONSUMPTION	
	% of region	% of sub-region	% of region	% of sub-region	% of region	% of sub-region						
ANE BUREAU												
ANE NEAR EAST	14		6		21		6		25		16	
Egypt	7	51	3	53	10	47	1	14	13	53	9	54
Jordan	1	6	0	4	1	5	0	2	0	0	1	6
Morocco	3	18	2	25	4	21	3	48	0	1	2	12
Oman	1	9	0	1	2	10	0	0	10	40	3	17
Tunisia	2	11	1	8	2	7	2	28	2	6	1	8
Yemen	1	6	1	8	2	9	0	8	0	0	0	2
ANE SOUTH ASIA	53		71		41		73		44		62	
Bangladesh	3	6	7	10	1	3	3	4	1	2	2	3
India	41	78	54	76	30	73	60	83	40	90	53	86
Nepal	1	1	1	2	1	3	1	1	0	0	0	0
Pakistan	7	13	7	10	8	19	7	10	3	8	6	10
Sri Lanka	1	2	1	2	1	2	1	1	0	0	0	1
ANE SOUTHEAST ASIA	32		22		33		21		31		22	
Burma	1	5	3	12	7	20	4	17	1	2	1	4
Indonesia	16	50	12	54	18	55	7	36	28	90	12	54
Philippines	6	19	4	18	3	9	3	14	1	2	3	16
Thailand	8	26	4	16	5	16	7	34	2	7	6	27
ANE OCEANIA	1		0		5		0		0		0	
Fiji	0	26	0	14	0	4	0	35	0	0	0	15
Papua New Guinea	0	51	0	71	3	87	0	56	0	0	0	57
Solomon Islands	0	3	0	6	0	5	0	8	0	0	0	4
Cook Islands	0	0	0	0	0	0	0	0	0	0	0	0
Kiribati	0	0	0	1	0	0	0	0	0	0	0	17
Niue	0	0	0	0	0	0	0	0	0	0	0	0
Tonga	0	15	0	2	0	0	0	0	0	0	0	0
Tuvalu	0	0	0	0	0	0	0	0	0	0	0	2
Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0
Western Samoa	0	2	0	3	0	3	0	0	0	0	0	2
	0	2	0	3	0	1	0	0	0	0	0	4

For explanation of derivation of percentages, see Appendix 2 Technical Notes.

DEVELOPING A TYPOLOGY OF ANE COUNTRIES BASED ON NATURAL RESOURCE ENDOWMENTS

I. PURPOSE

It is common to measure, rank, and compare countries according to the production, income, and trade of one or more natural resources. Yet it is the total resource base that supports development. And, it is the renewable resource base that is usually omitted from calculations of national income and wealth. To better understand the relationship between resources and development, we first developed a Resource Endowment Index for 15 ANE countries and then used the Index to categorize countries in terms of their resources as "very rich," "rich," "poor," or "very poor."

II. METHODOLOGY

To develop an overall Resource Endowment Index, we selected statistical measures for all major renewable and non-renewable resources, for which data were readily available. Most of the data came from the World Resources Report. (See Tables A & B.)

Renewable Resources. Among the renewable resources selected were: land used for agriculture and for pasture, forests, wilderness area or land not presently utilized, threatened species, protected areas, natural disasters, availability of freshwater, length of coastline, and marine fish catch. These resources are all considered renewable because with proper management, they can continue to be productive for the foreseeable future.

Non-renewable Resources. Indicators of non-renewable resources include minerals and energy, each analyzed in terms of present production and reserves.

An index of energy production was created by combining annual figures for coal, oil, and natural gas and using a standard measure of heat. The reserves of each resource were valued separately in metric tons or billion cubic meters. Hydroelectric resources were broken down into installed capacity and technical potential.

