Peru: An Assessment of Biological Diversity

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PERU:

AN ASSESSMENT OF

BIOLOGICAL DIVERSITY

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David Gow
Team Leader

EXECUTIVE SUMMARY

INTRODUCTION

The 1986 amendments to the Foreign Assistance Act, Sections 118 and 119, dealing with tropical deforestation and biological diversity, respectively, require that each country development strategy statement provide information on the following:

- The status of host-country efforts to conserve biological diversity and tropical forests;
- Actions that AID missions could take to conserve biological diversity and tropical forests; and
- The extent to which proposed actions meet the needs identified.

The objectives of this assessment are to provide AID/Peru with:

- Sufficient analysis to satisfy the congressional mandate on biological diversity and tropical-forest management; and
- Identification of important projects and programs that could be funded during the period 1989-1994.

BIOLOGICAL DIVERSITY

Conservation of biological diversity and tropical forests is of considerable importance to the world scientific community, to a growing number of the public in developing and developed countries, and to indigenous peoples. In addition, such efforts will improve the possibility for economic development in the long run.

Biological diversity refers to the variety and variability among living organisms and among the ecological complexes in which they occur. Diversity is indicated by the number of ecosystems, species, and genes, and by their relative abundance. The importance of diversity lies in the potential it provides for enhanced adaptability and evolutionary fitness -- in both biological and cultural terms.

THE ECOLOGY OF PERU

Although there is still debate about which neotropical country is biologically the richest in Latin America, there is little doubt that Peru is among the top three, along with Colombia and Brazil. With 1.28 million square kilometers, Peru is the third largest country in South America and the largest in the tropical Andean region. The country is divided into three geographical zones -- the coast, the sierra, and the selva. The majority of the population is concentrated on the coast and in the sierra. Within the three zones is an array of habitat types, and the country can be divided into 11 eco-regions, 16 biogeographical provinces, and 101 life zones and transitions.

Within this habitat diversity is one of the greatest variations in flora and fauna on earth. There are more species of birds -- more than 1,600 -- in Peru than in Brazil, a country considerably larger. Peru is thought to be the third most diverse country in terms of mammals. The jaguar, the yellow-tailed woolly monkey, the vicuna, and the giant river otter are among the more outstanding examples. Yet all have been or are endangered. The inland waters of the country support a wealth of fish species, perhaps as many as 900. The degree of endemism -- species unique to Peru -- is also high.

Nearly 60 percent of Peru is covered with forests, mostly moist tropical forest in the selva region. Although the majority of this portion of the country remains unstudied, inventory work has identified some 2,000 species of vascular plants native to Peru. This represents more than 20 percent of the continent's current floral diversity.

THREATS TO BIOLOGICAL DIVERSITY

The threat to individual rare or endangered species -- and, to a certain extent, natural and agronomic ecosystems -- originates from a highly complex mixture of social, economic, demographic, political, and ethical factors. Different observers present different perspectives, but general agreement can be found on a number of them. The main elements appear to be land-use disequilibria explained by human migration, inadequate and uncoordinated policies, and lack of government strategies and resources.

DESIGNATED PROTECTED AREAS

Peru legislates protection through its National System of Conservation Units, which includes 23 national parks, national reserves, national sanctuaries, and historical sanctuaries covering 5.5 million hectares, 4.3 percent of the national territory. However, government budgets for protection and administration are deficient. These units represent 63 of the country's 101 life zones, which means that more than one-third have no protection unit. Moreover, there is no systematic inventory of the biological resources within these units and no master plan to coordinate their development.

ECONOMIC ASPECTS OF BIOLOGICAL DIVERSITY

The economic importance of "wildlands industries" in Peru is unquestionable but also unquantifiable. Legal exports in 1985 included $5 million for wood products, $2 million for minor forest products, and $7 million for wildlife products. Chief among the last is carmen, a raw material for textile dyes produced by an insect in the sierra. Nature tourism, commercial fishing, and guano collection are other components of Peru's wildlands industries.

