

PD-ABE-856

79655

USAID ENVIRONMENTAL PROGRAM
A Narrative Summary
1990-1991



September 1991

**U.S. Agency for
International Development
(USAID)**

**Bureau for Research and Development
Office of Environment and Natural Resources
Washington, D.C. 20523**

EXPLANATORY NOTE

This report was prepared by USAID during the second half of fiscal year 1991. The present report represents USAID's first attempt to describe in narrative form the full range of activities the Agency is undertaking under its new 1990 Environmental Initiative in one "unified report." Topics included in this summary cover all the various technical areas of USAID's Initiative and new Environmental Strategy Framework, including tropical forests and biological diversity, pollution, water resources, global climate change and sustainable agriculture. As experience is gained with this unified approach to environmental program reporting, USAID expects in the future to produce periodic comprehensive descriptions of its environmental program in lieu of, or in addition to, narrow technical reports on individual aspects of its work (i.e., tropical forests, etc.) that have been published in the past.

Additional copies of this report can be obtained from:

Office of Environment and Natural Resources
Bureau for Research and Development
(R&D/ENR) SA-18
Washington, D.C. 20523 USA

or

Environment and Natural Resources Information Center (ENRIC)
DATEX, Inc.
1400 Eye Street, N.W., Suite 1155
Washington, D.C. 20005 USA
Phone: 202/789-1525
Fax: 202/789-1520



USAID ENVIRONMENTAL PROGRAM
A Narrative Summary
1990-1991



September 1991

**U.S. Agency for
International Development
(USAID)**

**Bureau for Research and Development
Office of Environment and Natural Resources
Washington, D.C. 20523**

TABLE OF CONTENTS

I.	Overview of USAID Environmental Strategy Framework	
	A. Environmental Strategy Framework	I-2
	1. Strategic Objectives	I-2
	2. Development Approaches	I-2
	B. Areas of Focus	I-4
	1. Tropical Forestry and Biodiversity	I-4
	2. Agriculture	I-5
	3. Global Climate Change/Energy Efficiency	I-5
	4. Urban and Industrial Pollution	I-5
	5. Water Resources Management, Watersheds and Coastal Zones	I-5
	C. Cooperation with Other Environmental and Development Organizations	I-6
	D. Agency Environmental Staffing	I-7
II.	1990 Program Highlights	
	A. Tropical Forests and Biological Diversity	II-1
	B. Urban and Industrial Pollution and Environmental Health	II-2
	C. Global Climate Change/Energy Development	II-3
	D. Water Resources, Coastal Zones, Wetlands and Watershed Management	II-3
	E. Sustainable Agriculture	II-4
III.	1990 Environmental Sector Project and Funding Summary with 1991 Budget Projections	
	A. 1990 Environmental Program	III-1
	B. 1991 Projected Total Environmental Program	III-2
IV.	Tropical Forests and Biological Diversity	
	A. Centrally Funded Projects	IV-2
	1. Cooperative Agreement for the Conservation of Biological Diversity	IV-2
	2. Competitive Research Grants Programs	IV-3
	3. Collaboration with the National Science Foundation	IV-4
	4. The Noah Project	IV-4

TABLE OF CONTENTS (Cont.)

B. Cooperation with Other Donors, International Organizations and Programs, and Other U.S. Government Agencies	IV-5
<i>Highlight on Strengthening International Forestry Research</i>	IV-6
C. Selected Regional Highlights	IV-7
1. Africa	IV-8
<i>Highlight on African Elephant Conservation</i>	IV-11
2. Asia and the Near East	IV-12
3. Latin America and the Caribbean	IV-16
<i>Highlight on the Parks in Peril Project</i>	IV-19
<i>Highlight on Conservation of Neotropical Migratory Birds</i>	IV-20
V. Urban and Industrial Pollution and Environmental Health	
A. Problem Overview	V-1
B. Bureau for Science and Technology	V-3
1. Office of Health	V-4
2. Office of Forestry, Environment and Natural Resources	V-4
C. Bureau for Asia and Private Enterprise	V-5
D. Bureau for Europe and the Near East	V-6
VI. Global Climate Change/Energy Development	
A. Problem Overview	VI-1
B. The USAID Response	VI-2
C. Activities in Key Regions	VI-3
1. The African Congo Basin	VI-3
<i>Highlight on Sudan: Two Models for Global Climate Change Projects</i>	VI-4
2. Asia	VI-5
3. Europe and the Near East	VI-6
4. Latin America and the Caribbean	VI-7
<i>Highlight on Brazil and Mexico</i>	VI-8
5. Global Efforts	VI-11
VII. Water Resources, Coastal Zones, Wetlands, and Watershed Management	
A. Problem Overview	VII-1
B. Highlights on Mission Coastal Management Projects	VII-2
1. Thailand	VII-2
2. Sri Lanka	VII-3

TABLE OF CONTENTS (Cont.)

3. Ecuador	VII-3
4. Other Areas	VII-4
C. Wetlands Conservation-1991	VII-5
VIII. Sustainable Agriculture	
A. USAID's Strategy for Sustainable Agriculture	VIII-2
<i>Highlight on Integrated Pest Management</i>	VIII-4
B. Centrally Funded Programs	VIII-5
1. Pest and Vector Management	VIII-5
2. Collaborative Research Support Program	VIII-5
3. Title XII University Activities	VIII-6
4. Research on Extreme Agroecological Conditions	VIII-7
5. Research Grants Supporting Sustainable Agriculture	VIII-8
C. Regional Efforts	VIII-9
1. Africa	VIII-9
2. Asia	VIII-12
3. Latin America and the Caribbean	VIII-13

Acronyms

I. OVERVIEW OF USAID ENVIRONMENTAL STRATEGY FRAMEWORK

The U.S. Agency for International Development (USAID) has long recognized that development and the environment are inextricably linked, each dependent on the other for sustainability and stability. The root causes of underdevelopment -- population pressures, poverty, inappropriate policies, unstable political systems, and inequitable access to land and other resources -- are the same as the root causes of environmental degradation. Lasting solutions to development problems -- such as the adoption of alternative agricultural practices and the use of more efficient energy technologies -- also can often help solve environmental problems.

The press of the basic needs of development, along with short-sighted development programs, traditionally have contributed to the neglect of environmental costs. Continued misuse of the environment and natural resources will increasingly threaten human physical and economic well-being.

Environmental and developmental problems cannot be solved in isolation from one another. A broad, comprehensive approach is needed that mobilizes the advantages of the environment and development communities, alike. USAID's Environmental Initiative, which took effect in June 1990, and its Environmental Strategy Framework, developed in 1991, build on these factors.

The Strategy Framework provides a comprehensive structure and rationale for the types of environmental interventions the Agency proposes to make in the coming five years. USAID takes action in each assisted country on the basis of specific national development plans that take into account each country's unique problems, strengths, and needs. These plans are continually updated. Plans for development that are supported by USAID are formulated with maximum input and participation from environmental organizations, representatives from the public and private sectors, and developing country governments. The development of these plans plays a fundamental role in the USAID environmental strategy. The very process of devising these plans strengthens the capacity of developing country governments to plan and more effectively manage the use of natural resources, as well as maintain environmental quality, in the context of economic development.

USAID's Environmental Strategy Framework completes a three-part package that USAID has developed during the past three years. It includes the Policy Paper on Environment and Natural Resources (1988), the Agency Environmental Initiative (1990), and the various emerging regional bureau and mission strategies on environment and natural resource management (1987-present). The Environmental Strategy Framework is used primarily to guide the USAID regions in strategy formulation and the missions in planning country programs and in allocating financial and staff resources.

A. ENVIRONMENTAL STRATEGY FRAMEWORK

1. Strategic Objectives

To achieve its goal of sustainable development, USAID has identified four strategic objectives:

- Support efforts by developing countries to conserve and improve their environment and manage their natural resources for long-term economic growth;**
- Help developing countries strengthen their capacity to plan and implement environmentally sustainable development activities;**
- Work with developing countries to address critical environmental problems of global and regional, as well as local, concern; and**
- Integrate appropriate environmental concerns into all USAID-supported development activities.**

2. Development Approaches

USAID's experience suggests that the following approaches are most effective in addressing environmental and development problems:

- Reforming economic and environmental policies;**
- Strengthening host-country institutions; and**
- Advocating private sector solutions.**

USAID's experience also suggests that local empowerment is critical to success and paves the road to a successful, open democratic society. Moreover, empowerment of local people provides a permanent force for environmental protection. Every effort is being made to incorporate local empowerment into the Agency's environmental programs.

Reforming Economic and Environmental Policies

Among the most significant causes of environmental degradation in developing countries are unsound economic policies and ineffective institutions and organizational structures for carrying out environmental laws, policies, and regulations. USAID works to remove policies that lead to environmental degradation, such as subsidies that encourage resource depletion. USAID also supports policies that promote sustainable development. In addition, the Agency works to improve developing nations' capabilities to undertake environmental economic analyses relating to natural resource trends.

Strengthening Host Country Institutions

Institutional problems often inhibit host countries from designing and implementing environmental programs. USAID supports education and training for individuals in institutions, ranging from grassroots organizations to government agencies. The Agency emphasizes institutional strengthening at the grassroots level because empowerment of local people provides a permanent force for environmental protection. In addition, the Agency promotes activities to improve the environmental information base in developing countries.

Advocating Private Sector Solutions

USAID makes frequent use of the private sector, especially private nongovernmental organizations (NGOs) and private voluntary organizations (PVOs), in carrying out its environmental program. The Agency also is increasingly looking to private enterprise and the for-profit private sector as allies and partners in advancing environmental program objectives.

Local NGOs and PVOs, as well as local business interests, figure increasingly in the Agency's emphasis on encouraging very strong local participation and locally motivated management of the environment and natural resources.

USAID involves and encourages domestic U.S. NGO and private commercial involvement in its environmental work and works to promote mutually beneficial ties among U.S. NGOs and business interests in its programs.

In particular, as USAID begins to deal increasingly with environmental quality and pollution problems, emphasis is being placed on private sector solutions to the prevention of industrial pollution. Greater attention is being paid to strong cooperation between the public and private sectors in developing countries; attention also is focusing upon mutually beneficial technology and trade prospects involving the U.S. private sector. Expanded environmental technology transfer and trade can be good business for all

concerned, while contributing to environmental quality and mutually beneficial resource sustainability objectives.

As USAID has paid greater attention to environmental and natural resources economic policy issues, private sector contributions to workable solutions are increasingly seen as being absolutely essential. From emerging markets for recycled solid waste to the economic value of nature tourism and "green" businesses based on the principle of sustainability, the private sector and private enterprise role in getting results is now widely recognized. Market forces can have positive impacts on achieving environmental goals.

In areas such as global climate change and the reduction of greenhouse gas emissions, U.S. industries are leaders in the development of a number of environmentally sound technologies, including energy efficiency, renewable energy, and the use of non-fossil fuels. USAID is working with U.S. private industry to further the transfer and adaption of relevant energy technologies that have positive implications for the environment. USAID will help industries in developing countries to improve their capacity to use a range of environmentally safe technologies and practices in sectors such as agriculture, mining, manufacturing, and transportation.

B. AREAS OF FOCUS

To encourage economic progress, enrich the planet's biological heritage, and improve the health and quality of human life, USAID will target its environmental projects in the following key problem areas:

- Tropical forests and biological diversity;
- Sustainable agriculture;
- Global climate change/energy efficiency and environmentally sound energy production and use;
- Urban and industrial pollution; and
- Management of water resources.

Within the areas of focus, many of USAID's ongoing and planned projects and programs pursue objectives such as those given below:

1. Tropical Forestry and Biodiversity

- Support conservation research;
- Improve the management of existing conservation sites;
- Identify and protect critical habitats not currently protected;
- Support multi-donor forest policy reform initiatives;

- Increase the knowledge base on sustained-yield forest management; and
- Increase the socioeconomic contribution of timber and non-timber products to local people and national economies.

2. Agriculture

- Increase the knowledge base on sustainable agriculture techniques;
- Support the integration of agricultural, economic, and environmental objectives in development activities; and
- Support collaboration in sustainable agriculture activities among donors, international agricultural research centers (IARCs), non-governmental organizations (NGOs), private voluntary organizations (PVOs), universities, and the private sector.

3. Global Climate Change/Energy Efficiency

- Increase energy efficiency to reduce greenhouse gas emissions;
- Improve energy planning that addresses environmental concerns, cost-efficiency, and alternative energy options; and
- Encourage the use of renewable energy and clean fossil fuel technologies.

4. Urban and Industrial Pollution

- Reduce industrial pollution through pollution prevention and control methods;
- Reduce water pollution by improving municipal water/wastewater treatment;
- Improve solid, toxic, and hazardous waste management; and
- Identify and address environmental health problems.

5. Water Resources Management, Watersheds and Coastal Zones

- Manage water resources more effectively, both for quantity and quality;
- Support integrated approaches to watershed management;
- Increase resource productivity of selected watersheds;
- Improve coastal resource management for economic development; and
- Increase host-country knowledge of coastal resources and their use.

C. COOPERATION WITH OTHER ENVIRONMENTAL AND DEVELOPMENT ORGANIZATIONS

USAID works closely with other U.S. Government agencies, international organizations, bilateral donors, U.S. and local NGOs, and private sector entities in addressing environmental problems.

In carrying out its environmental programs, USAID has forged strong ties and partnerships with other U.S. domestic government agencies. These include the U.S. Department of Agriculture Forest Service, the Peace Corps, and the Environmental Protection Agency, in addition to the State, Commerce, and Treasury departments, among others. Domestic and international nongovernmental and private voluntary organizations are also strong cooperators in carrying out many aspects of USAID's environmental work. These include such groups as the World Wildlife Fund (U.S.), the World Conservation Union (IUCN), The Nature Conservancy, the World Resources Institute, CARE, and the Pan American Development Foundation. Universities, foundations, institutes, botanical gardens, and many other organizations participate in USAID's environmental work.

USAID also interacts with other bilateral donors, as well as numerous international organizations, including multilateral organizations and U.N. agencies and their international development initiatives and projects.

At the request of Congress, USAID has taken an active role in encouraging greater environmental sensitivity by the multilateral development banks, particularly the World Bank, in project selection and design. This has been done primarily through an "early warning system" within USAID to alert environmental NGOs and U.S. Executive Directors at the multilateral development banks of project proposals having potentially undesirable environmental and/or developmental impacts. The process has contributed to a steady improvement in the performance of most banks.

USAID planned to work closely with the World Bank, the United Nations Environment Programme (UNEP), and the United Nations Development Programme (UNDP) in the Global Environment Facility -- a three-year pilot facility of about \$1.4 billion that will address global environmental issues -- and with the World Bank and other donors in the development of national environmental action plans. In addition, the Agency has been participating in many other international initiatives or ongoing programs such as preparations for the 1992 U.N. Conference on Environment and Development (UNCED), the efforts to reform the Tropical Forestry Action Plan, and the Intergovernmental Panel on Climate Change.

USAID's Environmental Strategy acknowledges the increasingly key role that NGOs will play in the Agency's environmental work. NGOs complement USAID's work by delivering services to and assisting communities, empowering local groups, and channeling environmental concerns manifested at the grassroots level to national decision makers.

D. AGENCY ENVIRONMENTAL STAFFING

USAID is working to increase staff environmental expertise. The Agency plans to meet its need for environmental expertise three ways: by hiring additional career, or direct hire (DH), environmental and energy staff; by training current direct hire staff to shift into environment/energy positions; and by increasing the level of effort in overall training and sensitization of USAID staff in environmental/energy matters by expanding the current environmental training program.

In spite of these efforts, USAID still has too few trained and experienced career staff working full-time on environment, natural resources, and energy initiatives overseas and in Washington, and steps to strengthen USAID's capacity will continue.

Because the Agency will likely face a reduction in its overall workforce, bureaus and missions must complete for new ENR ceilings with other priority programs, such as the democracy initiative and/or assistance to Eastern Europe.

To alleviate this ENR staffing impasse, recent internal recommendations have included:

- Authorizing additional IDI positions each year for the next five years to be filled with candidates with environmental skills;**
- Authorizing additional position ceilings each year for the next five years for hiring mid-level ENR employees; and**
- Authorizing funds from operating expense monies each year for the next five years to provide specialized ENR training to strengthen the environmental skills of selected employees.**

II. 1990 PROGRAM HIGHLIGHTS

A. TROPICAL FORESTS AND BIOLOGICAL DIVERSITY

- Significant achievements in biological diversity conservation have been made in the areas of technical assistance, research, training, information networking, and pilot demonstrations under a Cooperative Agreement for the Conservation of Biological Diversity with the World Wildlife Fund.
- To expand knowledge of potential threats to ecosystems and species in developing countries, USAID and the National Science Foundation initiated a collaborative research program in FY 1990.
- The U.S. Government pledged to support the World Bank's Global Environment Facility (GEF) through parallel financing from USAID. The Agency selected a number of projects in the area of tropical forest conservation, biological diversity, and energy efficiency and conservation as candidate efforts that might be programmed in concert with the World Bank.
- To strengthen the capacity of local communities and forestry and natural resources management institutions in tropical and subtropical developing countries, USAID will work with the U.S. Department of Agriculture and the Peace Corps through the new Forest Resources Management II Project.
- A Tropical Forestry Action Plan is being elaborated for Central America.
- A debt-for-nature agreement signed with Panama's Ministry of Planning and Economic Policy will capitalize a trust for *Fundación Natura*, thus forming a new conservation fund.
- An action plan was developed for *Les Arcadins*, the first marine park in Haiti.
- Two major new forestry projects were initiated in Nepal and Indonesia to strengthen each country's institutional capacity to improve forest and

conservation policies, planning, and management -- including the promotion of local community involvement to conserve forests and parks and identify economic opportunities to improve local livelihoods.