Developing an index of mineral production required much more work. The publication "Mineral Commodity Summaries," prepared annually by the U.S. Bureau of Mines, lists production and reserve data for some 60 of the world's most important minerals, and of these, 18 are produced by one or more of the ANE countries. The selection of production data, rather than export data, was

made so that countries which produced and consumed a great variety and quantity of minerals, such as India, would not be penalized. 1986 production levels (generally in metric tons) were multiplied by 1986 prices, and when possible, by the particular grade or type of mineral to produce the value of minerals production. These values were then divided by the population to get a per capita value. A similar process was undertaken for the value of the reserves. Those countries that had some mineral production, but no quantifiable mineral reserves (denoted in Table B by "X"), were ranked above those countries with none of either.

Denominators. To account for the discrepancies which would arise if India, for example, were compared with Nepal, most resource endowments have been divided by population to get per capita figures. Exceptions are: wilderness, protected areas, natural disasters, threatened species, forest land, pasture land, which are measured in terms of percent of total area or another resource/land ratio. The rankings for threatened species and natural disasters have been reversed, that is, the lower numbers have the higher ranking.

Ranking Countries

- (1) For each resource, an indicator was calculated for its per capita or per hectare value for each country. Each country was then ranked according to its endowment with the highest being ranked #1 and the lowest, #15. This process was carried out for all eleven renewable and eight non-renewable resource indicators.

Analyses of all data were carried to the number of decimal places needed to discriminate among countries. This method produces a tie between countries for a given resource indicator when the value of the indicator is zero. There are, for example, nine countries with oil reserves, and they are ranked accordingly; the remaining countries receive a ranking of 10.

- (2) The scores were then totaled separately for renewables and non-renewables. (See Table C.) Of course, the lower the score, the richer the resource endowment. Thailand, for example, ranked #2 in renewables and #1 in non-renewables. These two separate scores were then totaled to produce an overall score.
- (3) Finally, the total country resource scores were compared to produce a final rank and to permit the construction of a typology of resource richness. Overall scores under 100 (average rank of 5 or less: two countries) were considered "very rich"; scores from 100 to 140 (average rank 6.1-7.4: six countries) were considered "rich"; scores from 140 to 190 (average ranks 7.5-10.0: five countries) were considered "poor"; and scores above 190 (average rank 10+: two countries) were considered "very poor."

III. CONCLUSIONS

Table C presents the total scores and country rankings for renewable resources, non-renewable resources, and for all resources. There are also average rankings so that the countries can be grouped according to their overall endowment. Country scores and rankings are also shown by region. Regional (unweighted) averages are also calculated.

Results for the ANE region (examined in more detail in Chapter I, see Table 1-4) show that, in general, the countries of South East Asia are richer in natural resources on a per capita basis than those of either South Asia or the Near East. The two countries with the lowest scores (and therefore highest ranking) are Thailand and Indonesia, countries obviously rich in natural resources, while the countries with the highest scores are Jordan and Bangladesh.

Caveats

There are a number of limitations associated with the development and use of such an Index.

First, the Index can be used to rank the fifteen ANE countries. But, because no international standard or norm has been established, labelling some countries as "very rich" and others as "rich" is a subjective judgement.

Second, the Index can be used to show trends in resource endowment over time, but it is probably more useful to track changes in the individual resource indicators.

Third, the Index fails to capture quality aspects of the resource. A degraded forest is treated the same as a natural forest.

Fourth, it is in the nature of developing such an Index that the rankings do not reveal whether country A has 100 times what country B has (see minerals) but is ranked just above B, nor whether B is just .01 percent above A (see protected areas). It may be argued that, despite the equivalent rankings produced in the two examples cited above, country A has the much greater resources.

Furthermore, the procedure appears to give equal weight to all resources; but in fact, gives double weight to forests, minerals, and hydroelectricity, and something like 1.33 times the weight of the others to coal, oil, and natural gas. Additionally, the analysis gives oil reserves, natural disasters, cropland, and wilderness all the same weight. Declaring them of equal weight ignores the real-

world value of having an abundant and high-priced resource. If revenue from the sale of this resource is used to develop human capital and to improve management of existing resources, then a single resource can be of great and (here) uncaptured value. In the long-run, however, it is probably preferable for a country to control and to maintain a diverse resource base.