Management of wildlands for the conservation of biological diversity has important consequences for both economic efficiency and distributional equity. Four major efficiency questions are:

- The role of wild plants and animals in household consumption and commercialization;
- The locations and levels of investment to maintain germplasm stocks for later development of commercial products;
- Levels of investment and returns on natural-forest management and other enterprises consistent with biological-diversity strategies; and
- Levels of investment and returns on non-consumptive wildlands uses such as nature tourism.

The major distributional question concerns flows of benefits and costs to low-income households, particularly among indigenous peoples.

STRATEGY

AID/Peru works closely with the government of Peru and the country's non-governmental organizations to strengthen natural-resources management, specifically in relation to biological diversity and sustainable development of tropical forests. The strategy calls for describing options, defining priorities, and identifying interventions best suited to AID's policies, resources, and existing portfolio. Five guidelines for defining program directions in biological diversity are:

- Relate interventions for biological diversity to existing AID projects;
- Use the concept of comparative advantage to define and promote Peru's particular strengths for attracting resources and support from a variety of sources;
- Harmonize AID's strategy with other institutional structures in Peru;
- Concentrate on identifying and quantifying, to every extent possible, the economic benefits to be derived from maintaining biological diversity and sustained tropical-forest management; and
- Appeal to Peruvian national pride to protect endangered ecosystems, species, and germplasm that are unique to Peru and that could disappear in the near future without the participation of the local population.

RECOMMENDATIONS FOR PROGRAMS

Recommendations are organized under four program areas and projects defined within each:

- Conservation policy and education;
- Conservation and development;
- Research; and
- Training and institution building.

Program and project elements are presented separately to give AID maximum flexibility in responding to uncertain budget and personnel levels. A few key interventions are possible without large inputs of AID resources. However, should resources permit, AID will be able to combine a number of these elements into a larger, more comprehensive package.

CHAPTER ONE

OBJECTIVES AND SCOPE OF THIS ASSESSMENT

INTRODUCTION

The 1986 amendments to the Foreign Assistance Act, Sections 118 and 119, addressing tropical deforestation and biological diversity, require that each Country Development Strategy Statement -- AID's major strategy document -- provide information on the following:

- The status of host-country efforts to conserve biological diversity and tropical forests;
- Actions that AID missions can take to conserve biological diversity and tropical forests; and
- The extent to which proposed actions meet the needs identified.

Conservation of biological diversity and tropical forests is of considerable importance to the world scientific community, to a growing segment of the public in developing and developed countries, and to indigenous peoples. In addition, such efforts will improve the possibility for economic development, with an emphasis on the sustainable use of these resources. A decrease in biological diversity implies a restriction on development options (Norgaard 1987).

DEFINITION OF BIOLOGICAL DIVERSITY

According to the Office of Technology Assessment (1986), biological diversity refers to the variety and variability among living organisms and among the ecological complexes in which they occur. Diversity is indicated by the number of ecosystems, species, genes, and their relative abundance. The importance of diversity lies in the potential it provides for enhanced adaptability and evolutionary fitness -- in both biological and cultural terms. The concept of biological diversity embraces the following:

- **Ecosystem Diversity:** Diversity at the ecosystem level refers to the number of recognized ecosystems within a given area. Each bioclimatically unique life zone has an assemblage of plant and animal species characteristic of any undisturbed site within that life zone. For example, a landscape interspersed with croplands, pastures, and forests has more diversity than a landscape where most of the forests have been converted to pastures and croplands.

- **Species Diversity:** Within any given natural ecosystem, diversity is measured by the total number of species present and the relative importance -- or dominance -- of species within the system. Species diversity may be profoundly reduced by stress such as volcanic eruption or such human disturbances as agriculture or discharge of pollutants. For example, a humid tropical forest with 200 tree species has much greater diversity than the same forest after marginal agriculture has reduced or eliminated species.

- **Genetic Diversity:** A gene is a functional hereditary unit that occupies a fixed location on a chromosome and transmits particular characteristics from one generation to the next within a species. Genetic diversity is determined by the total pool of genes available, which in turn is closely related to the number of species present. New genes are created by various mutational processes. In applied genetics and biotechnology, genes may be selected from individual wild and domesticated organisms to achieve desired characteristics. For example, an environment that includes both the domestic varieties of a crop such as potatoes as well as its wild ancestors has more diversity than an environment whose wild ancestors have been eliminated.