- The Institute of Forestry project in Nepal was designed to upgrade the Institute's capacity to train foresters and natural resource managers, with special attention to community forestry management. The project will upgrade faculty competence and improve the Institute's administration, applied research, curricula, facilities, and policies.
- In the Philippines, a program was initiated to promote the sustainable management of tropical forests -- including policy reform to conserve old-growth forests -- and increase economic efficiency in the forest products industries. The program will support the establishment of a foundation to fund conservation activities by Philippine NGOs.
- In the South Pacific, a regional project will demonstrate sustainable enterprises that conserve biodiversity and help local communities generate income in several South Pacific countries.
- Two new programs are among the most comprehensive efforts to date to protect Madagascar's unique biological diversity and help improve the sustainability of local public and private natural resource management.
- In a major step in the process of decentralizing control over forest resources and empowering local populations to manage them, the government of Niger issued a decree giving village communities throughout the country rights to natural forests in the vicinity of their villages. The policy change was stimulated in large part by the successful experience of USAID's Forestry Land Use Planning Project (FLUP) in the Guesselbodi Forest, which has become a model for natural forest management for sustainable economic growth.

B. URBAN AND INDUSTRIAL POLLUTION AND ENVIRONMENTAL HEALTH

Significant steps were taken in FY 1990 to reduce water and industrial pollution, improve waste management, and address environmental health problems:

- USAID's regional and central Bureaus joined to develop the Urban and Industrial Pollution and Environmental Health Action Plan, which addresses the most serious industrial pollution and environmental health problems in the developing world. A new Environmental Health Strategy is among the new initiatives proposed as part of the Plan. It will be implemented through expansion of project work in the Bureau for Science and Technology, Office of Health, to provide technical assistance in water

supply, wastewater and solid waste management, and vector disease control.

- S&T/H's Water and Sanitation for Health Project (WASH) established a data bank known as the Peri-Urban Network to centralize existing information about current projects, evaluations, lessons learned, and on-going research.

C. GLOBAL CLIMATE CHANGE/ENERGY DEVELOPMENT

- The Bureau for Latin America and the Caribbean has initiated a regional project to address the problems of global climate change. The project will encourage policy reforms, technologies, and practices that will promote the sustainable and efficient use of forest and energy resources in the region. The initiative emphasizes efforts in Brazil and Mexico.

D. WATER RESOURCES, COASTAL ZONES, WETLANDS AND WATERSHED MANAGEMENT

- The Coastal Resources Management (CRM) Project, initiated in 1985 by the Office of Forestry, Environment and Natural Resources, Bureau for Science and Technology, is being implemented through a Cooperative Agreement with the University of Rhode Island. Among recent activities:
 - In Thailand, a Coral Protection Strategy was formulated and is currently being implemented in Phuket Province and in Phi National Park. By June 1990, a National Coral Reef Strategy that builds on these efforts was completed and adopted by the Thai Government.
 - In Sri Lanka, the Cabinet ratified the Sri Lanka Coastal Zone Management Plan prepared through the Coastal Resources Management Project in April 1990. Implementation of the plan is currently underway.
 - In Ecuador, a national coastal resources management program was adopted by a Presidential Decree in January 1989. Key features to this program, including the creation of an Interministerial CRM Commission, became operational in 1990.
 - In the Philippines, a small grants project is helping to evaluate some 136 wetland areas, prepare conservation and management plans for sample wetlands, and propose protective measures for key sites.

- In Oceania, USAID's Pacific Islands Marine Resources Project is helping strengthen coastal and marine resource conservation in the region, while increasing income opportunities for island communities. Pilot activities are projected for the Cook Islands, Kiribati, Papua New Guinea, Tonga, and Tuvalu. The programs aim to launch small-scale commercial operations in nearshore areas, while preserving inner reef and lagoon resources for subsistence uses.

E. SUSTAINABLE AGRICULTURE

- Within USAID's Bureau for Science and Technology, three offices -- Agriculture, Rural Development, and Forestry, Environment and Natural Resources -- have taken the lead in developing an USAID strategy for sustainable agriculture. An inter-office task force was formed on agricultural sustainability to discuss steps to help USAID address this critical issue.
- To identify and analyze sustainable agriculture systems throughout the world, the Office of Agriculture, in collaboration with the National Research Council, has undertaken the following three planning activities:
 - Identify knowledge gaps in research on sustainable agriculture topics. This work resulted in the release of the publication, "Toward Sustainability: A Plan for Collaborative Research on Agriculture and Natural Resource Management". The publication served as a conceptual framework for a new Collaborative Research Support Program currently being designed by U.S. universities.
 - Develop a broad agenda for directing worldwide research and development efforts related to the use of soil and water resources to sustain agriculture. The publication, "Toward Sustainability: Soil and Water Research Priorities for Developing Countries", was released in mid-1991 and is serving as a program guide for research in this topic.
 - Analyze the probable impacts the adoption of more nearly sustainable agriculture systems would have on land use in the humid tropics. The report is scheduled to be completed in early 1992 and serve as a reference document for the UNCED meeting in Brazil in 1992.

- **Completion of a series of case studies in Jordan, Mali, and Niger on sustainable agriculture issues in food, income, and resource management problems. The work is being funded by S & T's Office of Agriculture and carried out by Washington State University and Purdue University.**
- **Provision of technical support and advice through USDA's Agricultural Research Service to the Asia-Pacific Natural Agriculture Network (APNAN), whose 13 member countries have strong interests in developing research projects on low-input/sustainable agriculture.**

III. ENVIRONMENTAL PROGRAM FUNDING SUMMARY

In FY 1990, USAID committed \$392 million to projects and activities that fell within the environmental program. The adoption of the Environmental Initiative in 1990 and a widening of the program's definition to embrace global climate change issues is reflected in the funding obligations for FY 1991¹. With adjustments to correct for over-counting and the inclusion of estimated contributions from activities not coded as environmental but which nevertheless contribute to environmental objectives, USAID committed \$485 million in FY 1991 to the environmental program. The various computations are described below.

A. 1990 ENVIRONMENTAL PROGRAM

USAID was involved in 354 active and planned projects containing environmental and natural resources development activities during FY 1990. The Agency committed approximately \$392 million to these projects during FY 1990. Almost 30 percent -- some \$109 million -- of this amount was directed toward tropical forest development, conservation and protection; \$53 million was devoted to conserving biological diversity. However, many actions that support tropical forest conservation or protection also are likely to conserve biological diversity. The reverse also can occur. USAID's internal activity and special interest budget coding system identifies such cases so that double-counting of funding commitments can be avoided. The value of tropical forest activities that contributed to biological diversity conservation or management, and vice versa, was approximately \$29 million in 1990. Adjusting for such dual benefit projects or activities, the total commitment to both areas was \$133 million (\$109 million + \$53 million - \$29 million = \$133 million).

Separate tracking of the corresponding budget commitments for pollution, sustainable agriculture and other technical areas included in the 1990 Environmental Initiative was not performed in 1990 since the specifics of the Initiative were still being developed.

¹ Estimated obligations amounts were obtained from USAID's Project Budget Data System data as of September, 1991.

B. 1991 PROJECTED TOTAL ENVIRONMENTAL PROGRAM

Total obligations for FY 1991 for environmental activities, adjusted to eliminate over-counting in the case of multiple focus activities, were estimated to be \$485 million. Bureaus were expected to make the following contributions:

Bureau	Estimated \$ (millions)
Africa (AFR)	\$ 81.2
Asia and Private Enterprise (APRE)	\$ 29.6
Central (CTL)	\$ 44.9
Europe and the Near East (ENE)	\$256.9
Latin America and the Caribbean (LAC)	\$ 72.4
Total	\$485.0

This total, adjusted to eliminate over-counting, corresponds to all activities with environmental codes, as defined in early 1991 for the FY 1992 Congressional Presentation. Nevertheless the full scope of the Agency's 1991 Environmental Program is best represented by including some obligations coded as Energy, Agriculture and Health sector activities. Some activities in these sectors, even though not coded as environmental, will contribute to attaining objectives in various technical subprograms that have been developed within the Environmental Initiative and Strategy Framework. Within the Environment Program, total estimates of 1991 funding levels for each of the five subprogram areas are:

Environmental Subprograms	Estimated \$ (millions)
Tropical Forestry/Biological Diversity	\$152
Urban and Industrial Pollution	\$211
Water Resources Management	\$ 88
Global Climate Change/Energy Efficiency	\$233*
Sustainable Agriculture	\$115

(A sixth subject area, Environmental Policy and Integrated Planning and Management, has been proposed for future financial tracking purposes.)

Except for the estimate for tropical forestry/biological diversity, these amounts are not adjusted for multiple benefit activities, where one dollar obligated may contribute to achieving results in more than one technical category. For this reason, these figures are not additive. In addition, pollution, water, global climate and agriculture amounts include health, energy and agriculture funds above the \$485 million environmental activities total for FY 1991.

*This GCC figure includes all USAID obligations for tropical forestry and energy efficiency.

IV. TROPICAL FORESTS AND BIOLOGICAL DIVERSITY

To sustain life and livelihoods in the developing world, tropical forests and biological resources are crucial. They provide income, fuel, essential products for building and industrial uses, life-saving pharmaceuticals, and sources of materials to breed new and disease-resistant crops.

Yet tropical forests, along with the biological resources they contain, are disappearing at an alarming rate. More than half of the world's tropical forests have been lost since the turn of the century. FAO estimates that 16.9 million hectares of tropical forest -- an area almost as large as the state of Washington -- are lost annually as forests are modified, degraded, and converted to non-forest uses.

Although the developing world is the site where almost all the loss of tropical forests takes place, the consequences of the destruction threaten the future of developed and developing nations, alike.

Tropical forests -- including evergreen rainforest, moist deciduous forest, arid and semi-arid forest and related forest types -- are critically needed to protect global biological diversity. Such forests contain more than half of all species believed to exist on earth.

As population pressure increases, people clear or fragment tropical forests into small patches. As a result, plant and animal species are becoming extinct on an accelerated scale. Species extinction is occurring at the fastest rate known in human history. The main reason for the loss of biodiversity is the destruction of habitats as people convert wildlands and wetlands to agricultural and urban uses. Other contributing factors include the overharvesting of plants and animals, the indiscriminate use of pesticides, draining and filling wetlands, destructive fishing practices, and pollution of air and water and rainfall runoff.

In addition to accelerating and spreading the loss of species, another global consequence of deforestation is global warming. Tropical forests are storage sinks for carbon dioxide; they help prevent greenhouse gases from accumulating in the atmosphere. About one-third of current annual emissions of carbon dioxide arising from human activities is from burning tropical forests during land clearing. That is second only to the burning of fossil fuels as a human source of atmospheric carbon dioxide.

Moreover, the degradation of forests and the conversion of land in the tropics threatens the ability of the biosphere to sustain life. Essential ecological functions are impaired, including the regulation of water quality and quantity and the cycling of soil nutrients. Severe forest loss has already adversely affected the lives of more than one billion people as flooding, soil erosion, and the siltation of lakes, reservoir and irrigation systems has increased, while fuelwood has become more scarce and agricultural productivity has diminished.

The major cause of tropical deforestation in most developing countries is inequitable access to economic opportunity. Other causes are short-sighted government policies regarding land and tree tenure, the value of timber concessions, subsidies, the development of employment opportunities, and taxation -- particularly as it allows land to be used inefficiently. Faulty policies not only encourage the wasteful conversion of forests to agriculture, but also maintain inequitable socio-economic systems, thus restricting nations' opportunities for sustainable economic growth.

USAID emphasizes the development of sustainable natural resource management practices. The Agency is expanding programs in natural forest management, buffer zone management and forestry policy reform. In addition, USAID encourages developing countries to participate in debt-for-nature swaps to provide funds, including endowments, to develop parks and other natural areas and conserve plant and animal species. USAID supports activities to protect habitats and species, promote environmental education, and strengthen legislation, policies and institutions that can conserve biodiversity.

USAID recognizes that an important contributing cause of loss of biodiversity and tropical ecosystems is inequitable access to economic opportunity. Thus, the Agency's activities in developing agriculture, promoting education, generating employment, supporting job training, and assisting family planning are likely to have as much impact over time on conserving natural resources as the important work of developing the economic potential of natural areas and their buffer zones.

A. CENTRALLY FUNDED PROJECTS

In FY 1990-1991, a number of centrally funded projects have made a significant contribution to conserve tropical forests and biological diversity.

1. Cooperative Agreement for the Conservation of Biological Diversity

A Cooperative Agreement for the Conservation of Biological Diversity enables USAID to benefit from the broad range of expertise in the U.S. conservation community on the means of promoting sustainable development through better use of biological resources. The Agency signed the Agreement with the World Wildlife Fund (WWF) in 1988. As part of this agreement, a ten-year Conservation of Biological Diversity Project is being implemented by WWF, the Nature Conservancy, and the World Resources Institute.

Significant activities have taken place in a wide range of areas, including technical assistance, research, training, information networking and pilot demonstrations.

- In Amazonian Bolivia, a dendrological survey was conducted in the Elias Menezes Experimental Forest, a 54,700 hectare area of forest and swampland in eastern Santa Cruz province. The survey revealed a number of range extensions for Amazonian trees and included several new records for the flora of Bolivia. A management plan for the Experimental Forest is currently being developed. The dendrological survey will play a key role in facilitating the development of the management plan.
- In the Gambia, a management plan intended to be a model for the conservation and sustainable use of natural resources is being developed for the Kiang West National Park, a park known for its large number of migratory shorebirds.
- In Ecuador, an ecological assessment was conducted of the mid-altitude cloud forest habitat and wildlife under a variety of human resource uses in the Podocarpus National Park. Baseline surveys have covered a substantial area of the Park, including fringe sections particularly threatened by hunting, gold mining and selective logging.
- In Belize, assistance was provided to the Government to establish a Conservation Division, which will focus on centralizing and expanding the management of the country's parks and protected areas. Local NGOs conducted a habitat survey in the country to establish priorities for areas to be incorporated into a protected area system.
- In India, the Wildlife Institute of India was supported in its efforts to explore opportunities for rehabilitating the ecology and sustainable development of buffer zone resources in two contrasting settings: Hingolghadh Nature Sanctuary in Gujarat and Ranthambhore National Park, a large tiger reserve of international renown. Both areas face pressure on their peripheries from resource-poor villagers.

2. Competitive Research Grants Programs

The Program of Science and Technology Cooperation, a small research grant program managed by the Office of the Science Advisor, continues to fund investigator-initiated, externally reviewed grants. For example, in 1990, the Program funded a project led by the National Zoo to characterize the genes of herds of Asian elephants to develop breeding strategies that will help maintain genetic diversity.

Also as part of the grants Program, a study has been undertaken of livestock predation patterns in the Himalayas of Nepal where local efforts to stop predation of herds are

threatening the snow leopard. The study aims to develop control strategies that meet local needs to protect livestock but do not threaten the snow leopard.

In Sri Lanka, scientists from that nation and Harvard University are conducting studies of dipterocarp forests to define silviculture methods that will maintain forest productivity and diversity. In Thailand, efforts are underway to develop techniques for *ex-situ* preservation of the local palms, the rattans. In Brazil, funded projects are focusing on Babassu palms, which hold unique promise for restoring some degraded Amazonian forests and for improving understanding of soil depletion in Amazonian deforested areas. In Peru and Rwanda, studies funded by the Program are focusing on the role of animals in dispersing seeds in tropical forests.

3. Collaboration with the National Science Foundation

Through an Interagency Agreement with the National Science Foundation (NSF), USAID provided \$989,000 in FY 1990 for a collaborative research program that will expand knowledge of potential threats to ecosystems and species in developing countries. The projects funded by the two agencies will help strengthen programs and facilities for biodiversity research and education and will foster a productive working relationship among U.S. and foreign scientists.

With the funds awarded in FY 1990, U.S. researchers will lead studies in Brazil, Colombia, Costa Rica, Indonesia, Mexico, Nicaragua, the Philippines and Thailand. The 12 projects underway include studies of ecosystems, individual species, and the impact of continuing development on land use trends.

Collaboration will be further strengthened in FY 1991 when USAID funding of \$1.5 million will be provided. NSF matches these funds on a two- or three-to-one basis.

4. The Noah Project

In 1990, Congress requested that USAID study the need for *ex situ* conservation of biological diversity, as well as programs requiring support through Agency assistance. The program originally was envisioned by Congress as an "international rescue mission for the thousands of animal and plant species faced with the prospect of eminent extinction". The effort was given the name "Project Noah", in reference to the biblical story of Noah.

The Noah Project and its respective initiatives aim to stimulate urgent concern for the loss of the world's biodiversity, promote the science and technology necessary to advance the *ex situ* preservation of genetic material, and foster within the foreign aid community a recognition that a healthy natural environment is an indispensable requirement for successful human development.

The Bureau for Science and Technology responded to the Congressional request by preparing a report to Congress entitled "*Ex Situ* Conservation: Present Status and Future Priorities". Based upon the report's recommendations, Congress authorized USAID to initiate preservation activities and obligate \$750,000 in FY 1991. Awards were made to three institutions after extensive external and internal peer review.