Fifth, we have not included a measure of statistical accuracy. One can say with some assurance that Burma is "richer" than Nepal, but is Morocco richer than Pakistan?

Appendix 3
TABLE
A

INDICATORS OF NATURAL RESOURCE ENDOWMENT:
RENEWABLE RESOURCES

	1		2		3		4		5		6	
	CROPLAND		FOREST LAND		FOREST LAND		WILDERNESS AREA		PASTURE LIVESTOCK		PER DISASTERS	
	(hectares per capita 1985)		(hectares per capita 1980s)		(Percentage of total land area - 1980s)		(As % of Total Land Area 1983-85)		(Hectares per head 1984-86)		(Number per 1000 km ² 1964-86)	
	RANK		RANK		RANK		RANK		RANK		RANK	
ANE NEAR EAST												
Egypt	0.05	14	9.000	14	0.00	14	47	1	0.000	15	0.007	2
Jordan	0.12	12	0.012	11	0.51	12	0	10	0.491	4	0.051	10
Morocco	0.38	2	0.134	5	7.25	8	0	10	1.027	2	0.027	4
Oman	0.04	15	0.000	14	0.00	14	26	3	0.901	3	0.000	1
Tunisia	0.70	1	0.038	9	1.91	11	13	4	0.387	5	0.055	11
Yemen	0.20	7	0.001	13	0.05	13	27	2	1.989	1	0.026	3
ANE SOUTH ASIA												
Bangladesh	0.09	13	0.008	12	6.92	9	0	10	0.017	14	0.569	15
India	0.22	5	0.070	8	19.25	6	1	9	0.028	12	0.043	8
Nepal	0.14	9	0.117	6	15.50	7	0	10	0.128	8	0.142	12
Pakistan	0.20	6	0.023	10	3.22	10	4	8	0.056	10	0.031	5
Sri Lanka	0.14	10	0.096	7	25.63	5	0	10	0.130	7	0.379	14
ANE SOUTHEAST ASIA												
Burma	0.27	4	0.797	1	48.56	2	5	7	0.022	13	0.041	7
Indonesia	0.13	11	0.655	2	64.33	1	8	5	0.369	6	0.048	9
Philippines	0.14	8	0.159	4	31.89	3	0	10	0.078	9	0.333	13
Thailand	0.38	3	0.286	3	30.63	4	7	6	0.047	11	0.033	6
	Table 17.2 WRR 88-89		Table 18.1 WRR 88-89		Table 18.1 WRR 88-89		Table 16.1 WRR 88-89		Table 13 Appendix 2		Table IV "Development and the National Interest"	
	7		8		9		10		11		RENEWABLE TOTALS	
	PROTECTED AREAS (As % of Total Land Area 1988)		THREATENED SPECIES (Number per 1000 km ² 1980s)		TOTAL WATER RESOURCES (1000 cubic meters per capita per year 1989)		COASTLINE (Kilometers per million people 1989)		MARINE FISH CATCH (1000 mt per million people 1983-85)			
	RANK		RANK		RANK		RANK		RANK		RANK	
ANE NEAR EAST												
Egypt	0.62	10	0.113	10	1.13	12	48	10	0.51	13	111	13
Jordan	0.35	12	0.144	9	0.17	14	6	13	0.00	14	121	15
Morocco	0.66	9	0.479	2	1.23	11	76	7	19.24	4	77	6
Oman	0.25	13	0.028	14	1.42	10	1481	1	74.30	1	76	5
Tunisia	0.36	11	0.283	5	0.56	13	149	4	9.96	6	85	8
Yemen	0.00	15	0.010	15	0.13	15	68	8	2.22	10	88	9
ANE SOUTH ASIA												
Bangladesh	0.71	8	0.157	7	12.08	3	5	14	1.50	12	119	14
India	4.34	6	0.390	3	2.27	8	9	12	2.06	11	97	11
Nepal	7.05	5	0.285	4	9.42	4	0	15	0.00	15	103	12
Pakistan	9.36	2	0.040	13	2.72	6	10	11	2.79	9	80	7
Sri Lanka	10.61	1	1.560	1	2.51	7	78	5	8.99	8	89	10
ANE SOUTHEAST ASIA												
Burma	0.00	14	0.079	11	26.99	1	76	6	11.70	5	64	3
Indonesia	7.50	4	0.146	6	14.17	2	307	3	9.70	7	57	1
Philippines	1.67	7	0.275	6	5.41	5	608	2	22.28	3	74	4
Thailand	7.85	3	0.078	12	2.01	9	59	9	36.69	2	62	2
	Table 19.1 WRR 88-89		Tables 19.1; 19.4 WRR 88-89		Table 21.1 WRR 88-89		Table 22.1 WRR 88-89		Table 22.1 WRR 88-89			