There are two general approaches to maintaining biological diversity: maintaining it where it is found naturally -- on-site; or removing it from the site and keeping it elsewhere -- off-site. On-site maintenance can focus on a particular species, population, or entire ecosystem; off-site maintenance can focus on organisms preserved as germplasm or on those preserved in living collections. Table 1 lists examples of management systems.

TABLE 1

EXAMPLES OF MANAGEMENT SYSTEMS TO MAINTAIN BIOLOGICAL DIVERSITY

On-site		Off-site	
Ecosystem Maintenance	Species Management	Living Collections	Germplasm Storage
National parks	Agroecosystems	Zoological parks	Seed and pollen banks
Research natural areas	Wildlife refuges	Botanic gardens	Semen, ova, and embryo banks
Marine sanctuaries	In-situ gene banks	Field collections	Microbial-culture collections
Resource development planning	Game parks and reserves	Captive breeding programs	Tissue-culture collections
Increasing human intervention ----------			
---------- Increasing emphasis on natural process			

Source: Office of Technology Assessment 1986.

Although these management systems have different objectives, all four are necessary components of an overall strategy to conserve diversity. Conservation objectives may be enhanced by investing in any combination of the systems, and by improving links to take advantage of their potential congruity.

THE BIOLOGICAL IMPORTANCE OF PERU

Although there is some debate about which neotropical country is biologically the richest in Latin America, there is little doubt that Peru is among the top three along with Colombia and Brazil. However, given that the other two nations have "graduated" from AID's development assistance program, Peru becomes an obvious choice as a model country to demonstrate the agency's commitment to biological diversity and tropical-forestry conservation.

This report will not attempt to go into detail on the extent of species diversity in Peru. Many previous efforts have attempted to demonstrate, describe, and quantify the abundance of biological diversity and tropical forest resources in Peru. Some examples include: AID 1979; Brack 1986 and 1987a; CDC 1985 and 1987; Dourojeanni 1986a; Gentry 1980; DGFF 1987; O'Neill 1980; ONERN 1976 and 1986; Parker 1982; Terborgh 1980; WWF 1987a. It should be emphasized that the majority of the limited research completed has been at the basic inventory level -- leaving a tremendous amount of broader ecological and management issues to be addressed.

PERUVIAN ECOLOGY

Peru, with 1.28 million square kilometers, is the third largest country in South America and the largest in the tropical Andean region. The country is divided into three macro geographic zones, including the coast, sierra and selva, with the majority of the population concentrated on the coast and in the sierra. Within the three zones is an array of habitats. Depending on the level of resolution and methodology employed, the country can be divided into 11 eco-regions (Brack 1987), 16 biogeographical provinces (CDC 1987), and 101 life zones and transitions (ONERN 1976).

Within this habitat diversity is one of the greatest variations in flora and fauna on earth. There are more species of birds -- more than 1,600 --in Peru than in Brazil, a country substantially larger. One example of such diversity is that of Manu National Park, where more than 800 species of birds have been identified. This figure represents one quarter of the recorded bird species of South America (WWF 1987a).

Peru is thought to be the third most diverse country in Latin America in terms of mammals -- the jaguar, the yellow-tailed woolly monkey, the vicuna, and the giant river otter are among the more outstanding examples. Yet all have been or are endangered. The inland waters of the country support a wealth of fish species, perhaps as many as 900. In contrast, Zaire has approximately 500 species and the River Mississippi 250 species. So little entomological work has been done in Peru that one can only guess at its diversity in that area. Some estimates have put the number of beetle species alone at 5 million.

The degree of endemism -- species unique to Peru -- is high. A recent study by Brack (1987a) generated the following numbers of endemics: 50 fish species, 19 crustacean species, 90 bird species, 35 mammalian species, 69 reptile species, and 28 amphibian species. With additional field work, this list would increase substantially.