- A grant to the International Maize and Wheat Improvement Center (CIMMYT) will help begin the first coordinated multinational effort to regenerate and save the ancestral, primitive, and landrace genetic stocks of maize. This program will include collaborative efforts with 13 Latin American and Caribbean countries and serve as a model for future efforts to coordinate regeneration in other crops.
- A grant was made to the Genetic Resources Conservation Program at the University of California, Davis, in response to Congressional report language requiring USAID to "establish training programs and courses in *ex situ* management and preservation for developing country scientists". The California program is developing the first course that combines a variety of plant and animal *ex situ* conservation approaches, such as strategies, technologies, policies, case examples, and laboratory workshops.
- The third grant will enhance the ability of the staff of *Diversity* magazine to work with USAID Missions, as well as centrally funded conservation efforts. The grant responds to the need to establish a mechanism for global information sharing on *ex situ* preservation, including the creation of an international reporting system for *ex situ* documentation and technical support.

It is hoped that these initiatives will help contribute to the cause of conserving the world's agricultural biodiversity. Project Noah provides the starting point for efforts to strengthen national and international programs, while providing a new means for interaction among scientists in the United States and the developing world.

B. COOPERATION WITH OTHER DONORS, INTERNATIONAL ORGANIZATIONS AND PROGRAMS, AND OTHER U.S. GOVERNMENT AGENCIES

USAID works to increase cooperation with U.S. government agencies, other donors and international organizations. Among the numerous cooperative and participatory activities of USAID on the international front, several deserve at least brief mention. USAID has participated in the following: Intergovernmental Panel on Climate Change (IPCC) and Global Change activities; State Department involvement in Global Climate, Forest, and Biological Diversity Conventions; reform and transformation of the Tropical Forestry Action Plan; UNESCO's Man and the Biosphere Program (MAB); the International Tropical Timber Organization (ITTO); implementation of the Montreal Protocol on CFCs

and ozone layer depletion; and international cooperation with Brazil on efforts to advance conservation in Amazonia.

Notable cooperative efforts include the World Bank's Global Environment Facility (GEF), a three-year pilot facility of about \$1.4 billion to be used to address global environmental issues. GEF will be implemented by the World Bank, UNEP, and UNDP. In March 1991, the U.S. Government pledged to support the GEF through parallel financing from USAID. The United States has agreed to contribute up to \$150 million over three years.

To meet its GEF contribution, USAID planned to select a small number of well-conceived projects in the areas of tropical forest conservation, biological diversity, water resources and water quality, energy efficiency, and energy conservation to be programmed in concert with the World Bank.

USAID has been active in interagency formulation of U.S. positions and strategy for the United Nations Conference on Environment and Development (UNCED), to be held in Brazil in June, 1992. The Agency helped prepare U.S. positions on education and training, indigenous peoples, fuelwood and energy, and on financial and technical assistance for participation in the global forestry convention proposed by President Bush at the 1990 Houston Economic Summit. USAID also was participating in the preparations for a possible convention on biodiversity.

USAID continued to hold regular meetings under its Early Warning System with representatives of environmental NGOs, the Treasury and State Departments, and the U.S. Environmental Protection Agency to analyze potential environmental impacts of projects being designed by the World Bank and the regional development banks.

In December 1990, USAID entered into a ten-year \$45 million agreement with the U.S. Forest Service, the U.S. Department of Agriculture Office of International Cooperation and Development, and the U.S. Peace Corps to implement the Forest Resources Management II (FRM-II) Project. This Project is designed to promote the contribution of forest resources to sustainable development. It aims to strengthen the capacity of forestry and natural resources management institutions in tropical and subtropical developing countries by mobilizing public and private professional forestry and natural resources management communities, along with the Peace Corps.

Highlight on Strengthening International Forestry Research

USAID has continued to take steps toward strengthening the base for forestry research through actions such as that taken in FY 1990 with the participation of the Nairobi-based International Council for Research on Agroforestry (ICRAF). The focus was on agroforestry training and extension and proceeded through the Consultative Group on International Agriculture Research (CGIAR), which is supported by USAID.

CGIAR has now begun to formally embrace international forestry research. In March 1989, CGIAR's Technical Advisory Committee (TAC) began to review options for including forestry and agroforestry in the international agricultural research system. The starting point of the review was an examination of forestry and agroforestry technical and policy needs compiled by a task force in 1988. The Nairobi-based International Center for Research in Agroforestry (ICRAF) was given a global mandate for agroforestry research within the CGIAR system.

During its mid-term meeting in Paris in May 1991, the CGIAR turned its attention to forestry research. It appointed the Australia Center for International Agricultural Research (ACIAR) to implement the establishment of a new international entity to serve as a focal point for forestry research within the CGIAR. Dr. Ian Bevege of the ACIAR was appointed to head the implementation team.

At the meeting of CGIAR Center directors and donors in Washington in October 1991, Dr. Bevege reviewed work that had been done and outlined the strategy for the next year. ACIAR will:

- Identify potential host countries and initiate discussions with the host country selected;
- Prepare the necessary legal documents, such as the entity's charter and its agreement with the host country concerning its headquarters, and make arrangements for the documents' signature or adoption;
- Identify suitable candidates for membership in the entity's initial Board of Trustees and arrange for candidates' participation in the establishment of the new entity;
- Help the designated members of the initial Board of Trustees identify a suitable Director-General; and
- Carry out such other activities as are necessary or useful to establish the new forestry entity.

A progress report was to be presented to the CGIAR at its mid-term meeting in June 1991 in Istanbul, Turkey. The new International Institute for Forestry Research was expected to be fully operational by the end of 1992.

C. SELECTED REGIONAL HIGHLIGHTS

Selected FY 1990 achievements in tropical forestry and biological diversity in geographical regions are presented below.

1. Africa

Africa's biodiversity -- including wildlife -- is unique. Many areas, particularly Madagascar, host great numbers of endemic species. Africa also is home to the world's greatest diversity of primates.

In Africa, the goal of supporting the conservation of tropical forests and biological diversity is linked to the enhancement of agricultural productivity. This link is addressed in the Bureau for Africa's Natural Resources Management Program. The objectives are to help African governments to develop better approaches toward managing tropical forests and biological diversity resources and to create incentives for farmers to adopt more sustainable approaches to agriculture and natural resources management.

The plan emphasizes specific geographic sub-regions: arid and semi-arid; tropical highlands; and Madagascar and the Indian Ocean Islands. Within these sub-regions, the plan addresses three priorities: biological diversity; tropical forests; and sustainable agriculture.

Initially, a strategy to address biological diversity and tropical forests focused on two geographic sub-regions: (1) Madagascar and (2) the tropical highlands, including the Afromontane forests of Burundi, Rwanda, Uganda and Zaire. Increasing attention is being paid to the Congo Basin countries, with impetus from the Global Climate Change initiative, further discussed in a later section.

USAID supports a wide range of biodiversity programs -- many implemented by private voluntary organizations -- throughout Africa. The Agency supports tropical forest policy and national planning by designing and implementing Tropical Forestry Action Plans and Environmental Action Plans, in cooperation with other donors.

The Agency is the primary bilateral donor supporting biodiversity programs in a number of countries -- including Madagascar, Niger, and Uganda -- and has substantial programs underway in Botswana, Burkina Faso, Kenya, and Senegal.

Among USAID's achievements in tropical forestry and biological diversity in Africa in FY 1990 are the following:

- In Madagascar, USAID is cooperating with a number of institutions -- including the World Bank, World Wildlife Fund, and Duke University -- as well as local NGO's in a major effort to protect the island's unique biological diversity.

The USAID Mission in Madagascar has taken the lead in implementing the biodiversity and institutional components of the Environmental Action Plan organized by the World Bank. The Mission has initiated a \$26.6 million project (SAVEM), which was approved in FY 1990, and is designing a companion program (KEAPEM) of more than \$30 million, due for obligation in FY 1991.

The twin programs, which address issues of governance and local control over natural resources, are among the most comprehensive and innovative efforts currently underway to focus on how biological diversity conservation and sustainable rural development can co-exist and benefit the people of Madagascar. The projects will help improve the long-term sustainability of local public and private institutions related to natural resource management and will promote ecologically viable tourism programs.

- In Uganda, USAID is building on its extensive experience working with private voluntary organizations to protect the country's biodiversity. Uganda is experiencing increasing nature tourism, along with growing demands for forestry and other natural resource products. The Agency has designed a \$30 million program to support Government efforts to develop a comprehensive program for environmental management of these and other challenges. The program incorporates non-project and technical assistance, as well as an umbrella grant for private voluntary organizations. It is expected that the program will lead to the development of an Environmental Action Plan to serve as a blueprint for Uganda's natural resource and environmental policies.
- In Niger, the government issued a decree in May 1990 that gave village communities throughout the country usufruct and management rights to natural forests in the vicinity of their villages. This decree is a major step in the process of decentralizing control over natural resources and empowering local populations to manage them.

The policy change was stimulated in large part by the successful experience of USAID's Forestry Land Use Planning Project (FLUP) in the Guesselbodi Forest, which has become a model for natural forest management for sustainable economic growth.

Ten years ago, more than half the forest vegetation in Guesselbodi was cut and burned to create farmland. USAID helped introduce a series of small-scale, low-cost measures to encourage regeneration of natural forest that provided sustainable yields of wood and forage. A woodcutters association was established to enable local residents to share in the stewardship of the forest and accrue the benefits and share costs with the government. In the first official partnership to manage state lands between the Niger government and a private group, residents of the villages surrounding the forest were granted rights to harvest fuel and forage under a sustained yield plan in 1987.

Also under the FLUP Project, nearly 14,000 hectares in several forest areas including the Guesselbodi Forest were improved -- a seven-fold increase from three years ago.

- Also in Niger, significant gains were made through the Majjia Valley Windbreak project managed by CARE. Initial windbreak planting with neem (*Azadirachta indica*) trees began in 1975 in the then wind-eroded valley in the south-central part of the country. By FY 1990, more than 7,000 hectares were protected by windbreaks. At the same time, a more than 20 percent increase in millet and sorghum yields was reported in protected fields.
- In Senegal, a study of the current and proposed forestry codes was completed through the Senegal Reforestation Project. A wide range of other studies were carried out, covering such topics as the potential of tree products, marketing of treated and untreated roundwood and sawnwood, and the existing capacity of private nurseries. Seventy-five private nurseries were started. Twelve in-country training seminars were held for more than 200 forestry agents. More than 20 short courses and observation tours have taken place.
- In Southern Africa, the \$7.4 million Southern African Development Coordination Conference (SADCC) Regional Natural Resource Management Project was undertaken to facilitate regional cooperation to manage and protect natural resources for sustainable development.

The project was expected to improve the social and economic well-being of targeted rural community residents through sustainable community-based wildlife conservation and utilization projects in Botswana, Malawi, Zambia, and Zimbabwe. Education and training, skills-building for local institutions, planning, and applied research support are all integral components.

The project was to benefit the conservation and management of the elephant population in eastern Botswana and western Zimbabwe by strengthening the census, monitoring, applied research, and management capabilities of Botswana's Department of Wildlife and National Parks and Zimbabwe's Department of National Parks and Wildlife Management.

In Zambia, the project was to promote the use of community-based resource management, including the sustainable use of wildlife populations. Zambia contains some of the largest remaining concentrations of African savanna wildlife and has a high degree of local dependence on wildlife resources, particularly among isolated rural populations that practice subsistence hunting.

- In Tanzania, a three-year \$2.5 million program for sustainable economic development through wildlife conservation was initiated. The program, coordinated by the African Wildlife Foundation and the World Wide Fund for Nature, will support planning and assessment for wildlife management in the Ministry of Natural Resources.

24

In Cameroon, Wildlife Conservation International (WCI) was conducting surveys in Korup National Park, where large populations of forest elephants and gorillas are found. The vegetative and animal surveys aimed to facilitate a better understanding of the complexity of this reserve of unique biological diversity.

Highlight on African Elephant Conservation

The precipitous decline in the population of African elephants -- particularly in East Africa -- during the last 15 years has prompted concern in Africa and around the world and spurred action for increased management of African elephant populations.

In October 1989, elephant conservation efforts were aided by the effective ban on commercial trade in ivory and other elephant products among nations that adhere to the Convention on Trade in Endangered Species of Wild Fauna and Flora (CITES). The reduction in demand for elephant products that has followed has purchased time to implement sustainable African elephant management plans.

USAID has made special efforts to incorporate attention to elephant conservation into its development assistance programs. The Africa Bureau's African elephant strategy focuses on the long-term management of wildlife and associated habitats. The Bureau addresses African elephant conservation within the context of its biodiversity/tropical forest strategy. The Bureau undertakes policy and project activities that focus on rationally managing critical habitats important to biological diversity and providing human populations surrounding these habitats with alternatives to support sustainable development.

USAID's obligations for elephant conservation in Africa were about \$12.5 million in FY 1990 and were planned to be of similar magnitude in FY 1991. This includes activities to conserve elephants in Botswana, Cameroon, Kenya, Tanzania, Zambia, and Zimbabwe. Additional activities may be projected for the Central African Republic, the Congo, Ghana, and Namibia.

In FY 1990, USAID initiated three major new projects in Cameroon, Niger, and Tanzania to protect flora and fauna, including elephants. Other ongoing activities in Botswana, Kenya, Zambia, and Zimbabwe, as well as regional actions, brought total FY 1990 USAID-supported direct and indirect elephant conservation and management activities to the level cited above.

In Cameroon, Wildlife Conservation International, with USAID's backing, is assisting in the management of Korup National Park. The project aims to inventory flora and fauna -- including elephants -- in the Park to develop a Park management plan; provide training to Cameroonian forest researchers and local rural people; and identify and develop sustainable economic opportunities for rural populations now living within the Park boundaries.

In Niger, the U.S. Peace Corps is working with USAID to improve the management of the international Park "W" (named after a meander in the Niger River) to help rural populations coexist better with the park's flora and fauna. The project aims to develop protected area management activities that will provide environmentally sound income-generating benefits to human populations that surround the protected area. The project's five components are (1) a socio-economic study to provide additional information to help design community development activities (2) community development activities within Park "W" (3) biological research (4) development of management plans, and (5) monitoring and evaluation.

In Tanzania, the African Wildlife Foundation, with USAID support, implemented the Protected Area Planning and Assessment Project, which aims to train the Tanzania Wildlife Department in the development of land use management plans for Tanzania's wildlife management areas. These plans will provide the basis for the long term sustainable management of the nation's wildlife. The African elephant will be a special concern addressed during the development of these management plans. In addition, with earlier appropriations, USAID is supporting the Mweka Wildlife College, which is providing training for wildlife area managers in Tanzania and other parts of English-speaking Africa.

USAID, with the African Wildlife Foundation, planned to provide important support in FY 1991 to the African Elephant Conservation Coordinating Group (AECCG) to help African nations develop elephant conservation programs. The effort was to provide funds to 14 countries to formulate national elephant conservation programs. In addition, the project was to fund a working group of experts to develop a summary analysis of needs throughout the continent for elephant conservation and review the potential for Africa to produce coordinated data, policies, and programs for issues surrounding elephant conservation and the trade in ivory. Moreover, the project would support a meeting of African Range states to discuss the plans, analyses, and reviews.

In addition to its own programs, USAID coordinates elephant conservation programs with other U.S. federal agencies, including the Department of Defense, the Peace Corps, the State Department, and the USDA Fish and Wildlife Service; with private voluntary organizations, such as the African Wildlife Foundation, CARE, Wildlife Conservation International, the World Conservation Union (IUCN), and the World Wildlife Fund; and with other international donors, such as the EEC, FAO, ODA, and UNEP.

2. Asia and the Near East

The destruction of tropical forests and biological diversity has major implications for current and future development in the countries of Asia and the Near East. The regions are richly endowed with genetic resources. In Asia, the moist tropical forests and extensive coral reefs of Southeast Asia are of global significance and provide important sources of income and employment in these countries.

Genetic resources critical to the improvement of some of the world's most important crops -- including wheat, rice, almonds, bananas, oranges, peaches, and numerous fruits and vegetables -- are indigenous to Asia and the Near East.

Demand for products and services from forests and other biological resources is rising as populations increase and urbanization expands. Thailand, once a major exporter of wood, has become an importer from Burma and Malaysia. The demand for Philippine wood is so great that old growth dipterocarp forests, the backbone of the Philippines' species-rich terrestrial ecosystems, probably will disappear within seven years at current rates.

Indonesian forests are being mined at rates greater than 1,000,000 hectares per year to meet demand. However, if managed on a sustained yield basis, they could produce sustained benefit streams that would exceed the \$2.5 billion in foreign exchange now earned each year from exports of wood and wood products.

Demand for non-timber forest products remains high. Half of India's forest revenues are derived from non-timber forest products. Non-timber forest exports from Indonesia run over \$200 million per year, and Thailand now imports non-timber forest products it once exported.

The destruction of biodiversity is closing future economic growth options. Southeast Asia will soon have the highest species extinction rates in the world. Less than four percent of the Asia and Near East land area has been designated as protected and much of that does not receive actual protection from unauthorized use. Short-term investments compete with conservation investments for compelling reasons: it often is difficult to assign value to biodiversity conservation in economic analyses, and many benefits of biodiversity accrue to future generations, as well as residents of other countries.

The principle of conserving the area's natural resource endowment and managing it in a sustainable way is gaining support from leaders in the region. New efforts to conserve genetic resources and establish and better manage protected areas are underway.

Among achievements in FY 1990 were the initiation of two major new forestry projects in Nepal and Indonesia that focus on increasing the capacity for economic analysis and planning, as well as the need for policy change to ensure greater sustainability. These and other project activities are described below.

- In Indonesia, the four-year \$18.5 million Natural Resources Management Project was to back the creation of a forest planning group within the Planning Ministry to analyze and address forest economic and policy issues. An applied research station for sustainable natural forest management was to be established in West Kalimantan to test methods for sustainable forest management and to link them to the policy-making process. Management plans were to be developed for three protected areas in Kalimantan and Sulawesi: Bukitbaka Reserve (West Kalimantan); Gunung Palung National Park (West Kalimantan); and the Bunaken

Manado Marine Reserve (Northern Sulawesi). Donor co-ordination efforts had leveraged \$10 million from the International Tropical Timber Organization (ITTO) to help support the field research.