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Appendix 3 TABLE B		INDICATORS OF NATURAL RESOURCE ENDOWMENT: NON-RENEWABLE RESOURCES									
		12		13		14		15		16	
		MINERAL PRODUCTION		MINERAL RESERVES		COAL, OIL AND GAS PRODUCTION		COAL RESERVES		OIL RESERVES	
		(All major minerals 1986 value per 100,000 population)		(All major minerals 1986 value per 100,000 population)		(1986 production in petajoules / p.c.)		(million metric tons per capita various years)		(million metric tons per capita 1984)	
RANK		RANK		RANK		RANK		RANK			
ANE NEAR EAST											
Egypt	0 11	0 10	36.73 2	1.03 5	1.78 3						
Jordan	478 5	36635 6	0.24 13	0.00 8	0.00 10						
Morocco	203 6	66019 5	1.12 10	1.87 3	0.00 10						
Oman	0 11	0 10	1022.65 1	0.00 8	339.70 1						
Tunisia	175 7	589 8	30.66 3	0.00 8	25.87 2						
Yemen	0 11	0 10	1.95 9	0.00 8	0.00 10						
ANE SOUTH ASIA											
Bangladesh	0 11	0 10	1.08 11	0.00 8	0.00 10						
India	65 8	4422 7	6.92 5	1.94 2	0.58 5						
Nepal	0 11	0 10	0.00 14	0.00 8	0.00 10						
Pakistan	11 9	X 9	4.04 7	0.93 6	0.12 7						
Sri Lanka	4 10	X 9	0.00 14	0.00 8	0.00 10						
ANE SOUTHEAST ASIA											
Burma	203500 3	2713404 3	2.59 8	0.05 7	0.09 8						
Indonesia	680542 2	21619944 2	23.22 4	0.00 8	6.72 4						
Philippines	14692 4	1504095 4	0.65 12	1.37 4	0.05 9						
Thailand	1687596 1	26803246 1	5.18 6	16.03 1	0.22 6						
		U.S. Bureau of Mines "Mineral Commodity Summaries, 1988"	U.S. Bureau of Mines "Mineral Commodity Summaries, 1988"	Table 20.1 WRR 88-89	Table 20.2 WRR 88-89	Table 20.2 WRR 88-89					
		17 NATURAL GAS RESERVES (billion cubic meters per capita 1984)	18 HYDRO- ELECTRICITY INSTALLED CAPACITY (megawatts per capita 1985)	19 HYDRO- ELECTRICITY TECHNICAL POTENTIAL (megawatts per capita)	NON- RENEWABLE TOTALS						
		RANK	RANK	RANK	RANK						
ANE NEAR EAST											
Egypt	3.3 5	53 1	62 9		46 3						
Jordan	0.0 10	0 13	3 13		78 9						
Morocco	0.2 9	25 6	102 7		56 6						
Oman	61.6 1	0 13	0 14		59 7						
Tunisia	11.0 2	8 8	8 11		49 6						
Yemen	0.0 10	0 13	0 14		85 11						
ANE SOUTH ASIA											
Bangladesh	1.7 7	1 12	7 12		81 10						
India	0.4 8	19 7	123 6		48 3						
Nepal	0.0 10	7 9	1011 1		73 8						
Pakistan	4.1 4	27 5	179 5		52 4						
Sri Lanka	0.0 10	39 2	42 10		73 8						
ANE SOUTHEAST ASIA											
Burma	0.0 10	4 10	748 2		51 3						
Indonesia	10.5 3	3 11	453 3		37 2						
Philippines	0.0 10	31 4	63 8		55 5						
Thailand	1.9 6	33 3	367 4		28 1						
		Table 20.2 WRR 88-89	Table 20.2 WRR 88-89	Table 20.2 WRR 88-89							