Nearly 60 percent of Peru is covered with forests, mostly high moist tropical forest in the selva region. Although the majority of this portion of the country remains unstudied, inventory work has identified some 20,000 species of vascular plants native to Peru. This figure represents more than 20 percent of the continent's current floral diversity. There are at least 3,500 species of trees, 95 percent of which have no current commercial market (Dourojeanni 1987b). Studies from the Palcazu Valley show that perhaps as many as 1,500 species can be found in an area 70 km x 25 km (Hartshorn et al 1986). New records for Peru -- as well as possible new species to science -- are continually being found.

SOCIOECONOMIC VALUE OF PERU'S DIVERSITY

Peru has been, and will continue to be, dependent on natural resources for its social and economic development. Potatoes, beans, tobacco, guava, peppers, squash, and perhaps even corn are native to Peru. All have figured prominently in the Peruvian diet for thousands of years. The importance of these species on a global scale cannot be overstated, and Peruvian germplasm continues to be used for plant production research around the world.

Other plant material native to Peru such as chinchona, for making quinine, and curare, used in heart surgery, also have assumed worldwide importance. Many lesser-known plants -- used for medicinal, alimentary, and religious purposes -- are not found in traditional markets, yet are indispensable in the daily lives of rural Peruvians. Although many new plant species of potential economic value are continuously being found, the financial resources invested in such research have been minimal.

In addition to plants, wildlife plays a vital role, in terms of satisfying basic human needs and supplying hard currency for the nation's economy. Brack (1987a)

and Dourojeanni (1986a) have done extensive surveys on the significance of wildlife and its conservation for Peru's social development. Examples include wild pig, deer, and monkeys for food; reptiles and pigs for skins; shore birds for the production of guano; vicuna for fibers; fish and parrots for the pet trade; primates for medical research; several species for sport hunting; and carmen, a dye produced by the insect cochinilla. With appropriate management, wildlife could play an even more important role in the economy.

OBJECTIVES OF THIS ASSESSMENT

The objectives of this assessment are to provide AID/Peru with:

- Sufficient analysis to satisfy the congressional mandate on biological diversity and tropical-forest management; and
- Identification of important programs and projects that could be funded and implemented during the period 1989 to 1994.

More specifically, the assessment reports on the present status of conservation, impact of development activities, protection of endangered species, and relevant institutions, thereby providing the context for understanding the major issues to be addressed. From these issues, a strategy is proposed for various programs containing specific projects.

ASSESSMENT METHODOLOGY

Much has been written about rapid rural appraisal -- in Peru and elsewhere-- as a means of collecting information reliably and quickly for program and project design. The approach followed by this team can best be defined as rapid urban appraisal of key institutions, individuals, and reports. As a result of financial constraints, the team was in country for a very short period of time -- an average of less than two weeks each. Because a final report had to be left in Peru, no time was available for trips outside Lima. Therefore, this is very much a desk-top study that relies exclusively on analysis of earlier reports, structured interviews with key institutions and individuals, informal interviews, and intensive debate among team members.

CHAPTER TWO
THE PRESENT STATUS OF CONSERVATION

THREATS TO BIOLOGICAL DIVERSITY

The threat to individual rare or endangered species -- and to certain natural and agronomic ecosystems -- originates from a complex mixture of social, economic, demographic, political, and ethical factors. Different observers present different perspectives, but general agreement can be found on a number of them. . The main elements seem to be land-use disequilibria explained by human migration, inadequate and uncoordinated policies, and lack of government resources and strategies.

Peruvians often consider themselves an agricultural nation, when in fact only a small proportion of their territory is suitable for agriculture. Grazing intensity in Peru is one of the lowest in Latin America -- about one head per three hectares. Grazing occupies 24 million hectares, whereas land-capability classifications indicate a maximum of 18 million hectares. Crop yields are only one-tenth to one-half of what they could be with better management and infrastructure. About 90 percent of agricultural investment is on the coast, mainly for irrigation, with the remaining small residual for the sierra and selva (Dourojeanni 1987b).