- **In Nepal, the Forestry Development Project was to enhance the capabilities of the Ministry of Forests and Soil Conservation to plan and conduct economic analyses. The project also was to help increase the productivity and sustainability of forestry production systems through better policies and improved public and private forest management.**

The project emphasizes the implementation of Nepal's Master Plan for the Forestry Sector, which is based on the premise that local communities, rather than the government, will manage the majority of the 5.6 million hectares of remaining forest land.

The project's improved stove component was to facilitate the design, construction, and marketing of improved wood-burning stoves for home and commercial use. A phased reduction of government subsidies and the use of demand-driven, private sector production and marketing of stoves will be included in the pilot program. Local cost support included income generated from the sale of kerosene, a substitute for fuelwood for heating and cooking.

- **In Nepal, Yale University's School of Forestry and Environmental Studies began implementing the USAID-funded Institute of Forestry Project in mid- 1989. The five-year \$5.2 million project is improving the Institute's capability to meet the demand for professional resource managers by providing the technical assistance, training, and other institutional support needed to carry out more effective teaching, research, and extension. The Institute's curriculum was being revised and brought into line with the Master Plan for the Forestry Sector.**

Recent project activities have included a workshop on research methods applicable to social forestry and the "Social Sciences in Asian Forestry Curricula Workshop". The latter brought together experts on forestry education from the United States and Asia to explore the general means of increasing the social science content of the region's forestry curricula. More than \$1 million of additional funding for this project has been obtained from the ITTO.

- **Also in Nepal, USAID provided small grants to support biological diversity activities through the Biological Support Program. These included support to Chitwan National Park, the Malaku-Barun Conservation Project, which extends the Mt. Everest (Sagarmatha) National Park, and the Annapurna Conservation area.**

In the Annapurna area, for example, the World Wildlife Fund was working with the USAID mission and a local NGO to develop an innovative new concept of protected area management that combines conservation and development. The project supports training and supervision of the core staff of the Annapurna Conservation Area, one of the most famous trekking regions in the world. The project addresses the needs of the trekkers, local people, and the increasing wildlife populations in the park. A special park entry fee was being collected and the funds were being channelled directly into the management of the Conservation Area. The project also has leveraged additional USAID support for studies on livestock predation by snow leopards and wolves, and for microhydro projects to reduce pressures on fuelwood supplies along trekking routes.

- In Thailand, the capacity of the Royal Forest Department to manage national parks and sanctuaries has been strengthened through the six-year \$44 million Management of Natural Resources and Environment for Sustainable Development (MANRES) project.

Some of this funding helped support several biodiversity activities, such as facilitating the development of a national assessment of botanical research needs, developing a publication on the endangered fauna of Thailand, and planning for a study tour of U.S. zoological parks by Thai zoologists.

- Significant biodiversity programs are part of most Mission programs in Asia. In India, for example, the USAID Mission continued its support for a major Plant Genetic Resources Project, which focuses on *ex situ* conservation of crop genetic resources. In addition, the Mission started contributing to the Wildlife Institute of India to fund training in wildlife and protected area management.

In Indonesia, USAID continued support for a non-governmental biological diversity program through grants to the Indonesia Environmental Forum.

In Sri Lanka, the USAID-funded Natural Resources and Environmental Policy Project increased the capacity of public and private institutions to develop sound environmental policies and programs through natural resource management, public-private partnerships, training, and public education and participation. A key element was helping the Central Environmental Authority and line ministries implement the Government's environmental impact assessment regulations.

The Regional South Pacific USAID Mission, headquartered in Fiji, worked to conserve biological diversity and provide alternative models of sustainable forest management. A biodiversity background assessment for the island nations of the South Pacific was initiated in 1987 through the Nature Conservancy. This was followed by a regional assessment of

critical ecosystems. This growing data and information base has benefitted local institutions.

Papua New Guinea has the most extensive remaining stands of undisturbed primary tropical forest in Southeast Asia. Very little is known about the biodiversity of this region, yet uncontrolled commercial logging continues to destroy habitats at an alarming rate. Forest products are the third largest source of foreign exchange. Mission activities supported policy dialogue within Papua New Guinea, and through the South Pacific Regional Environmental Program (SREP), as well as a regional ministerial-level forum for discussing such issues. USAID was planning to fund a biodiversity conservation needs assessment for Papua New Guinea.

- In the South Pacific, a new project will be initiated in FY 1991. The Profitable Environmental Protection Project (PEP) was to demonstrate sustainable enterprises that conserve biodiversity and help local communities generate income in several South Pacific countries.

3. Latin America and the Caribbean

The countries of Latin America and the Caribbean are rich in biological diversity. The region includes several of the world's most biologically diverse countries, including Brazil, Bolivia, Colombia, Ecuador, Mexico, and Peru. Moreover, the region contains about 40 percent of the plant and animal species of the world's tropical forests. As much as 36 percent of the production of the world foods have their genetic origin in Latin America. Many of the related wild species of the world's major food crops, including potatoes, corn, tomatoes, plantains, and cacao, come from Latin American forests.

Forest resources are very important to development in Latin America and the Caribbean. Forests cover about one-third of the region's total area. Although forest products provide only a small share of the GNP in most nations of the region, forests contribute large unmeasured economic benefits to people. The export of forest products has become increasingly important for earning foreign exchange, particularly for Brazil, Chile, Honduras, and Paraguay. More than half the region's population depends on fuelwood for cooking.

Deforestation rates in the region jumped from 3.8 million hectares per year in the 1970s to 6.8 million hectares per year in the 1980s, as forest land was converted to pastures and cropland. Reforestation efforts are insufficient to offset the biomass losses and, of course, cannot restore lost biodiversity. Few, if any, reforestation programs recognize the tenure and policy constraints to these programs, namely, the land most in need of reforestation is predominantly in the hands of small farmers who cannot remove their land from annual crop production. At current rates of deforestation, up to 350,000 species may disappear in the next decade or two. Also, monopolistic timber economies

rarely provide price incentives for growing trees. At least 20 hectares are being cut for each hectare replanted.

USAID assistance in the region focuses on developing the economic potential of natural areas and their buffer zones; promoting research and management of priority tropical and commercial forests for environmentally sound, sustainable yield of a variety of forest products; and conserving biodiversity and wildlands.

Among FY 1990 achievements are the following:

- For Central America, a Tropical Forestry Action Plan was being elaborated under the auspices of the Central American Commission on Environment and Development (CCAD). This effort was expected to produce a forestry master plan for the region.
- For all seven Central American countries, a consortium consisting of the Nature Conservancy, CARE, and Conservation International initiated work with local NGOs to design a project aimed at stimulating environmental awareness among policy leaders and within national and local institutions throughout the region. The project was to operate under the \$46.3 million, six-year Regional Natural Resources Management Project for Central America (RENARM), initiated in late FY 1988.
- Centro BOSCOA, a new, permanent facility for research and training in sustainable forestry, agriculture, and ecotourism has been established. In early December 1990, the Center was the site of a major World Wildlife Fund Tropical Forestry regional workshop on grassroots sustainable natural forest management. The Center was used for training programs by the Organization of Tropical Studies, the National University of Costa Rica, and others.
- Biodiversity grants were awarded to Conservation International, the New York Botanical Garden, and the Wildlife Preservation Trust International under the Latin America and Caribbean Regional Environmental Support Project. The project, authorized for \$12.3 million in March 1990, promotes improved management and conservation of natural resources.
- In Haiti, an action plan was developed by the World Wildlife Fund for *Les Arcadins*, Haiti's first marine park. Protection was to be accorded to a fragile coral reef of significant biological diversity. Surveys of the biology, fisheries, tourism potential and socio-cultural milieu of the *Les Arcadins* area were conducted and will serve as a baseline for management decisions in park implementation.

Les Arcadins will provide ecological, social and economic benefits by preserving areas of biodiversity, revitalizing the local economy as a major recreational diving center for tourists, and contributing to the welfare of

nearby artisanal fishing communities by improving the management of renewable fisheries resources. Other Caribbean countries have expressed interest in using *Les Arcadins* as a model for marine park development.

- In Belize, USAID, in collaboration with the World Wildlife Fund, the Peace Corps, and the Belize Fisheries Department, has helped establish and manage the Hol Chan Marine Reserve. Hol Chan was the first reserve established on the 400 mile long Belize Barrier Reef, the most extensive and complex coral reef system in the Atlantic. It now serves as a model for comprehensive, multiple use management. More than 20,000 visitors come to the reef each year. Fish populations have increased and the local population of Ambergris Caye has materially benefitted from the reserve's establishment.
- In Panama, support was being provided to the National Directorate for Renewable Natural Resources (IRENARE) to establish three national forest reserves that will have a combined area of approximately 141,000 hectares.
- Also in Panama, a debt-for-nature agreement was signed with the Ministry of Planning and Economic Policy. This was to capitalize a trust that will serve as a new conservation fund for *Fundación Natura*. Income from conservation bonds will be used to support watershed management, reforestation, protected area management, and sustainable development activities.
- In Costa Rica, more than 185 acres were reforested under the Forest Conservation and Management Project (BOSCOSA) with the participation of NGOs, including independent farmers unions that were once vocal proponents of wood harvesting permits.
- Between Costa Rica and Nicaragua, a USAID grant to the Caribbean Conservation Corporation resulted in the development of a wildlife corridor that consolidates a conservation area stretching more than 40 miles from Nicaragua south to Tortuguero National Park in Costa Rica. The total area preserved encompasses a contiguous complex of protected areas of more than one million acres that provides habitat for various forms of wildlife, including more than 300 species of birds, 13 endangered species of mammals, and 6 endangered reptile species.
- In Guatemala, Conservation International will describe and propose legal boundaries and conservation management categories for eight high priority biological diversity and tropical forest areas. The project constitutes the second part of a long-term strategy of the National Council of Protected Areas (CONAP) for the legalization of 44 special protection areas named in Guatemala's Protected Areas Law (Decree 4-89).

- Also in Guatemala, Wildlife Preservation Trust International will conduct three courses in zoo biology and management training. These aim to improve the standards of animal management by providing participants from major zoos in the Central America region with the skills and knowledge to work with zoo animals in a professional capacity. The effort is expected to lead to the development of a master plan for each zoo in the region.
- In Ecuador, a cooperative agreement with CARE, the Nature Conservancy, and Wildlife Conservation International provided funds for the design and implementation of the Sustainable Uses for Biological Resources (SUBIR) Project, whose goal is to develop the economic potential of natural areas and their buffer zones in selected areas. In addition to a major emphasis on field activities to develop natural areas, the project also will include policy analysis, research, training and technical assistance components.
- In Amazonian Ecuador, the New York Botanical Garden will conduct the first study aimed at determining the market value of extractable products of useful plants, as well as the effects of extraction on the reproductive biology and sustainability of economic species. In Bolivia a botanical inventory of the Amboro and Noel Kempff Mercado national parks also will be conducted.
- In Bolivia, an Environmental Action Plan was being developed that will provide a framework for the integration of environmental considerations into Bolivia's overall economic and social decision-making process.

Highlight on the Parks In Peril Project

The Parks in Peril Project was designed to ensure adequate on-site protection for threatened national parks and reserves in the region that have global biological importance. The three-year project was initiated in September 1990 through a cooperative agreement with the Nature Conservancy. USAID provided \$2 million; the Nature Conservancy provided \$1 million in matching funds.

In 1991, emphasis was to be placed on protecting biological diversity and strengthening the ability of local conservationists to manage almost 7 million acres in the following 10 parks:

Country	Protected Area	Acres
Bolivia	Noel Kempff Mercado Natl. Park	2,272,400
	Amoro Natl. Park	432,000
Colombia	La Paya Natl. Park	1,042,340
Costa Rica	Corcovado Natl. Park	103,220
Dominican Republic	Jaragua Natl. Park	340,000
Guatemala	Sierra de las Minas Natl. Park	224,770
Mexico	El Triunfo Biosphere Reserve	294,500
	Ria Celestun and Ria Lagartos	264,400
Panama	Darien Biosphere Reserve	1,420,250
Peru	Pampas Del Heath Natl. Sanctuary	252,209

In FY 1991, the Nature Conservancy was to continue to strengthen management capabilities in 10 additional parks in peril. Community outreach was to be expanded, on-site monitoring initiated, and long-term mechanisms developed for financial sustainability.

Highlight on Conservation of Neotropical Migratory Birds

The populations of many species of birds that breed in North America but winter south of the border are declining throughout the Americas and contribute to the loss of biological diversity in the Western Hemisphere.

The Neotropical Migratory Bird Conservation Program was initiated in FY 1990 to determine the status and causes of population changes of neotropical migratory birds, to maintain stable populations, and to enhance or restore declining populations.

The program will be a comprehensive, cooperative effort involving partnerships among government agencies in the United States, Canada, and Latin American and Caribbean countries, as well as foundations, professional organizations, conservation groups, and businesses. USAID was utilizing the \$500,000 earmarked by Congress for FY 1991 to develop a comprehensive framework for conserving neotropical migratory birds.

V. URBAN AND INDUSTRIAL POLLUTION AND ENVIRONMENTAL HEALTH

A. PROBLEM OVERVIEW

Cities are rapidly growing in most countries of the world. In 1950, less than one-third of the world's population lived in urban areas. By 2025, it is estimated that nearly two-thirds of the world's population will live in cities. In developing countries today, more than half of GDP is generated in urban areas.

But rapid growth of urban areas in developing countries is accompanied by widespread environmental degradation, especially water pollution -- a severe problem in cities throughout the developing world. Cities already hard-pressed to keep up with basic services such as water and sanitation are even more pressed to meet accelerating demands for both potable water and sewerage. Consequently, sewerage lags behind water supply; collection infrastructure is inadequate and waste waters go untreated. Untreated residential, industrial, and toxic wastes contaminate nearby fields and fishing grounds, endanger human health, and threaten tourist industries. The recent cholera outbreak in Latin America clearly illustrates the relationship between urban environmental pollution and public health.

In many cities the provision of basic services is not keeping up with growth. More than half the residents in the Latin America and Caribbean region lack sewers. Sewage treatment is virtually nonexistent in much of the developing world. In the Dominican Republic, the share of all urban households with piped water supply declined from 91 percent in 1970 to 70 percent only ten years later. In Abidjan in the Cote d'Ivoire, water supply coverage dropped from 57 percent in 1977 to 47 percent in 1983.

Solid waste management is an increasing problem on two fronts: collection and disposal. It is estimated that 30 to 50 percent of solid wastes generated within urban centers remains uncollected. Uncollected refuse frequently piles up on vacant land in or adjacent to densely populated neighborhoods, posing a serious health hazard to nearby residents.

Municipal waste that *is* collected often is deposited into unregulated and environmentally unsound landfills, posing a threat to groundwater and downstream surface water supplies. In São Paulo, Brazil, one-third of the population lives in areas without any solid waste

collection service. In Bangkok, Thailand, 20 percent of the garbage is left uncollected. In Dar es Salaam, Tanzania, more than 78 percent of daily solid waste was uncollected in 1985.

The decline in water, sanitation and sewerage services is only one manifestation of the municipalities' inability to keep pace with urban growth. Another striking deficiency is municipal authorities' inability to provide adequate and appropriate land for settlement by new urban dwellers. The eruption of squatter settlements throughout the developing world clearly illustrates this incapacity. Squatter settlements often constitute a high percentage of the total urban population and continue to grow at a phenomenal rate. An estimated 50 percent of the population of Tegucigalpa, Honduras lives in squatter settlements, as does 79 percent of the population of Addis Ababa, Ethiopia.

Most often, these new settlements are located on land that is inexpensive, mainly because it is located some distance from the city center and jobs or is situated on environmentally problematical sites. Most of these squatter settlements are on flood plains, steep hillsides, or adjacent to noxious industries or dumps.

Dense squatter settlements in the hills above Port-au-Prince, Haiti have already destroyed virtually all of the watershed around that city. In Mexico City, Mexico, approximately 1.5 million people live on the drained lake bed of Texcoco, an area plagued by constant flooding, dust storms in the dry season, and an almost complete lack of urban services.

Squatter settlements typically lack paved roads, adequate water, sewers, stormwater drains, and garbage collection and disposal. They are densely populated; the combination of overcrowding, inadequate housing, and lack of services exacerbate the populations' already serious health problems and provide ripe breeding grounds for a variety of additional health problems.

Some of these problems can be fatal. These include Chagas disease, which infects an estimated 24 million Latin Americans. It damages the heart and enlarges the liver, spleen, and lymph glands. The disease is borne by protozoans that live in mud walls and thatched roofs; the illness is perpetuated in inadequate housing. Lead poisoning is caused by leaded gasoline and the proximity of housing to congested roads, corroded lead pipes in the water distribution system, contamination of stored water by lead particulates in the air, and lead-based paint. Poisoning can cause cardiovascular ailments and learning disabilities. Respiratory problems are aggravated by several factors, including cooking indoors without adequate ventilation and exposure to dust and other airborne particulate matter. Vector-borne diseases result from the location of breeding grounds, such as pools of stagnant water and uncollected garbage, near residences.

Microbiological diseases such as diarrhea, dengue fever, cholera, and dysentery result from drinking, swimming, bathing, and washing clothes in contaminated water. Contaminated water and poor sanitation contribute to extremely high rates of diarrhea, worm infestation, and other water-borne diseases. The World Health Organization (WHO), for example, estimates that three-quarters of all illness and 80 percent of child deaths in the developing world are associated, in one way or another, with unsafe

disposal of excreta, poor hygiene, and water supplies that are inadequate either in quantity or quality.