Appendix 3
Table
C

A TYPOLOGY OF ANE COUNTRIES
BASED ON RESOURCE ENDOWMENT
AND COMPARISON WITH INCOME PER CAPITA

	RENEWABLE RESOURCE SCORE	RANK	NON-RENEWABLE RESOURCE SCORE	RANK	TOTAL RESOURCE SCORE	RANK	AVERAGE INDICATOR RANK	INCOME PER CAPITA (1987) RANK	US\$
BY ENDOWMENT									
VERY RICH									
Thailand	60	2	28	1	88	1	4.6	4	850
Indonesia	58	1	37	2	95	2	5.0	8	450
RICH									
Burma	65	3	51	6	116	3	6.1	12	200
Philippines	74	4	55	8	129	4	6.8	7	590
Morocco	76	5	56	9	132	5	6.9	6	610
Pakistan	80	7	52	7	132	5	6.9	10	350
Tunisia	86	8	49	5	135	6	7.1	3	1180
Oman	77	6	59	10	136	7	7.2	1	5810
POOR									
India	98	11	48	4	146	8	7.7	11	300
Egypt	111	13	46	3	157	9	8.3	5	680
Sri Lanka	89	10	73	11	162	10	8.5	9	400
Yemen	88	9	85	14	173	11	9.1	7	590
Nepal	103	12	73	11	176	12	9.3	13	160
VERY POOR									
Jordan	119	14	78	12	197	13	10.4	2	1560
Bangladesh	119	14	81	13	200	14	10.5	13	160
BY REGION									
A/NE NEAR EAST									
Egypt	111	13	46	3	157	9	8.3	5	680
Jordan	119	14	78	12	197	13	10.4	2	1560
Morocco	76	5	56	9	132	5	6.9	6	610
Oman	77	6	59	10	136	7	7.2	1	5810
Tunisia	86	8	49	5	135	6	7.1	3	1180
Yemen	88	9	85	14	173	11	9.1	7	590
A/NE SOUTH ASIA									
Bangladesh	119	14	81	13	200	14	10.5	13	160
India	98	11	48	4	146	8	7.7	11	300
Nepal	103	12	73	11	176	12	9.3	13	160
Pakistan	80	7	52	7	132	5	6.9	10	350
Sri Lanka	89	10	73	11	162	10	8.5	9	400
A/NE SOUTHEAST ASIA									
Burma	65	3	51	6	116	3	6.1	12	200
Indonesia	58	1	37	2	95	2	5.0	8	450
Philippines	74	4	55	8	129	4	6.8	7	590
Thailand	60	2	28	1	88	1	4.6	4	850

Note: This table reproduces Table 1-4.

Source: Panayotou, T. Natural Resources and the Environment in the Economies of Asia and the Near East: Growth, Structural Change and Policy Reform, 1989.

Note: Regional averages are unweighted means.