These factors help explain the migration out of the Andean highlands to other parts of the country. Beginning in the 1960s, military and civilian governments have been promoting the eastern Andean slopes and Amazon Basin as a politically painless approach to mitigating land hunger in the Sierra, reducing migration to the coastal cities, and occupying national territory in remote regions. Yet only a small proportion of the land is capable of sustained agriculture -- 5-6 percent, according to current estimates. Annual forest cutting for colonization and marginal agriculture cannot be estimated accurately, but is probably about 250,000-300,000 thousand hectares (Dourojeanni 1987a and 1987b; WWF 1987). Roughly 60 percent of the forest removal is carried out on the eastern Andean slopes, a region susceptible to soil and water erosion (DGFF 1987a).

Because about 95 percent of Peru's forests are in the selva, most of the wood-products industries are concentrated there, primarily near Iquitos and Pucallpa. Technical standards are low, with logging extraction rates typically six to eight cubic meters or less per hectare. Capacity utilization in sawmills and plywood plants is only 40-45 percent. Peru exported forest products valued at $5 million in 1985, but also imported forest products valued at $2 million (DGFF 1987).

The precise relation between the forest-products industries and biological diversity is not clear, but the general weakness of the sector does not favor conservation consciousness. Within the Ministry of Agriculture, the forest-products industry is overshadowed by that of agriculture, with forestry receiving less than 5 percent of the budget.

Three other critical forest types under land-use pressure are the *Podocarpus* forests of the northern sierra, plus the mangroves and dry forests of the north coast. It is estimated that 20,000 hectares of dry forest on the north coast is lost to desertification each year. Moreover, the entire sierra has only 6,000 hectares of natural forest remaining, with the rest of the sierra woodlands consisting mainly of planted eucalyptus for fuel, posts, and windbreaks. Of the 200,000 hectares of eucalyptus, only about one-half is considered productive (DGFF 1987a); hence the plantation base is too small to relieve cutting pressure on the natural forests.

Other environmental problems include the connection between loss of forest cover and resulting landslides and floods. Between 1925 and 1982, 46,000 persons died in these catastrophes. Erosion is considered medium or serious over 21 percent of the sierra, yet watershed management hardly exists. Additional concerns are loss of lands to wind erosion on the north coast, urban expansion onto highly productive soils around Lima, salinization in the irrigated areas of the coast, heavy use of pesticides on the coast, and water pollution of several rivers. In light of these and other factors, Dourojeanni (1987b) believes that more land is being lost to production than is being gained, especially when accounting for land productivity. None of these concerns is favorable for the protection of ecosystems and biological diversity.

A final set of problems concerns biodiversity of marine resources. Peru regards coastal waters within a 200-mile limit as national territory, a zone that includes a rich variety of marine life. Some 66 islands were once inhabited by sea birds, but

bird populations have fallen substantially with the decline in anchovy population. Such declines are related to El Nino (in 1982-83) and to overfishing. Many other species have been seriously affected, and economic losses have been pronounced for both the fishing and guano industries (ONERN 1986).

DESIGNATED PROTECTED AREAS

Peru legislates protection through its National System of Conservation Units (SINUC), which cover 4.3 percent of the national territory -- 5.5 million hectares -- in 23 different units. The four types of units in SINUC are national parks, national reserves, national sanctuaries, and historical sanctuaries (Table 2). The purposes of each are described elsewhere (Ponce 1983). Six national forests cover an additional 4.6 percent of the country (Table 3); hence, 8.9 percent of the country is nominally given some form of natural-resource or conservation management.