Air pollution brought about by industrial growth and the rapid proliferation of automobiles using lead fuel is becoming a severe problem in many cities. Occupational health and safety are major problems in most developing countries. Urban environmental degradation threatens human health and economic growth, alike.

More than 600 million people live in urban areas where levels of sulphur dioxide exceed the limits recommended by WHO and more than one billion people are exposed to unhealthy levels of suspended particulate matter such as soot, ash and hydrocarbons, according to a study conducted by WHO and the U.N. Environment Programme (UNEP). The study evaluated pollution data for cities participating in the Global Environment Monitoring System (GEMS) for the period 1980-84.

Urban/industrial pollution and environmental health is one of the areas of focus identified in the Agency's FY 1990 Environmental Initiative, which specifies the following:

- Consider environmental issues related to health in the development of all future health policies, strategies, and programs;
- Increase funding to strengthen pollution prevention and control policies, legislation, and the regulatory and analytical capabilities of public and private entities;
- In a select number of countries, prepare case studies that prioritize pollution problems and their economic costs and demonstrate viable means of reducing or preventing urban environmental pollution and its associated economic issues;
- Enlist the U.S. private industrial sector to provide technical assistance and training to prevent and control industrial pollution and promote occupational health and safety, and stimulate formation of U.S./developing country joint private ventures in these areas;
- Develop and collaborate -- with the World Bank, regional development banks, and other donors -- pilot projects to demonstrate technologies and policy approaches to reduce air and water pollution in urban areas.

B. BUREAU FOR SCIENCE AND TECHNOLOGY

In the 1990, USAID's regional and central Bureaus joined forces to develop the Urban and Industrial Pollution and Environmental Health Action Initiative. The initiative addresses the most serious industrial pollution and environmental health problems in the developing world. It covers a wide range of areas, including improving water/wastewater management; alleviating industrial pollution; improving solid toxic and hazardous waste

management; and improving institutional capacities to manage urban environmental problems.

1. Office of Health

Several new activities were proposed as part of the plan's implementation. Among these is a revised Water and Sanitation for Health Project (WASH) in the Office of Health, Bureau for Science and Technology that will address several issues identified for greater attention within the framework of the Agency's Urban Pollution and Environmental Health Initiative. Issues to be addressed include water supply/wastewater management; solid waste management; management of toxic, radiological and hazardous waste; occupational health; injury prevention; food hygiene; and vector-borne disease control.

WASH provides technical assistance in water supply, wastewater, and solid waste management under the Urban Pollution and Environmental Health Initiative. Technical assistance in vector-borne disease control will be provided by USAID's Vector Biology and Disease Control Project.

Significant steps were taken to improve the information base in the water and sanitation area in FY 1990. The WASH Project established a data bank -- known as the Peri-Urban Network -- to centralize existing information about current projects, evaluations, lessons learned, and on-going research. WASH also investigated environmental pollution problems associated with textile dyeing and leather processing in Mauritius and recommended the development of a Master Plan to control water pollution from industrial effluents.

Also in FY 1990, WASH provided technical assistance for the privatization of solid waste collection in Port-au-Prince, Haiti -- a city that generates some 1,000 tons of solid waste each day. A local firm is currently surveying the opportunities for private sector involvement in solid waste collection.

2. Office of Forestry, Environment and Natural Resources

The Bureau for Science and Technology, Office of Forestry, Environment and Natural Resources, will introduce its new 10-year \$35 million Environmental Pollution Prevention Project (EP3) in FY 1992. This project will provide an important channel for cooperation between USAID, the Environmental Protection Agency and private non-profit and industrial organizations in addressing the issues of industrial pollution prevention and control, toxic contamination, and deteriorating environmental health in developing countries.

EP3 will provide public and private sector decision makers with pollution prevention and control techniques, technologies and know-how, assistance with financing prevention improvements, and environmental quality support services to create the enabling environment for urban and industrial pollution management, reduction, and prevention.

Support services will draw on professional and institutional capabilities in the United States from public (federal, state, and local) and private (non-profit and industry) sources.

USAID's regional Bureaus also have expanded their activities in the areas of urban industrial pollution and environmental health in FY 1990 and early 1991. Selected examples are highlighted in the sections following.

C. BUREAU FOR ASIA AND PRIVATE ENTERPRISE

The Office of Housing and Urban Programs in the Bureau for Asia and Private Enterprise (APRE) has worked to implement the Private Provision of Social Services Initiative (PPSS), which enables developing countries to improve their existing solid waste management systems and adopt environmentally sound waste management practices, such as garbage sorting, land use planning, and sanitary land-fill construction. The program aims to demonstrate the feasibility of privatizing municipal solid waste management services to improve the effectiveness, efficiency, and environmental soundness of existing collection and disposal practices. The program is designed to provide participating municipalities with specific recommendations to upgrade their current level of service, as well as to suggest opportunities for privatization. Technical assistance also is provided to countries interested in privatizing waste management services under the Initiative.

The PPSS program currently is helping a number of countries evaluate and improve their municipal solid waste management practices. Cities receiving technical assistance under this Initiative are Chiang-Mai and Phuket (Thailand); Gaborone (Botswana); Guayaguil (Ecuador); Mbabane (Swaziland); Port-au-Prince (Haiti); Sfax (Tunisia); Tegucigalpa (Honduras); seven secondary cities in Costa Rica; and cities in Mali, Senegal, and Togo.

To improve the Agency's capacity to analyze urban environmental problems, technical assistance has also been provided during the past year through APRE's Office of Housing and its seven Regional Housing and Urban Development Offices (RHUDOs) to USAID Missions. In the past year, technical assistance has been provided to the Dominican Republic, India, Morocco, and Nicaragua. On a regional level, a study of the Caribbean was conducted to examine urban trends and environmental consequences of rapid development. A country-specific urban environmental strategy was prepared for the RHUDO in Jamaica and incorporated into the Mission's environmental Action Plan. RHUDO Asia will complete its urban environmental strategy in FY 1991.

A comparative risk assessment study evaluating the human health risks associated with urban environmental problems in Bangkok, Thailand was conducted by APRE's Office of Housing and Urban Programs and the U.S. Environmental Protection Agency (EPA). The FY 1990 study tested a methodology developed by EPA to determine whether it could be adapted to conditions in the developing world. Urban environmental health risks in Bangkok also were ranked as to priorities for attention.

The study pinpointed two higher-risk environmental problems in Bangkok: airborne particulate matter; and lead, through exposure to leaded gasoline emissions, industrial point source emissions, corroded water distribution pipes, and leaded paint and soil. The comparative risk assessment had a direct impact on shaping urban environmental policy. The Government of Thailand is now taking direct measures to reduce lead emissions by curtailing the use of leaded gasoline in Bangkok.

In the Philippines beginning in 1991, the Industrial Environment Management Project will promote economically sound industrial environmental management. The project will focus on: improving industrial waste management; building environmental management capacity through training; disseminating information aimed at enforcing the country's environmental regulations; and developing environmental management systems for market cities. The project will be implemented by a wide range of public and private sector agencies to complement efforts of the World Bank and the Asian Development Bank.

D. BUREAU FOR EUROPE AND THE NEAR EAST

The Europe and Near East (ENE) Bureau has identified wastewater management as a current priority. A Water Quality and Conservation Project is planned for Jordan to mitigate the negative impacts of industrial pollution on water resources, water conservation, contamination of ground water, and water allocation and pricing policy.

Since 1978, USAID has played a major role in implementing wastewater management projects in Egypt. Activities under the \$315 million Alexandria Wastewater Project currently focus on the construction of sewage treatment facilities and the construction of sewage mains.

USAID also is implementing the multi-year \$904 million Cairo Wastewater/Sewage II project. To date, \$96 million has been obligated toward constructing underground sewage interceptors in Cairo.

In addition to activities in Alexandria and Cairo, USAID is implementing the \$380 million Canal Cities II Project in the canal cities of Ismalia, Port Said, and Suez. The Canal Cities II Project, which began in 1987 and is scheduled for completion in 1997, currently involves the construction of waste treatment facilities in each of the canal cities. Once the waste treatment facilities have been constructed, the responsibility for plant operation and maintenance will be turned over to Egyptian operators who have been trained in water and wastewater management.

By the end of FY 1990, water treatment facilities were constructed in the provincial cities of Beni-Suef, Fayoum, and Minea to improve the quality of local water supplies.

A primary focus for the ENE Bureau in FY 1990 has been on building institutions in Eastern Europe to curtail environmental degradation in urban areas. USAID's Improving Public Sector Environmental Health Services Project is working to improve

environmental quality and strengthen the capacity of governments in policy and program formulation.

Institution building efforts in Eastern Europe -- including strengthening the role of NGOs -- also have benefitted from the Region's Environment Initiatives project. For example, Agency support has been provided to the Regional Environmental Center in Budapest, Hungary. The Center is playing an integral role in raising public awareness of urban environmental issues in the country. The Center's current activities include the development of environmental health brochures for distribution to the general public on such issues as lead in drinking water, pesticide disposal, and energy conservation in the home. The Center is developing environmental education materials for use in the Central and Eastern European educational systems and is establishing a speaker's bureau of environmental professionals to visit university campuses.

The Project in Development and the Environment (PRIDE), a five-year effort, was expected to be initiated in FY 1991. It will provide the ENE Bureau and ENE missions with technical, analytical, and informational support to promote sound environmental and natural resource use for long-term sustainable economic growth. The project will focus on urban and industrial pollution and water management, and will test approaches such as the promotion of private sector adaption of no- or low-cost pollution abatement technology.

VI. GLOBAL CLIMATE CHANGE/ENERGY DEVELOPMENT

A. PROBLEM OVERVIEW

Human activity particularly since the industrial revolution has rapidly changed the earth's environment, has profoundly affected human health and the survival of plant and animal species, and appears to be changing the global climate.

The world's population has tripled since 1900. Industrial production has grown forty-fold since 1950. As industrial growth has increased, so has energy consumption. Massive generation of wastes and pollutants and a catastrophic loss of forests have resulted. Tropical forests worldwide have been reduced to about 55 percent of their original cover and are being further reduced by about 169,000 square kilometers per year, according to preliminary figures of FAO's assessment of tropical forests.

Industrialization and deforestation activities have greatly increased the concentration of carbon dioxide, nitrous oxides, and chlorofluorocarbons (CFCs) in the atmosphere. These gases trap the sun's heat in the earth's atmosphere, dangerously increasing the "greenhouse effect." This threatens to alter the earth's climate by increasing temperatures, changing rainfall patterns, and raising sea levels.

The build-up of greenhouse gases is linked mainly to increases in the amounts of fossil fuels burned for energy generation and to massive clearing of forests by burning, which release carbon dioxide. Forest loss also reduces an important sink for carbon dioxide.

In developing countries, the burning associated with deforestation contributes substantially to greenhouse gas emissions. Tropical forests located in Brazil, Central Africa, Indonesia, and other developing countries contribute as much as 30 percent of global carbon dioxide emissions when burned. Moreover, developing countries are under pressure to increase their energy use to support their necessary economic growth. Increases in commercial energy use by these countries are likely to be a large future source of greenhouse gas emissions.

The magnitude and impact of the climate changes associated with the above influences are not yet clear. Their potential threat to health and economies, however, has led to a forceful response by the international community. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization

(WMO) and the United Nations Environmental Programme (UNEP). IPCC is responsible for assessing the state of knowledge about climate changes and its impacts and considering possible response strategies.

An observed result of the release into the atmosphere of CFCs, a by-product of industrial processes, has been a progressive thinning of the earth's protective ozone layer, which filters out large portions of ultraviolet-B radiation. The industrialized countries as a group created the Montreal Protocol, an international agreement to control the production and use of CFCs. A three-year \$150 million fund was established in 1989 to help developing countries make the transition from CFCs to CFC substitutes. The United States is contributing \$30 million to this fund.

The United States is contributing up to \$150 million over three years to the Global Environment Facility (GEF). This three-year pilot operation of about \$1.4 billion will address ozone depletion and global climate change (including tropical forest conservation, energy efficiency and energy conservation). GEF was created in November 1990, is located in the World Bank, and operates in collaboration with UNEP and UNDP.

B. THE USAID RESPONSE

USAID is the largest and most active U.S. government agency funding activities in developing countries which address climate change. The Agency's objective is to mitigate to the extent possible the threat of global climate change by helping nations to reduce emissions of carbon dioxide, methane, and other trace gases; increasing the earth's storage capacity of such gases; and reducing the use of CFCs.

In FY 1990, Congress targeted \$15 million specifically to "combat the global warming phenomenon and the long-term threat that greenhouse gas emissions pose to the entire world." The funding target amount was doubled to \$30 million for FY 1991. Congress also targeted \$20 million to provide assistance and training for the promotion of end-use energy efficiency and renewable energy resources, particularly in key middle- and low-income developing countries that contribute significantly to global greenhouse gas emissions.

Many of the activities that USAID has supported in the past as part of its mandate of sustainable, environmentally sound development (such as programs in forestry, renewable energy, energy efficiency, and sustainable agriculture), have contributed to the objectives of reducing greenhouse gas emissions, even if they were not originally designed with that specific goal in mind.

The Agency's approach to global climate change follows what has come to be known as the "no regrets" strategy. This strategy supports initiatives that make good sense in development terms, technically, economically, financially, and socially and that also contribute to the mitigation of greenhouse gas emissions or climate change -- even if the effect on factors influencing the global climate cannot be quantified. For example, arresting deforestation benefits agriculture and water resources and conserves biological

diversity. Adopting more efficient energy systems produces economic savings, improved productivity, and multiple environmental benefits.

In FY 1990, USAID provided approximately \$213 million to support forestry and energy efficiency activities that might contribute positively to reducing greenhouse gas emissions. Funding was expected to reach more than \$225 million for all forestry and energy efficiency activities in FY 1991.

In the future, emphasis will be placed on designing new projects and, to the extent possible, reorienting existing projects, specifically to mitigate the causes of global climate change.

In FY 1990, USAID submitted a report to Congress entitled "Greenhouse Gas Emissions and the Developing Countries: Strategic Options and the USAID Response". USAID then began work on a Global Climate Change Strategy and the identification of "key" countries or regions -- such as Central America, the Congo Basin, India, Indonesia, Mexico, the Philippines, and Poland -- that will receive special attention in the Agency's efforts to reduce greenhouse gas emissions. The Strategy was to be completed in FY 1991.

C. ACTIVITIES IN KEY REGIONS

1. The African Congo Basin

In sub-Saharan Africa, burning vegetation is a source of greenhouse gas emissions, although current emissions are low. However, future emissions are potentially large. This potential can be estimated from carbon inventory, the amount of carbon stored in existing vegetation. In most of the less developed countries of sub-Saharan Africa, the carbon inventory is more than 1,000 times greater than current annual emissions.

The Congo Basin has the greatest store of carbon of any region in Africa and thus is the region's greatest potential contributor to global climate change from future vegetative cover changes. The Basin includes six countries: Cameroon; the Central African Republic; Congo; Equatorial Guinea; Gabon; and Zaire. These nations account for approximately one-half of the potential emissions of climate-changing gases from future vegetative cover changes in Africa.

USAID's activities in Africa addressing the problem of global climate change are focusing on the Congo Basin. The Agency's objectives in this area are to: assess the extent of forest area in the Basin; determine the extent of biomass burning in the tropical forests and savannah regions of the countries concerned; and prepare an Action Plan for the Basin.

In the first year, a general inventory of the extent and status of the forest area in the six countries will be developed. This will entail acquiring and analyzing satellite imagery to

provide the preliminary data base for future activities. The Action Plan for the Congo Basin also was to be completed.

USAID efforts will complement those of other donors in the region, including the European Economic Community's Conservation and Rational Utilization of Forested Ecosystems in Central Africa program, scheduled to begin in 1991.

USAID is addressing the issue of global climate change in other ways. The Africa Bureau Natural Resources Management Support (NRMS) Project is undertaking activities to conduct forest inventories and manage tropical forests in the Congo Basin as a means to reduce tropical deforestation.

Highlight on Sudan: Two Models for Global Climate Change Projects

Two USAID projects in the Sudan can serve as useful models for future global climate change projects. The Sudan Reforestation and Anti-Desertification (SRAAD) Project was among the first in Africa to use U.S. technology in natural resources applications. It employs geographic information systems (GIS), remote sensing, global positioning instruments, and rapid rural appraisals. The Project combines monitoring of information about natural resources and the environment with analysis of policy issues. The Project developed a sound information base for planning, managing, and monitoring forest resources by mapping vegetation and taking inventory of resources in Western Sudan. The SRAAD Project is serving as a model for other projects currently being developed for Kenya, Madagascar, Rwanda, and Uganda, all of which will combine impact monitoring and natural resources management.

The Sudan Renewable Energy Project (SREP-II) focused on strengthening the capacity of one institution -- the government's Renewable Energy Research Institute (RERI), a dependency of the Energy Research Council. It will support the development and dissemination of viable renewable energy technologies.

Initiated in 1988, the Project supported work in four areas of technology development and commercialization: fuelwood production and forestry; charcoal stoves; briquetting of agricultural residues; and water pumping.

Among the project achievements were increased production of improved charcoal stoves; scientific testing and evaluation of energy-efficient charcoal stoves; and the commercialization of efficient stoves. The project also helped support the FAO in its efforts to expand the commercial production of fuel blocks made from bagasse. As a result of SREP input, a small cooperative is producing up to 60,000 blocks per month and selling them to a local brick-making industry.