APPENDIX 4

LIST OF BACKGROUND ISSUE PAPERS FOR THE ANE STRATEGY PROJECT

- Armstrong, A., P. Durst, and C. Gallegos. 1989. Deforestation and its implications for the Asia/Near East region. Paper prepared for Asia/Near East Bureau, AID. Washington, D.C. 60pp.
- Archer, R., and R. Ichord. 1989. Global warming and climate change: Role of the Asia/Near East region. Paper prepared for the Asia/Near East Bureau, AID. Washington, D.C. 28pp.
- Barber, C.V. 1989. Institutional issues in environmental and natural resources management for the Asia/Near East region. Paper prepared for the Asia/Near East Bureau, AID. Washington, D.C., World Resources Institute. 69pp.
- Barbier, Edward B. 1989. Economic aspects of sustainable agriculture: A strategy for Asia and the Near East. Paper prepared for the Asia/Near East Bureau, AID. London, International Institute for Environment and Development and the Economics Department of University College. 43pp.
- Bentley, W. 1989. Soil loss and watershed degradation: Implications for the Asia and Near East region. Paper prepared for the Asia/Near East Bureau, AID. Morrilton, AR, Winrock Institute for Agricultural Development. 34pp.
- Higgins, M.L., W.W. Barclay, and J.N. Pretty. 1989. The use and management of agricultural chemicals in the Asia and Near East region. AID. Washington, D.C. 112pp.
- Johnson, N., and J. Alcorn. 1989. Ecological, economic and development values of biological diversity. Paper prepared for the Asia/Near East Bureau, AID. Washington, D.C., World Resources Institute. 100pp.
- Lurie, C. and D. Laredo. 1989. Environmental impacts of rapid urbanization and industrial development: Water resources in the urban context. Paper prepared for the Asia/Near East Bureau, AID. Boston, MA, Camp Dresser and McKee Inc. 124pp.
- Mackie, C. 1989. Watershed management issues and opportunities in Asia and Near East countries. Paper prepared for Asia/Near East Bureau, AID. Washington, D.C., World Resources Institute. 27pp.

Marcil, T.C. and R.A. Carpenter. 1990. Hazardous (toxic) chemicals and wastes; A natural resources issues paper. Paper prepared for the Asia/Near East Bureau, AID. New York, NY, East-West Center, Environment and Policy Institute and World Environment Center. 134pp.

Olsen, S., L.Z. Hale, R. DuBois, D. Robadue, Jr., and G. Foer. 1989. Integrated resources management for coastal environment in the Asia Near East region. Paper prepared for the Asia/Near East Bureau, AID. University of Rhode Island, Narragansett. 77pp.

Panayotou, T. 1989. Natural resources and the environment in the economies of Asia and the Near East: Growth, structural change, and policy reform. Paper prepared for the Asia/Near East Bureau, AID. Cambridge, MA, Institute for International Development. 95pp.

Parker, J.K. 1989. Integrating gender concerns into the Asia and Near East environmental and natural resources strategy in the 1990s. Paper prepared for the Asia/Near East Bureau, AID. Gainesville, FL, Tropical Research and Development, Inc. 101pp.

RCG/Hagler, Bailly, Inc. 1989. Energy inefficiency in the Asia/Near East Region and its environmental implications. Paper prepared for the Asia/Near East Bureau, AID. Washington, D.C., RCG/Hagler, Bailly, Inc. 168pp.

Resch, T.M. 1989. Non-profit assistance to the natural resources sector of the Asia/Near East region. Draft prepared for the Asia/Near East Bureau, AID. Washington, D.C., United States Department of Agriculture Forest Service. 25pp.

Richards, D.C. 1989. Strengthening non-governmental organizations working on natural resources management issues at the grassroots. Paper prepared for the Asia/Near East Bureau, AID. Washington, D.C., World Resources Institute. 44pp.

Tavangar, J.D. 1989. Rural water supply sanitation, and environmental issues in Asia and the Near East. Paper prepared for the Asia/Near East Bureau, AID. Washington, D.C. 83pp.