TABLE 2

NATIONAL PARKS, RESERVES, AND SANCTUARIES IN PERU

	Legal Status	Name	Area (Ha.)	Biogeographical Province
1.	NP	Cerros de Amotape	91,300	Equatorial dry forest
2.	NP	Huascaran	340,000	Puna
3.	NP	Cutervo	2,500	Cloud forest
4.	NP	Tingo Maria	18,000	Cloud forest
5.	NP	Manu	1,532, 806	Amazon/cloud forest/puna
6.	NP	Rio Abiseo	274,520	Cloud forest/puna
7.	NP	Yanachaga-Chemillen	122,000	Cloud forest
8.	NR	Lachay	5,070	Coastal desert
9.	NR	Paracas	335,000	Coastal desert
10.	NR	Pampa Galeras	6,500	Puna
11.	NR	Junin	53,000	Puna
12.	NR	Titicaca	36,180	Puna/lake
13.	NR	Salinas y Aguada	366,936	Puna W. Andes slopes
14.	NR	Pacaya-Samiria	2,080,000	Amazon
15.	NR	Calipuy	64,000	Puna/W. Andes slopes
16.	NS	Huayllay	6,815	Puna
17.	NS	Calipuy	4,500	Puna
18.	NS	Pampas del Heath	102,109	Amazon (chaco)
19.	NS	Lagunas de Mejia	391	Coastal desert
20.	NS	De Ampay	3,635	Puna
21.	HS	Pampas de Ayacucho	300	Puna
22.	HS	Chacamarca	2,500	Puna
23.	HS	Machu Picchu	32,592	Cloud forest
		Total:	5,480,654	

Sources: CDC 1987; DGFF 1987a; Ponce 1983.

TABLE 3

NATIONAL FORESTS OF PERU

1.	Alexander von Humboldt	645.000	ha.
2.	Apurimac	2,071,700	
3.	Biabo-Cordillera Azul	2,084,500	
4.	Manu	300,200	
5.	Mariscal Caceres	337,000	
6.	Pastaza-Morona-Marallon	75,102	
	Total:	5,513,502	ha.

Source: Direccion General Forestal y de Fauna.

However, government budgets for protection and administration are deficient. Referring to the SINUC, Ponce (1983) reported that four units have at least sporadic managerial attention, seven suffer severe management limitations, and seven receive no attention. Loayza (1987) reports that Machu Picchu is under intensive management but nevertheless experiences overutilization. Of the national parks, only Huascaran, Rio Abiseo, and Manu are given some form of protection. The same applies for Lachay, Paracas, Pampas Galeras, and Pacaya-Samiria among the national reserves, with Junin and Titicaca possessing limited protection.

These are, of course, subjective judgments. The diagnostic for the Tropical Forestry Action Plan (DGFF 1987a) reports 153 park guards for 5.2 million hectares, or one guard per 34,000 hectares. This index is only one among many that might be constructed to indicate the severe deficiency of administrative and managerial inputs.

The units in SINUC represent 63 of Peru's 101 life zones and transitions. More than one-third of the life zones have no protection unit. Furthermore, there is no systematic inventory of the biological resources within the units of SINUC, and no master plan to coordinate their development. The number of dendrologists in Peru may not exceed a dozen; foresters and other natural-resource managers are reported to have inadequate training in forest botany.

The problems of protection extend across the country, making the setting of conservation priorities a difficult task. Obviously, the selva merits special consideration because of the massive disruptions there. Four additional regions are identified by the Conservation Data Center (1986) as requiring immediate attention:

- **Dry equatorial forest:** This region suffers from overgrazing and intensive firewood extraction. Protection consists of one national park, one national forest, and one hunting reserve. Only the last is considered to have effective management.

- **Pacific coastal desert:** This region comprises 7.8 percent of Peru but is represented by only a single national reserve. Although it is not as rich in species as other regions, the coastal desert does contain isolated plant and animal communities with a high degree of endemism.

- **Puna:** More than 20 percent of Peru consists of puna, a region of high population density and intensive human activity. A total of 3.4 percent of the puna is included within SINUC, but most units have little or no management capability.

- **Western Andean slopes:** Covering almost 7 percent of Peru, this area is not well represented by parks and reserves. The region suffers from overgrazing, poor land-use practices, and extensive hillside erosion.

ECONOMIC ASPECTS OF BIODIVERSITY

The economic importance of "wildlands industries" in Peru is unquestionable but also unquantifiable. Legal exports in 1985 included $5 million for wood products, $2 million for minor forest products, and $7 million for wildlife products (DGFF 1987a). Chief among the last is carmen, a raw material for textile dyes produced by an insect in the arid and semi-arid Sierra. Nature tourism, commercial fishing, and guano collection are other market components of Peru's wildlands industries.