2. Asia

Throughout the region, USAID is supporting activities in energy efficiency, energy planning, renewable energy, and forestry that will lessen the potential for global climate change. From the standpoint of greenhouse gas emission potentials the Agency is concentrating on India, Indonesia, Pakistan, and the Philippines. Highlights of sample activities are provided below:

- In India, USAID is involved in a number of activities to promote energy efficiency. The Agency is developing a comprehensive approach to least-cost investment planning in the power sector. This will include a review of economical ways to increase efficiencies in power generation, distribution, and end-use.
- Also in India, the Agency expects to support a five-year \$15 million energy efficiency project to promote efficiency improvement in generation and industrial end-uses. The effort will reduce energy subsidies and support private cogeneration investments that would sell private power to the grid. Another energy resources development project will set up a photovoltaics testing and training center.
- In India as well, USAID has implemented an innovative approach to energy technology commercialization. The \$20 million Program to Accelerate the Commercialization of Energy Research (PACER) provides financial support and other incentives to promote joint ventures among Indian researchers and private entrepreneurs. U.S. partners are usually involved, as well. PACER projects include renewables and the development of more energy-efficient technologies.
- Also in India, the \$20 million Energy Management, Consultation, and Training Project (EMCAT) has been designed to focus on the power sector and related environmental issues. Scheduled to begin in FY 1991, the project will foster new energy technologies, help develop new innovative financing and management methods, and encourage the expansion of energy and related environmental services in India. A collaborative effort, it will be implemented under the auspices of the Multi-Agency Group on Power Sector Innovation (MAGPI).
- In Indonesia, USAID has been working with other donor agencies under the collaborative umbrella of the Multi-Agency Group on Power Sector Innovation to determine the management, technical, and institutional improvements that can be made to improve the performance of isolated diesel power plants.
- Also in Indonesia, USAID is partially funding investigations of biomass and solar energy possibilities that are being carried out by the national Energy Research Laboratory.

- In Indonesia as well, a new \$18.5 million Natural Resources project addresses environmental policy issues and sustainable management of the nation's forests, as well as other critical needs related to the conservation of biological diversity.
- In the Philippines, a new \$125 million Natural Resources Management Project will promote economically and ecologically sustainable management of the nation's natural resources. Special attention will be paid to tropical rainforests and biodiversity. Policy reforms are a major thrust of this program, which will improve the management of about 4 million hectares of rainforests.
- The International Rice Research Institute -- supported by USAID under the Consultative Group on International Agricultural Research (CGIAR) - - is studying effects of carbon dioxide, temperature changes, and CFCs on the cultivation and productivity of rice.

3. Europe and the Near East

USAID work in the region concentrates on programs and projects in energy efficiency, energy planning, renewable energy, and forestry. The Agency is focusing on nations that are major sources of greenhouse gas emissions:

- In Eastern Europe, as part of efforts to develop an environmental strategy for the region, USAID has examined various approaches to promoting energy efficiency. These include cooperating with the U.S. Environmental Protection Agency on the Regional Environmental Center in Hungary. Energy, including efficiency mechanisms, is one of the key issues that the regional center is addressing in its first year of operation.

To improve energy efficiency in selected industries and refineries, a \$10 million Energy Efficiency project is working in six countries. A \$14 million Regional Energy Efficiency Project will expand this focus to the power sector, as well as regional oil, electricity, and gas systems. A \$10 million program in Hungary also will help finance energy efficiency investments.

- In Poland, USAID is engaged in planning several activities intended to conserve energy and reduce greenhouse gas emissions. These activities include: supporting low-cost, quick-impact energy efficiency measures in selected industrial plants and refineries; demonstrating cost-effective approaches to sulphur dioxide and nitrogen oxide emissions from large power plants; and launching a model program to improve efficiency and reduce air pollution in the historic city of Krakow. Studies also were conducted to consider using Poland's abundant coalbed methane resources as an energy source to reduce the country's reliance on coal. Other studies

examined the possibilities of setting up energy-efficiency centers in Warsaw and Krakowice.

4. Latin America and the Caribbean

Emission of greenhouse gases by Latin American and Caribbean countries is projected to increase dramatically if alternatives to current practices are not developed and implemented. The two principle sources of greenhouse gases in the region are deforestation and energy use.

During the 1980s, a very substantial part of worldwide deforestation took place in the Amazon, producing an estimated 160 to 300 or more billion metric tons of carbon dioxide -- five to ten percent per annum of the world's total carbon dioxide emissions. In Mexico, 700,000 hectares are cleared per year. In Central America each year, 470,000 hectares are cleared. If these rates of deforestation continue, most of the region's remaining forests will be destroyed by the first part of the next century.

The burning of fossil fuels directly produces greenhouse gases. In 1987, for example, Brazil produced an estimated 23 million metric tons of carbon dioxide and Mexico produced 35 million metric tons by burning coal, gas, and oil. Hydro-electric power, which supplies 69 percent of the region's electricity and is supposedly "clean", can indirectly contribute significant levels of greenhouse gases. The reservoirs of hydroelectric facilities flood large expanses of forests, especially in the flat Amazon Basin, destroying these forests and their capability to absorb and hold greenhouse gases. (Under the anaerobic conditions of the flooded forests, plant material breaks down, releasing large quantities of methane, a gas twenty to thirty times more effective than carbon dioxide in trapping heat.)

Improving energy efficiency would have a positive effect in reducing energy-related greenhouse gas emissions. It also would benefit the region's economies because a substantial proportion of the region's foreign debt stems from loans needed to purchase fuel or energy.

The Environment/Global Climate Change Project (E/GCC)

The Bureau for Latin America and the Caribbean authorized a five-year \$27 million initiative, called the Environment/Global Climate Change (E/GCC) Project, specifically intended to address the problems of global climate change. The project will focus on Brazil, Mexico and Central America.

The E/GCC Project aims to promote policy reforms, technologies, and practices that will result in the sustainable and efficient use of forest and energy resources in the region. Pilot activities will be conducted to develop and demonstrate the sustainable use of forest resources and the more efficient use of energy or alternatives to fossil fuels. The results will be disseminated to potential users for broader adoption, as well as to policy makers

to increase awareness of economically viable alternatives to current wasteful practices. Management and economic policies related to environment and natural resource issues will be analyzed and governmental and non-governmental institutions will be strengthened to facilitate development and implementation of policy reforms.

In FY 1990, \$1.25 million was provided for global climate change activities in Brazil. More than \$11.78 million is projected to be spent in the country during the next five years. The E/GCC Project-funded activities in Brazil will address: deforestation; energy efficiency, park and buffer zone management; ecotourism; environmental education; micro-enterprise development; strengthening of support (through training) for Brazil's federal agencies concerned with the environment; and strengthening of local NGOs.

In Mexico, \$950,000 was provided in FY 1990. Some \$10.25 million is projected to be spent during the course of the E/GCC project to support management of protected forests, extractive reserves, and buffer zones, including research and community-based demonstration activities. Assistance will be given to a local NGO to develop technical norms and improve policies to reduce greenhouse gases. A debt-for-nature swap will be backed to protect two biosphere management programs. In the field of energy efficiency and conservation, the Project will support steps to promote alternatives to conventional energy sources, including mini-hydro, sugarcane residues, and geothermal sources.

Several projects will involve cogeneration and the participation of the private sector in power generation. In Mexico, USAID also will provide training for employees and managers of the federal electric company and the Electrical Research Institute to promote energy efficiency and "clean" techniques. The E/GCC Project also is training USAID staff and has increased the number and expertise of staff in energy and natural resource management issues related to global climate change. More than \$146,000 was provided for training USAID staff in issues related to global warming, including energy efficiency and sustainable forestry.

Also under the Project, a \$500,000 matching grant was provided to the Nature Conservancy to support the establishment and long-term protection of the 143,000-acre Mbaracayu Nature Reserve in eastern Paraguay. The Mbaracayu tract is covered by virgin forest of rich biodiversity and is the last large single ownership of dense humid sub-tropical forest in southern Latin America.

Under the Latin America and Caribbean Bureau's Environmental Support Project, funding was provided for two global climate change advisors who are now stationed in Brazil and Mexico.

Highlight on Brazil and Mexico

The activities in Brazil funded by the E/GCC Project in FY 1990 include six grants to the World Wildlife Fund (WWF), a grant to the University of Florida at Gainesville, and a collaborative effort to establish an Energy Efficiency Institute. Specifically:

- Technical experts and the governmental environmental regulatory agency in the State of Acre will develop technical guidelines for the preparation and evaluation of environmental assessments that must precede forest clearing or exploitation.
- WWF will work with grassroots NGOs to initiate community organization, land tenure studies, and forest resource assessments -- necessary precursors to the large-scale establishment of extractive reserves in the Amapa region.
- WWF will provide training, management assistance, and basic infrastructure needs to Amazon-based NGOs, including the *Fundação Victoria Amazonica*, a new wildlife management, environmental, and ecotourism organization.
- A small fund will be made available to Brazil's national environmental Agency, the Special Environment Secretariat (SEMA), and its implementing arm, the Brazilian Institute for Environmental and Renewable Natural Resources (IBAMA), to provide technical assistance for strategic planning and policy development.
- A workshop on economic policies and natural resources will be designed by WWF and Brazilian counterparts for the Brazilian civil servants who are responsible for addressing natural resource economic issues in the country's 35 federal agencies.
- The University of Florida will help a consortium of institutions carry out a three-year program of substantive research and extension activities. The program will develop and implement alternatives for diversifying small-scale agriculture and agroforestry production systems in sustainable ways in the State of Acre.
- The Bureau for Science and Technology's Office of Forestry, Environment and Natural Resources is also contributing to GCC work in Brazil. Under a Cooperative Agreement with the World Wildlife Fund, WWF is working with the USAID Mission in Brasilia, with local NGOs, and with local scientists to establish national and local conservation guidelines and priorities, identify models of land use that maintain natural vegetation and biodiversity, and examine national and local priorities to see how these impact global climate change.

Under another grant, the Smithsonian Institution was to provide graduate training in forest research through its Biological Dynamics of Forest Fragments (BDFF) project, and it will strengthen BDFF's links to four other long-term tropical forest field stations.

Woods Hole Research Center has grant support to implement a project that evaluates the ecological, economic and social performance of existing agricultural systems on degraded lands; expand knowledge of promising agricultural systems for degraded lands through applied research; communicate the results of this evaluation to extension workers, rural unions, policy makers and NGOs; and train Brazilian scientists through apprenticeships with project investigators.

- USAID is working in coordination with other donor agencies to create the Energy Efficiency Institute. This will be operated by an NGO that will work to increase awareness and implementation of energy efficiency in the private sector and provide policy advice to the government.

E/GCC activities funded in FY 1990 in Mexico include:

- Support for the consolidation and management of the Calakmul Biosphere Reserve. The area is of great national and international importance because of its large (1,786,990 acre) expanse of tropical forests and the unique biological diversity protected within its boundaries. Calakmul is contiguous with protected natural areas in Belize and Guatemala, which together constitute one the largest (5 million acres) and richest tropical forest complexes in the Americas.
- A grant to the Mexico Chapter of Conservation International for the consolidation and management of the 800,000-acre Montes Azules Biosphere Reserve. The area lies in the heart of the Lacandona forest, Mexico's last large tract of lowland tropical evergreen forest. The Reserve constitutes the "core protected area" of the Selva and has come under increasing pressure in recent years from logging, hunting, slash-and-burn agriculture, road building, oil exploration, and land clearing for grazing.
- A \$99,330 grant to the *Fundación Universo Veintiuno* to develop technical ecological norms to help control global climate change and environmental contamination problems. The grant also will support a workshop to develop a research agenda and methodologies relating to global climate change in tropical Mexico. Training and technical assistance in global climate change will be provided.
- A grant to the *Fundación Chiapaneca Miguel Alvares del Toro* (FUNDAMAT), a local non-profit group that will help conserve tropical forests in southern Mexico through outreach and buffer zone management in selected protected areas.

Several ongoing projects in the Bureau of Science and Technology, Office of Energy also contributed to E/GCC goals in the Latin America and Caribbean region. The Biomass Energy Systems and Technology (BEST) project is a \$12 million, 11-year (1983-1994)

financial, and institutional risks of using biomass to produce electricity and/or liquid fuels in developing countries. The project also disseminates information about promising techniques and approaches in those areas.

In Latin America and the Caribbean, accomplishments under the BEST project include the passage of a law in Costa Rica that allows the private sector to sell power produced through biomass conversion to the national grid and the development of a 4.7-megawatt power plant at the El Viejo sugar mill, a result of a review of the cogeneration potential in the sugar industry. In Guatemala, BEST developed a methodology for determining avoided cost capacity and energy costs and guidelines for purchase contracts for privately generated power. This is expected to lead to the production of 50 megawatts of private generation capacity in the next two years.

The Energy Policy Development and Conservation Project in Costa Rica conducted a feasibility study in FY 1990 that identified the relative economic benefits of demand-side management, least-cost planning, and investments in efficiency. The study was requested by the national utility, Instituto Costarricense de Electricidad, and the Ministry of Natural Resources, Energy and Mines (MIRENEM) and conducted through USAID's Office of Energy.

The study stemmed from a 1988 conference co-sponsored by USAID and the Government of Costa Rica on problems in the power sector in Central America and the Caribbean. A final report with recommendations was to be presented to ICE in April 1991, with recommendations for financing to be considered by ICE, USAID, and the Inter-American Development Bank.

5. Global Efforts

- USAID is carrying out a Global Energy Efficiency Initiative (GEEI), targeted at improving energy efficiency in USAID-assisted and other "key" countries that have the potential to contribute significantly to global climate change.

The GEEI has established a U.S. Working Group consisting of the Department of Energy and its national laboratories, the Environmental Protection Agency, the Congressional Office of Technology Assessment, Battelle Memorial Institute, Princeton University and other organizations. A comprehensive study of the impact of energy efficiency on global climate change has been completed. Project proposals have been prepared for several countries in Asia and Eastern Europe, including India, Indonesia, the Philippines, and Poland. USAID has budgeted more than \$4 million in FY 1991 for the GEEI.

- USAID also is working with the U.S. Electric Power Research Institute (EPRI) and with electric utilities in Western Europe, Canada, Japan, Korea, India, and Taiwan, as well as a number of other developing

countries. The group is exploring the formulation of an international electric utility industry network that would sponsor collaborative research and the development of technologies that address the potential for climate change.

VII. WATER RESOURCES, COASTAL ZONES, WETLANDS, AND WATERSHED MANAGEMENT

A. PROBLEM OVERVIEW

The coastal zone -- that area of land subject to marine influence and the area of sea subject to land influence -- is home to 85 percent of the world's population. The coastal zone is fragile, biologically productive, and susceptible to degradation through human activities, yet coasts will absorb most of the world's population increase in the coming decades.

Coastal zones serve as important loci for tourism -- an important foreign exchange earner -- as well as a center for major transportation and water-based industrial facilities, fishing industries, and agricultural activities. The feeding, breeding, and nursery grounds for an estimated 98 percent of global offshore fisheries are located in coastal areas, and a high proportion of the best alluvial soils are in coastal zones. Thus, coastal regions contribute significantly to national economies.

Eighty percent of USAID-assisted countries are coastal states.

In the near term, economic development in many countries will depend largely upon how coastal areas are utilized and managed. Critical to achieving this economic development are integrated coastal resource management programs directed at developing coordinated strategies to conserve the coastal zone and guide its multiple use.

Management of coastal zones, wetlands, and watersheds are interrelated issues. Broadly defined, "watersheds" encompass terrestrial areas drained by a river or river system. The coastal zone represents the transition from terrestrial to marine influences and *vice versa*. It comprises not only the shoreline ecosystems, but also the upland watersheds draining into coastal waters, as well as the nearshore sub-littoral ecosystems influenced by land-based activities. Extending several hundred kilometers seaward, the coastal zone includes offshore banks and continental shelves.

Wetlands serve a variety of environmental functions critical to development activities. They are feeding, breeding, and nursery grounds for fish and support numerous wild plants and animals. Wetlands regulate and buffer droughts and floods and act as important water purifiers.

Because water provides the essential linkage between the land and sea elements of coastal ecosystems -- including brackish and salt water wetlands (salt marshes and mangroves), coral reefs, estuaries, lagoons, and seagrass meadows -- no single part of the coastal environment operates independently of any other. It is this interdependence that makes the coastal complex particularly susceptible to terrestrial and sea-based sources of pollution and the impacts of natural hazards.

USAID recognizes that management along traditional sectoral lines cannot solve the major natural resource issues in coastal environments. Moreover, the Agency recognizes that solutions to complex problems related to sustainable economic development of coastal areas must focus on the interactions among a myriad of sectoral activities relating to multiple needs, including those of agriculture; conservation; energy; fisheries; forestry; industrial development; tourism; urban planning; and water resources and watershed management. USAID is implementing pilot integrated coastal zone management programs in three countries: Ecuador, Sri Lanka, and Thailand.

B. HIGHLIGHTS OF MISSION COASTAL MANAGEMENT PROJECTS

USAID has pioneered the development and implementation of coastal zone management programs in developing countries. Moreover, the Agency has developed a comparative advantage in strengthening the capability of institutions in developing countries to formulate and execute effective integrated coastal and resource management programs. It has contributed in key ways to USAID mission assistance for coastal zone management and conservation.

The Coastal Resources Management (CRM) Project was initiated in 1985 by the Office of Forestry, Environment and Natural Resources, Bureau for Science and Technology, and is being implemented through a Cooperative Agreement with the University of Rhode Island.

1. Thailand

The Thailand pilot project in coastal resource management was launched with a demonstration project in Phuket province. The project stressed the early testing of management techniques that could be implemented at the local level and directed at selected coastal problems: water quality and coastal watershed management; the economics of tourism; and marine protected area management. Together, these elements represented the foundation for integrated coastal area management in Phuket.