Presumably, most wood products and minor forest products are not exported but consumed domestically -- for firewood, posts and poles, medicines, food plants, and fibers. Likewise, the legal export of wildlife products is a small fraction of production when illegal trade and direct household consumption of wild fish and game are also considered.

Other benefits could be identified, such as the favorable effects on water and soil relationships of leaving forested areas under natural vegetative cover. Yet another use for natural areas is as a setting for environmental education. In sum, various wildlands goods and services are tangible and others are intangible; some are marketed and others are directly consumed by the producer; some provide foreign exchange and others do not.

Management of wildlands for the conservation of biological diversity has important consequences for both economic efficiency and distributional equity. Four major efficiency questions are:

- The role of wild plants and animals in household consumption and commercialization;
- The locations and levels of investment to maintain germplasm stocks for later development of commercial products;
- Levels of investments and returns in natural-forest management and other enterprises consistent with biodiversity strategies; and
- Levels of investments and returns in non-consumptive wildlands uses such as nature tourism.

The major distributional question concerns flows of benefits and costs to low-income households, particularly among indigenous peoples.

Consumption and Sale of Wild Plants and Animals

Consumption and sale of wild plants and animals are of major economic importance in Peru, particularly for rural families living in and adjacent to forest areas. Most of the production does not pass through formal markets. Consequently, estimates of economic magnitudes are easily understated. Nevertheless, a handful of studies suggest substantial flows of benefits.

Padoch et al. (1985) reports incomes derived from a market-oriented agroforestry culture practiced by settlers in Tamshiyacu, near Iquitos. Principal sources of income derive from a broad mix of both cultivated and wild plant and animal products. Average annual household income is about $1,200, well above the regional average; income in a few households approaches $5,000. Tamshiyacu households practicing agroforestry generally have higher incomes than nearby farmers engaged in commercial rice production. Despite a few unresolved questions about production costs, the authors conclude, "Amazonian cyclic agroforestry systems are obviously capable of being commercially successful enterprises, in addition to serving as sources of local household needs" (p. 57).

In contrast with the commercial orientation in the Padoch study at Tamshiyacu, Salick (n.d.) examines the subsistence consumption of indigenous plants by the Amuesha in the Palcazu Valley, a setting of extremely high biological diversity. The ethnobotanical investigation found that the Amuesha consume a tremendous variety of natural plants for foods, medicines, fibers, dyes, magic plants, and firewood. Particular importance is attached to the cassava plant, which holds a central position in Amuesha religion but whose genetic diversity is rapidly being reduced.

Dourojeanni (1986b) discusses the uses of wild fauna for human food and for exports of hides, skins, and live animals. This work refers to all of Amazonia, but many statistics are given for the Peruvian selva. Various studies cited by Dourojeanni demonstrate that hunting and fishing are the main sources of protein in Amazonia. Wild fish and game provide 85 percent of the meat consumed, despite the availability of cows, pigs, and domestic fowl. In 1976, Peruvian meat consumption from wild animals was estimated to be 13,000 metric tons. If this official figure underestimated the actual total by half, the commercial equivalent value of wild meat would have equaled that of commercial logging (Myers 1986).

Despite recent protection measures and the existence of CITES (the Convention on the International Trade of Endangered Species), the production and sale of skins, hides, and live animals from wild fauna continue to be substantial. There is legal export of products not restricted by CITES, plus illegal export of restricted and non-restricted products.

Statistics from more than 20 years ago show Peru's registered export of Amazonian skins and hides exceeding 300,000 a year, with this figure probably accounting for less than 60 percent of actual production and export. At approximately the same time, the legal export of live animals through Iquitos averaged 250,000 specimens annually. These numbers have diminished in recent years, although prices -- especially for contraband products -- probably have risen.

The capture and export of live animals have embraced no fewer than 150 Amazonian species. About 90 percent of figure corresponds to ornamental birds-- especially parrots and parakeets -- and primates for pets or biomedical research. According to a study conducted several years ago, the world demand for neotropical primates for this latter use will reach 29,000 animals by the year 2000 (PAHO 1976).