The demonstration project made coral reef protection in Phuket province and its surrounding areas a priority because Phuket's coral reef habitat is considered significant locally and nationally -- not only for its ecological values, but for the economic benefits it brings through fisheries and tourism, as well. Tourism is the number one source of foreign exchange in Thailand. A Coral Protection Strategy was developed to identify, through local consultation, measures that could be implemented to better manage the reefs. The aim is to allow these areas to be used on a sustainable basis for coastal

tourism, fisheries, education, and other activities that are the foundation of Phuket's economy.

The Coral Protection Strategy formulated by USAID's Coastal Resources Management Project is currently being implemented in Phuket Province and in Phi National Park. In June 1990, a National Coral Reef Strategy that builds on these efforts was completed and adopted by the Thai Government.

The four-year Thailand pilot project concluded with a major national policy seminar in July 1991. Successful completion of major project components included:

- National policy reform (Provincial CRM Planning, Coral Reef Management);
- Local level demonstration projects in integrated coastal management (Phuket), marine park management (Tarutau and Phi National Parks), and coral reef management (Phuket and vicinity);
- Institutional strengthening of Royal Thai agencies (Office of the National Environment Board, a "CRM Center of Excellence" at Prince of Songkla University); and
- Increasing public awareness of coastal issues.

2. Sri Lanka

Sri Lanka was chosen as a pilot CRM project because of its experience in coastal resources management in the developing world. The main objective of this pilot effort was to help the Coast Conservation Department prepare its legislatively mandated National Coastal Zone Management Program. The Sri Lanka Coastal Zone Management Plan (CZMP), prepared through the CRM project, was approved by the Cabinet. Implementation of the plan is currently underway. Another successfully completed target activity was the training of district officers about the CZMP as a first step toward devolving authority from central to local governments. USAID/Colombo built upon the CRM pilot approach as a template for designing the Mission's National Resources Policy Project (NAREPP). The newly published report, "Coastal Sri Lanka -- An Agenda for the 1990s", provides the framework for Sri Lanka's second generation coastal program as part of the Mission's natural resources initiative.

3. Ecuador

Ecuador adopted a national coastal resources management program by presidential decree in January 1989. The program built upon the CRM Project's technical work and an innovative public participation effort. Key features of this program, including the creation of an Interministerial CRM Commission, became operational in 1990. A new

governmental unit, the Technical Secretariat to the Commission, is being funded by the Government of Ecuador. The leadership and support for the national CRM program is being augmented by the *Fundación Pedro Vicente Maldonado*, a Guayaquil-based private voluntary organization dedicated to sustainable use of natural resources in the coastal region. In addition, the CRM program involves a growing number of interagency working groups, teams of Ecuadorian experts, local coordinators, and the members of the Advisory and Executive Committees in each of the five special area management zones. Interagency teams called "Ranger Corps" have been formed to improve enforcement of existing laws and regulations. The Interministerial CRM Commission is currently reviewing and approving the plans for six special area management zones.

Ecuador's National Coastal Resources Management Program is benefiting from a "debt swap" approved by the *Junta Monetaria* in March 1991. Proceeds from the swap are funding coastal resources management activities for the *Fundación Pedro Vicente Maldonado*, including environmental education for school children and the public and efforts to strengthen institutions.

4. Other Areas

A number of other recent USAID initiatives are underway in the area of coastal zone and marine resource management. In the Philippines, for example -- where 70 to 90 percent of coastal wetlands have been destroyed or severely degraded during the last 30 years -- a USAID-supported small grants project is helping to evaluate some 136 wetland areas, prepare conservation and management plans for sample wetlands, and propose protective measures for key sites.

The Philippines Wetland Conservation Program, carried out by the Asian Wetland Bureau, Philippines Foundation through the U.S. Fish and Wildlife Service, is building on the work of the Asian Wetland Inventory project, which has identified the major wetlands in the country. The project, also supported by the World Wide Fund for Nature, is expected to provide protection status for Olango Island as a Migratory Bird Sanctuary.

Through the Regional Office for the South Pacific in Suva, USAID's Pacific Islands Marine Resources Project is helping strengthen coastal and marine resource conservation in the region while increasing income opportunities for island communities. Pilot activities are projected in the Cook Islands, Kiribati, Papua New Guinea, Tuvalu, and Tonga to launch small-scale commercial operations in nearshore areas, while preserving inner reef and lagoon resources for subsistence uses. The project also will promote better use of deep bottom fishing offshore and establish a bluewater small boat tuna fishery, as well as a black pearl oyster culture industry for income and export. Assistance will be provided to Governments to manage efforts to preserve fragile atoll and lagoon environments.

The Association of Southeast Asian Nations (ASEAN) has initiated the Coastal Resources Management Project to help its members upgrade coastal resources management through

applied pilot research activities and improved management of important sites in each member country.

The centrally managed competitive research grants program of the USAID Science Advisor has a relatively active portfolio of projects focused on coastal zone issues. For example, several ongoing grants in 1990 dealt with mangrove forests and their effects on offshore fisheries. These include a project that studies the effect of oil dispersants on corals and mangroves and provides some of the only data currently available on the new classes of dispersants and their effects in tropical waters.

C. WETLANDS CONSERVATION-1991

Since 1986, the United States has been a signatory to Convention on Wetlands of International Importance Especially as Waterfowl Habitat (known as the Ramsar Convention).

In keeping with the U.S. commitment to conserve and protect wetlands, USAID supports more than 30 projects that contribute positively to wetlands conservation and protection objectives. Projects with the most positive effects address protected area or multiple-use management of wetlands. These efforts characteristically combine direct intervention (such as assistance to develop and implement resource management plans) and indirect support to planning and implementation processes (such as environmental education, training, research, and policy analysis).

In addition to projects that directly conserve and protect wetlands, USAID also has projects that have the potential to indirectly benefit wetlands. Among these are projects that target general environmental support to the resource management planning process. Several projects support soil conservation and watershed management, which reduce sediment loading and stress on downstream wetlands.

Funding for projects involving wetlands and closely related coastal zone conservation, management, and protection is estimated at about \$7 million in FY 1991 and FY 1992.

As the Agency increases the number of projects addressing the management of natural resources, inland and coastal wetlands concerns are receiving greater attention.

USAID intends to give additional emphasis to wetlands conservation in its programs by: developing specific Agency guidelines for the design of activities that may affect wetlands; improving environmental data bases; and incorporating a wetlands component into staff environmental training programs.

VIII. SUSTAINABLE AGRICULTURE

One of the critical global issues of the 1990s is how to generate and sustain environmentally sound agricultural development. The alarming rates of resource depletion and the loss of existing cultivated areas around the world clearly testify to the significance of this issue. For example, each year as much as 6 million hectares of drylands -- an area the size of West Virginia -- may be rendered unproductive by mismanagement, and 11 million hectares of forest lands may be cleared to make way for shifting cultivation and sedentary agriculture.

These activities pose grave implications for the loss of valuable biological and genetic resources needed to support future crop and forestry development. Removal of forest cover and inappropriate use and over-exploitation of crop and range lands contribute to high annual rates of soil erosion. Pollution of surface and groundwater and other off-site effects that result from the over-use of pesticides and fertilizers are disrupting hydrologic systems and causing extreme damage to biological systems. In irrigated lands, salinization and waterlogging are critical problems threatening what used to be highly productive areas.

Agricultural development is critical to economic growth. It provides not only food, fiber and fuel, but also employment, income, and savings to a large percentage of the population in the developing world. Without a growing and dynamic agricultural sector, overall development will lag.

Growth in total food production has increased in developed and developing countries alike during the last 40 years. In fact, total production increased more rapidly in developing countries than in developed nations. For example, production of cereals -- coarse grain, rice, and wheat -- increased from 1.3 billion metric tons to 1.8 billion metric tons from 1971 to 1985.

However, the picture darkens when population growth is factored in. Due to population growth, the poorest countries in Africa and the Near East actually experienced zero growth or a decline in per capita food production since the mid-seventies. Hunger and malnutrition remain problems. Income growth, which averaged 3.5 percent per year, has generated additional food demands. Countries in Africa, Asia, and Latin America that were once exporting cereal grain now are net grain importers.

Moreover, by the beginning of the eighties, food imports -- through commercial and development assistance channels -- began to play an important role in the food balance-of-trade in the developing world.

Foremost for many policy makers in developing countries is the problem of how to ensure food security from local sources. In the countries with food deficits, the problem is where to find the foreign exchange to import cereal grains from North America and other international markets. However, increasing debt and balance-of-trade problems are limiting the ability of developing countries to import needed cereal grains. As pressures mount for countries to expand the agricultural frontier into areas that are at best marginal, the result is often increased per-unit production costs.

Recently, USAID also has taken a number of positive steps to incorporate natural resource and environmental concerns into agricultural development planning, policy, and programs. The Agency is now putting into place a new agricultural focus that establishes as a goal the long-term maintenance and enhancement of the natural resource base. This includes efforts to establish sustainable farming systems that are capable of responding to changing conditions and continuing gains in economic and social welfare of the people in the developing world.

The House and Senate 1990 Appropriations Committee reports directed USAID to consider providing no less than \$10 million over 3 years, beginning in FY 1990, to a new program in sustainable agriculture and natural resource management. The reports also recommended that USAID provide an additional \$5 million in FY 1990 to allow current USAID programs to address issues of sustainable agriculture more effectively.

A. USAID'S STRATEGY FOR SUSTAINABLE AGRICULTURE

Within USAID's Bureau for Science and Technology, three offices -- the Offices of Agriculture; Rural Development; and Forestry, Environment and Natural Resources -- took the lead in developing a USAID strategy for sustainable agriculture. These offices have formed an inter-office task force on agricultural sustainability to discuss steps to help USAID address this critical issue. Preliminary field guidance on sustainable agriculture was issued to overseas missions.

The task force defined sustainable agriculture as "a management system for renewable natural resources that provides food, income, and livelihood for present and future generations and that maintains or improves the economic productivity and ecosystem services of these resources." The definition implies that current management choices must give priority attention to maintaining the renewable natural resource base and its ability to meet changing needs.

The strategy for sustainable agriculture will take into account a number of factors, including:

- **The need to better understand sustainable agricultural systems at all levels in the developing world;**
- **The promotion of biological diversity within farming systems;**
- **A long-term commitment to sustainable agriculture issues, especially in those areas of the world where environmental degradation is eroding the productive capacity of the natural resource base;**
- **The need for policy support for the concept of sustainability in agricultural development; and**
- **The key role the private sector can play in implementing sustainable agriculture initiatives.**

The Offices of Agriculture and Rural Development also are enlisting the assistance of the National Research Council to design a new Collaborative Research Support Program (CRSP) in Sustainable Agriculture and Natural Resource Management. The CRSP, which was to begin in 1991, will finance research in areas of particular interest to sustainable agriculture, including:

- **Soil ecology management (to develop biological alternatives to improve soil fertility and structure and control soil pathogens);**
- **Cultural practices that can provide alternatives to intensive inputs for pest and weed control, nutrient cycling, and soil conservation;**
- **Integrated pest management (to maintain populations of pests at "acceptable levels" while providing protection against hazards to humans, domestic animals, plants, and the environment);**
- **Socioeconomic incentive systems that reinforce practices of sustainable agriculture; and**
- **Methodologies for integrating agricultural, socioeconomic, and ecological disciplines.**

The promotion of environmentally sound agriculture was addressed in the Agency's FY 1990 Environmental Initiative. The Initiative recognizes that promotion of sustainable agriculture will likely call for: modification in current methods of economic analysis to reflect the real value of natural resources; better integration of environmental assessments into the project design process; full participation of the local population; incorporation of appropriate advances in biology and technology; and greater emphasis on the use of integrated pest management (IPM).

The Environmental Initiative notes that the Agency will take action in the following areas related to sustainable agriculture:

- Significantly increase the proportion of the agricultural portfolio devoted to environmentally beneficial agricultural activities, with an emphasis on integrated pest management, agroforestry, sustainable alternatives to shifting cultivation, and agricultural policy reform.
- Complete a set of guidelines on Agricultural Pest and Pesticide Management that update the 1978 Pesticide Policy and firmly establish IPM as the primary method of pest control supported by USAID.
- Undertake country-specific assessments of the pest management needs of developing countries and identify constraints to more widespread application of IPM practices.
- Initiate pilot projects to demonstrate the economic and environmental benefits of integrated pest management and expand existing IPM activities in the Latin America/Caribbean region.
- Work with the World Bank, the OECD, and the United Nations technical agencies to reorient the research agendas of the CGIARs to IPM, agroforestry, water conservation and management, and other environmentally and socially sound agricultural management practices.
- Develop and support programs in sustainable agriculture to: identify methodologies for designing and implementing sustainable agricultural systems; build institutional capacity in sustainable agriculture; and provide technical support in this area to USAID Missions and offices.

Highlight on Integrated Pest Management

Pests damage half the crop production around the world. Worldwide, pests cause estimated pre-harvest agricultural crop losses of approximately 36 percent of potential yield, and an additional 14 percent of post harvest losses. USAID supports activities designed to better manage agricultural pest problems.

Moreover, pests spread disease. It is estimated that 500 million people in the world are infected with tropical diseases, many of which, such as malaria, are vector-borne. Thus, USAID's development assistance strategy to improve human health conditions in developing countries includes support to control the vectors that spread the major diseases.

USAID ensures that all the activities it supports are ecologically and economically sustainable. These considerations are particularly important in agricultural pest management and vector control programs which, if not properly designed and implemented, can have serious negative impacts on the environment.

USAID's policy is to promote integrated pest management (IPM) as the primary method of pest control. IPM attempts to control pests in an economically and environmentally

62

rational manner. It emphasizes non-chemical tactics that cause minimal disruption to the ecosystem.

B. CENTRALLY FUNDED PROGRAMS

A number of the Agency's centrally funded programs contribute directly to sustainable agriculture.

1. Pest and Vector Management

The Integrated Pest Management and Environmental Protection Project helps USAID develop, implement, and evaluate projects in pest and pesticide management. Active since 1971, it is managed by the Bureau for Science and Technology and is currently implemented by the Consortium for International Crop Protection (CICP), a group of 13 universities and the U.S. Department of Agriculture that is administered from the University of Maryland. CICP has provided technical assistance in pest management and conducted training programs in several developing countries. It also is USAID's primary source for conducting environmental assessments focusing on pesticide use. An expanded program for IPM research is anticipated as a component within the new Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program.

The Vector Biology and Control Project is designed to develop and strengthen programs to minimize the debilitating effects of vector-borne human diseases, such as malaria, schistosomiasis, and onchocerciasis. The project recognizes that vector-borne disease control strategies that rely heavily on the use of pesticides are not economically sustainable. After thorough analysis of the sociocultural and biological factors that contribute to vector-borne disease, the project develops management strategies that promote an integrated approach appropriate for given local settings. The project is managed by the Bureau for Science and Technology.

2. Collaborative Research Support Program

The new Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (CRSP) will add to the significant achievements of eight other CRSPs funded by USAID that help bring U.S. agricultural research system capabilities and successes to bear to help increase farmer productivity, incomes, and employment opportunities in developing countries.

The CRSPs, created by the 1975 Title XII legislation, were conceived as long-term efforts to solve problems of inadequate food supplies and distribution and to train scientists in developing countries to address these problems on a sustained basis. USAID currently supports eight CRSPs: Small Ruminants; Sorghum and Millet; Bean and

Cowpea; Soil Management; Peanut; Nutrition; Fisheries Stock Assessment; and Pond Dynamics/Aquaculture.

The CRSPs are coordinated and funded through the USAID Offices of Agriculture and Nutrition and implemented by means of grants to U.S. universities, which develop the collaborative links with counterparts in developing countries and networks with other cooperating institutions.

The CRSPs have made an important contribution to the development of environmentally sound and sustainable agriculture. Among CRSP achievements:

- **Sorghum/Millet CRSP scientists have discovered and identified the germination physiology of the striga, a parasitic weed that is one of the major constraints to the production of millet, sorghum, maize, and beans in sub-Saharan Africa. Scientists have identified sorghum germplasm that is devoid of the striga seed stimulant and resistant to striga.**
- **The Small Ruminant CRSP applied a rapid appraisal technique to map polymorphic loci of the dual-purpose goat. This represents the first use of this procedure to map the genes of any domestic livestock species. Results will enable scientists to trade genetic parasite resistance in specific lines of dual-purpose goats.**
- **The Bean/Cowpea CRSP designed an effective, inexpensive, easily built, low-technology solar heater for use by farmers in developing nations for cowpeas and other crops with insect storage problems. The heater can reduce the post-harvest storage losses in West Africa caused by the cowpea weevil, which approach \$50 million annually. Exposing cowpeas to temperatures of 57 degrees Centigrade for one hour kills all stages of the cowpea weevil in seed.**
- **The Peanut CRSP has taken significant steps to address the problem of aflatoxin, which affects the safe consumption of peanut and other food and feed grains world-wide. Absorptive clays added to contaminated crude peanut oil in Texas and Senegal were found to remove essentially all the aflatoxin from the oil.**

3. Title XII University Activities

A wide range of projects implemented under arrangements with Title XII universities also contributed to the goal of sustainable agriculture in FY 1990:

- A consortium of U.S. universities, operating with funding from several donors, conducted a workshop on the biological control of pests in Jamaica; this resulted in the founding of a Caribbean network for Biological Control of pests. The workshop was to be duplicated in Central America in 1991. The networks will enhance biological control of pests in the Caribbean and Central America by increasing knowledge and serving as a mechanism for sharing current knowledge and future developments.
- The International Benchmarks Sites Network, a new approach for exploring sustainability and productivity of agro-ecosystems, was tested worldwide and is expected to provide options on policies, programs, and practices to decision makers.
- The Post-Harvest Grain Systems project with Kansas State University trained individuals from 15 countries in grain storage and marketing in FY 1990. The same year, students from 10 countries received training in agro-industrial projects. Thirteen students from Pakistan were trained in grain storage management.
- Thirty-eight students from developing countries were trained in seed technology in FY 1990 by the Research and Development of Improved Seed Production and Utilization in Developing Countries Project, operated with Mississippi State University.
- To control and detect two blood-borne diseases (anaplasmosis and babesiosis) affecting cattle world-wide, a project applying new biotechnologies to develop recombinant vaccines and diagnostics has actively patented its results to obtain proprietary protection for commercial development. Diagnostics using the recombinant DNA approach are sensitive and specific for these diseases and are easily employed in the field.

4. Research on Extreme Agroecological Conditions

Under the Program of Science and Technology Cooperation (PSTC), the National Academy of Sciences published two major reports in 1990: The Improvement of Tropical and Subtropical Rangelands and Saline Agriculture: Salt Tolerant Plants for Developing Countries. Both books are intended for decision makers in developing countries. Nearly 600 copies of the first book and some 2500 copies of the second book have been distributed.

The first book focuses on improving tropical and subtropical rangeland, which cover about one-quarter of the earth's land surface. The large majority of these lands are at least moderately degraded. Encouraging sustainable use of these lands is of critical environmental importance.

The second book explores saline agriculture, which offers opportunities to introduce agriculture into coastal deserts; to effectively use brackish waters, thus reducing pressures on higher quality but limited water resources; and, to sustain agriculture in irrigated and other areas that have already been degraded by salinization. While the report warns that saline agriculture is not a substitute for good agricultural practice nor a palliative for improper irrigation, it does open new alternatives for sustainable agriculture in some circumstances.

5. Research Grants Supporting Sustainable Agriculture

USAID's competitive research grants programs are supporting many peer reviewed grants relating to sustainable agriculture. For example:

- A grant was made by the Program of Science and Technology Cooperation (PSTC) to Thai scientists to study techniques to enhance cattle productivity, while conserving Asian wild cattle genetic resources.
- Research was funded under PSTC to study the reservoirs of plant viral and microplasm infections; to use natural products from wild plants for insecticides; and to increase the persistence of bacterial mosquito control agents.
- Another grant was made to develop a radically new technology: using somatic embryos for germplasm storage and clonal propagation. Research is focused on producing an alternative to seed that can be generated in the laboratory instead of in plants and that can be used in *ex situ* preservation of fruiting species.
- A study was funded to enhance soil productivity on some South Pacific islands by examining the effect of soil amendments on some difficult island soils. Nutrient flows in alley cropping systems are being examined and efforts are underway to develop models to predict inoculation requirements for biological nitrogen fixation in legumes in tropical soils.
- Cooperative Development Research grants were made to evaluate new irrigation techniques in Swaziland for

uniformity of application and to develop gravity powered irrigation technology.

C. REGIONAL EFFORTS

USAID's regional Bureaus and Missions achieved significant advances in the area of sustainable agriculture.

1. Africa

Effective management of the environment is especially important for sub-Saharan African countries whose soil, water, and forest resources are limited. The challenge for these countries is to balance current use against future need. Not only must current resources be used efficiently; provisions must also be made for their conservation and replacement and for future expansion.

Under the Development Fund for Africa (DFA), the Africa Bureau is mandated to focus on strategic objectives that have impacts on the people-level. In the context of sustainable agriculture, strategic targets commit the Bureau to help governments help their populations achieve sustainable increases in yields and income through better management of natural resources. Moreover, the Bureau is committed to supporting actions that link sustainable economic development with long-term stewardship of the natural resource base. Conversely, it is becoming clear that such long-term stewardship will be unlikely to occur if the prospects for economic returns are poor.

Agriculture is the dominant sector in most sub-Saharan African economies. Among the USAID goals in Africa are to: increase the contribution of the agricultural sector to sustained economic growth; achieve broad-based improvements in food security; and promote sustained increases in agricultural productivity through greater use of higher yielding technologies, increased market efficiencies, and improved management of natural resources.

The "Plan for Supporting Natural Resources Management in Sub-Saharan Africa" was adopted in 1987 and continues to be an operational programming tool. The natural resources strategy for the region is based on a focus that includes sustainable agriculture, particularly soil management.

A number of USAID programs in agricultural research and technology are reaping rewards in Africa. For example:

- The Africa Emergency Locust and Grasshopper Assistance Project (AELGA) was initiated by the Africa Bureau as a medium-term response to the desert locust and grasshopper outbreaks in Africa. Several activities in the area of research, training, and technical assistance have been supported through this project. Research has focused on pesticide

effectiveness, the impact of pesticides on non-target organisms, and biological control of grasshoppers and locusts using insect pathogens. The biological control work was conducted in Mali and Cape Verde during 1989. The research in Cape Verde was continued until December 1990.

The AELGA project, in cooperation with other donors, also is supporting the International Institute of Tropical Agriculture (IITA) in Benin to investigate biological control of grasshoppers and locusts with fungal pathogens. Training programs funded through the AELGA project have included safe pesticide application, the development of training and extension materials, and the human health aspects of pesticide use. In 1990, AELGA also sponsored the participation of seven U.S. scientists at a West African IPM conference and organized a workshop on pesticide disposal. The project has jointly funded preventative locust surveys with the FAO.

- In the Gambia during the last three years, the Gambia Research Service responded to farmers' requests for information and training in new agricultural technologies by expanding its program of on-farm trials. One such trial introduced local farmers to sesame. The effort has been cited as an example of the success that can occur when a good fit is made between farmer interest, crop characteristics, and enthusiastic extension.

Most Gambian farmers grow peanuts, the country's largest export. Because peanuts are farmers' only cash income source, they sell as many nuts as they can. Yet, this sometimes leaves farmers and their families without enough peanut oil for their own cooking. Until recently, the Gambia Produce Marketing Board was the only authorized processor of peanut oil. Adding to the problem is the fact that the lack of fat in the local diet is the main cause of severe malnutrition among Gambian children under five years old. Thus, the significance of sesame -- especially sesame oil, became clear.

To provide a cheap source of fat for the family diet, Catholic Relief Services (CRS) conducted field trials with sesame starting in 1978; the NGO found that the crop does well in the Gambia. The crop's popularity soared in 1983 when it proved highly resistant to a drought that severely damaged peanuts and sunflowers. It also was discovered that sesame cake can be used to fatten rams, which are much in demand on religious feast days.

By 1990, more than 50,000 Gambian farmers, mostly women, were organized into 16 sesame growers associations, each with its own oil-processing facility. CRS trains in literacy, as well as record-keeping and equipment maintenance. Many of the farmers now not only have a ready source of cheap oil but, after selling their surplus, some extra income to cover school fees or finance trading activities.

- In Mali, as a result of the USAID Upper Valley Development Project, a growing number of farmers are adopting practices that have long-term, as well as short-term, impacts on the productive capacity of their farms. In the early 1980s, many farmers in the project zone were producing only two or three crops that were destined for consumption or the local market. Today, by contrast, many smallholders produce a wide array of crops with management options that were not available or known to them before the project. New techniques have been introduced, including: the use of mineral and organic fertilizers; rotation cropping; improved fallowing using forage legumes; and the use of harvest residues to fertilize the soil.

Last year, more than half the millet crop and nearly 40 percent of the maize crop was treated with manure, a farm input that was often wasted in the past. In 1989-90, nearly 250 farmers adopted practices to make better use of manure. More than 22,500 hectares were rotated last year. Forage legumes are new to many smallholders, but their use has spread to 20 villages.

The project also supports a number of activities that build local capacity to manage natural resources-based enterprises. These include: training village-level extension agents from 46 villages; supporting farm-day events; and supporting village-level associations in managing enterprises. Associations trained by the project have received nearly \$250,000 in agricultural loans from the private sector. Evidence is very strong that such initiatives as farm-days and training agents will help increase the number of smallholders investing in appropriate technologies.

Significant steps have been taken to address the problem of food security in Africa. Beginning with the 1984-85 Africa-wide drought, USAID has made major advances in famine preparedness and management of relief operations. The Famine Early Warning System, for example, was designed and financed by USAID to identify problems in the food supply system that could lead to famine conditions in Africa. Such critical information is provided to decision makers so that famine conditions can be preempted, thereby helping insure food security in affected countries.

In 1990, the Famine Early Warning System sounded two massive alarms. In northern and eastern Ethiopia, three million people were identified at famine risk in late July. In Sudan, USAID gave warning in early August of an impending nation-wide food crisis that could touch more than 10 million people in the next year.

In both cases, new USAID-funded remote sensing technology permitted warning two months earlier than ever before. This early warning, along with new methods to identify people who were most at risk, permitted the U.S. government and other donors to rapidly develop emergency food and relief responses and potentially save thousands of lives.

At present, this warning capability applies principally to the Sahelian band, stretching from Mauritania in the west to Ethiopia in the east. These new methods are now being transferred to indigenous regional organizations in East and Southern Africa where, even in surplus years, chronic and temporary pockets of food insecurity can exist.

2. Asia

In FY 1990, USAID's Bureau for Asia and the Private Enterprise developed a draft environmental and natural resource management strategy. The document proposed strengthened activities related to agricultural 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.

USAID Missions in the region undertook many activities relating to sustainable agriculture in FY 1990. Among these:

- In Pakistan, four regional conferences in Peshawar, Karachi, Faisalabad, and Quetta addressed the topic of "Agricultural Sustainability and Natural Resource Management in 1990 and Beyond." The conferences were sponsored jointly by the Government of Pakistan and USAID in May 1990.

The conferences provided a forum for provincial government officials, scientists, businessmen, and academics, as well as local farmers and fishermen, to better understand the social, economic, political, and environmental ties that bind sustainable agriculture and natural resource management.

A national conference on "Agricultural Sustainability and Natural Resource Management" was planned to take place in Islamabad in May 1991. This conference, to be jointly chaired by the Pakistan Agriculture Research Council, the Ministry of Food and Agriculture, and the Ministry of Environment and Urban Affairs, was to lead to the formation of a National Task Force to develop an Action Plan to support sustainable agricultural development and natural resource conservation during the next decade.

- In Indonesia, the Upland Agriculture and Conservation Project has worked in two critical watersheds in densely populated Java to increase farm production and decrease soil erosion. Several viable alternatives for the traditional Javanese upland farming system have been developed that show good potential for achieving production and conservation goals. Bench terracing has long been the preferred treatment by Javanese upland farmers to achieve production gains. The project has developed approaches, such as ridge terracing and alley cropping, that are better suited to the varied agro-ecological conditions of the Javanese uplands and

less costly in both initial investment and maintenance. In the past year, these new approaches were introduced on almost 10,000 hectares.

- Recent research findings have identified seven promising pest-resistant species of the economically important multipurpose tree, *Leucaena*, grown by approximately 30 percent of all Philippine farmers. *Leucaena* production has been reduced by 75 percent due to the pest *Heteropssylum*. Several spiders, insect predators, and types of fungi have been found to be natural predators and parasites of the pest, including a beetle that is currently being mass-reared for trial application by *Leucaena* growers.
- The ARRSP Project supported policy reforms to reduce use of pesticides on rice and funded the Rice Integrated Pest Management Training Program in Indonesia. This effort expects to train 2,530 IPM field specialists, 14,000 extension workers assigned to field crops, and 2.5 million farmers in IPM principles and techniques by 1994. Training began in the last year for 110 IPM trainers and 52 observers. The program also supported policy reform initiatives that resulted in the complete elimination of pesticide subsidies, further increasing the incentive to farmers to adopt IPM approaches.
- In FY 1990, representatives from seven U.S. IPM programs visited Egypt to work with Egyptian scientists under the National Agricultural Research Project to formulate research proposals in a wide variety of fields, including: citrus crops; nematode management; natural pesticides; and biochemical toxicology.

3. Latin America and the Caribbean

"Environmental and Natural Resource Management in Central America: A Strategy for USAID Assistance" identified sustainable agriculture as one of its five priority areas. The goal of sustainable agriculture in the region is currently being approached through integrated pest management activities.

Training, research, and education in adapting integrated pest management continue to be areas of focus at the Center for Tropical Research and Education (CATIE) in Costa Rica and the Panamerican Agricultural School (EAP) at Zamorano, Honduras. The two institutions collaborate closely in the implementation of activities under USAID's Regional Environmental and Natural Resources Management (RENARM) project, which was initiated in FY 1990.

The Pan American Agricultural School trained more than 300 students in FY 1990 through its five-day course in environmentally sound pesticide application. The Central American Institute for Nutrition (INCAP) is currently developing a correspondence course for medical doctors and health clinic staff in the diagnosis and treatment of pesticide toxicity.

A number of integrated pest management and crop protection activities also were carried out under the Non-Traditional Agricultural Export Support Project. The U.S. Environmental Protection Agency and the U.S. Food and Drug Administration have examined laboratories, contributed to workshops and seminars, and provided guidance on specific pesticides. All seven Central American countries sent government and private sector representatives to the EPA/FDA-conducted seminars.

Long-term sustainability will become an increasing part of USAID's agricultural programs. The Agency will continue to work closely with other institutions, both public and private, to help developing countries make maximum progress toward implementing programs for sustained agricultural development.

The development of an agriculture sector that can continue to provide food and income for the world's growing population is a major challenge. USAID's leadership efforts in working toward a viable strategy for integrating sustainable agriculture concerns into its economic development program will help assure that not only are the world's food needs met today, but that they are met for generations to come.

Acronyms

ACIAR	Australia Center for International Agricultural Research
AECCG	African Elephant Conservation Coordinating Group
AELGA	Africa Emergency Locust and Grasshopper Assistance Project
APNAN	Asia-Pacific Natural Agriculture Network
APRE	Bureau for Asia and Private Enterprise (USAID)
ASEAN	Association of Southeast Asian Nations
BEST	Biomass Energy Systems and Technology Project
BOSCOSA	Forest Conservation and Management Project (Costa Rica)
CATIE	Center for Tropical Research and Education
CCAD	Central American Commission on Environment and Development
CFC	Chlorofluorocarbon
CGIAR	Consultative Group on International Agricultural Research
CICP	Consortium for International Crop Protection
CIMMYT	International Maize and Wheat Improvement Center
CITES	Convention on Trade in Endangered Species of Wild Fauna and Flora
CONAP	National Council of Protected Areas (Guatemala)
CRM	Coastal Resources Management Project
CRSP	Collaborative Research Support Program
DFA	Development Fund for Africa
DH	Direct Hire
EAP	Pan American Agricultural School
EEC	European Economic Community
E/GCC	Environment/Global Climate Change Project (USAID)
EMCAT	Energy Management, Consultation, and Training Project (India)
ENE	Bureau for Europe and the Near East (USAID)
ENR	Directorate for Energy and Natural Resources (USAID)
EPA	Environmental Protection Agency
EP3	Environmental Pollution Prevention Project
EPRI	Electric Power Research Institute
FAO	<u>Food and Agricultural Organization</u>
FLUP	Forestry Land Use Planning Project
FUNDAMAT	<i>Fundación Chiapaneca Miguel Alvares del Toro (Mexico)</i>
FRM-II	Forest Resources Management II Project
GDP	Gross Domestic Product
GEEI	Global Energy Efficiency Initiative
GEF	Global Environment Facility
GEMS	Global Environment Monitoring System
IARC	International Agricultural Research Center
IBAMA	Institute for Environment and Renewable Natural Resources (Brazil)
ICRAF	International Center for Research in Agroforestry
ICE	Instituto Costarricense de Electricidad
IDI	International Development Intern
IITA	International Institute of Tropical Agriculture
INCAP	Central American Institute for Nutrition
IPCC	Intergovernmental Panel on Climate Change

IPM	Integrated Pest Management
IRENARE	National Directorate for Renewable Natural Resources (Panama)
ITTO	International Tropical Timber Organization
IUCN	World Conservation Union
MAB	Man and the Biosphere Program
MAGPI	Multi-Agency Group on Power Sector Innovation
MANRES	Management of Natural Resources and Environment for Sustainable Development
MIRENEM	Ministry of Natural Resources, Energy, and Mines (Costa Rica)
NAREPP	National Resources Policy Project
NGO	Nongovernmental Organization
NRMS	Natural Resources Management Support Project (USAID)
NSF	National Science Foundation
ODA	Overseas Development Administration(U.K.)
OECD	Organization of Economic Cooperation and Development
PACER	Program to Accelerate the Commercialization of Energy Research (India)
PEP	Profitable Environmental Protection Program
PRIDE	Project in Development and the Environment
PVO	Private Voluntary Organization
RENARM	Regional Environmental and Natural Resources Management Project
RERI	Renewable Energy Research Institute (Sudan)
RHUDO	Rural Housing and Urban Development Office (USAID)
SADCC	Southern African Development Coordination Conference
SEMA	Special Environment Secretariat (Brazil)
SRAAD	Sudan Reforestation and Anti-Desertification Project
SREP	South Pacific Regional Environmental Program
SREP-II	Sudan Renewable Energy Project
S&T/H	Bureau for Science and Technology/Office of Health (USAID)
S&T/FENR	Bureau for Science and Technology/Office of Forestry, Environment and Natural Resources (USAID)
SUBIR	Sustainable Uses for Biological Resources Project (Ecuador)
TAC	Technical Advisory Committee (CGIAR)
TNC	The Nature Conservancy
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WASH	Water and Sanitation for Health Project
WCI	Wildlife Conservation International
WHO	World Health Organization
WMO	World Meteorological Organization
WWF	World Wildlife Fund