Yet more than half of the 44 species of mammals in the humid tropics of South America with threatened, vulnerable, rare, or indeterminate populations are primates of three genera. Each primate species is used for particular purposes (Dourojeanni 1986), suggesting that various kinds of inter-species substitutions may not be technically or economically feasible.

Investments in Germplasm Banks

One of the central economic arguments for on-site preservation of natural ecosystems is to retain options for later commercial use of currently unexplored plant and animal products and germplasm. A partial list of Peru's historical contribution of wild biota for domestication and widespread diffusion includes potatoes, tomatoes, beans, tobacco, guava, peppers, squash, cinchona, coca, carmen, and vicuna (WWF 1987a).

Exploration of new and currently wild species, races, and varieties requires research and time. A statistical or pseudo-statistical distribution gives the probabilities that one or more species will have commercialization possibilities at specified points in the future. A market quantity and price must be assumed, and a discount rate chosen, to estimate value of the germplasm reserves net of expected research investments. The procedure is crude and estimates are not reliable, but something like this approach perhaps should guide the thinking about medicines--for example, anti-cancer drugs and plant products for contraceptives. Myers (1986) cites a number of studies on promising plants.

Peru undoubtedly possesses numerous non-commercial species that could, with research and development, have important market value and income potential. Scientists and social scientists enumerate dozens, if not hundreds, of unstudied wild plants and animals that might attain greater economic importance for either local consumption or market sale. Amerindians in western Amazonia use no fewer than 1,300 plants as drugs and narcotics, many of which have properties relevant for modern medicine (Plotkin 1982; Schultes 1980).

Salick (n.d) focuses on how the Amuesha in Palcazu use the genetic diversity in wild cocona -- peach tomato -- as a basis for selecting plants for domestication. Myers (1986) reviews a large number of studies on fruits and beverages, edible oils,

and animal products of the western Amazon derived from previously unknown flora and fauna. Dourojeanni (1986a and 1986b) and Terborgh et al. (1986) enumerate wild fauna with domestication possibilities. Simeone (1987) has noted the presence of a potentially important commercial timber species in Palcazu that has yet to be identified.

Investments and Returns in Natural Forest Management

Management for biological diversity implies integral management of whole ecosystems. A variety of techniques and philosophies come into play in projects on forest farming, natural-forest management, and domestication of wild animals. The techniques are often experimental, and yields and market prices uncertain. Moreover, there can be substantial externalities, multiple-use complexities, divergences between market prices and shadow prices, and questions about the appropriate rate of interest (Leslie 1987), all which make financial and economic analysis difficult.

Because of these difficulties, the costs and returns of enterprises consistent with the biodiversity approach will require a second look, especially when conceptual models and empirical estimates have been developed by non-economists, a situation that characterizes much of the work to date. The Central Selva Resource Management Project forecasts attractive financial returns that invite a careful audit of model, data, and assumptions.

The same reservation extends to figures quoted in Myers (1986) on enterprises for raising monkeys -- $24,250 per year on two to three hectares -- and for integrated game cropping -- $20,000 per square kilometer. Details worthy of study concern the elasticity of product demand, assumptions about competing producers, assumptions about commercial yields differing from experimental yields, cost comprehensiveness, and possibilities of rising factor prices.

Non-Consumptive Wildlands Uses: Nature Tourism

Strategies to maintain biological diversity through parks, reserves, and other protected areas bring foreign exchange to Peru through a number of channels. Perhaps the most important is the attraction of foreign visitors for science, bird watching, adventure, and other forms of tourism. Saito (1987) studied the impact of

Huascaran National Park on the employment and income of a nearby community, finding that the park provided the primary source of economic activity. Munn (1987) reports a number of statistics for nature tourism in the region of Madre de Dios, estimating that nature tourism there already provides 10,000 visitors and $1.2 million annually. Munn believes that by increasing investments in infrastructure and lodges, this figure could rise to $15-30 million within 15 years.

Nature tourism generates a number of questions from the standpoint of economic development. First is the matter of economic "leakages" to sources outside of Peru. Within Peru, it must be established that employment and direct benefits flow to low-income families, especially those residing close to the protected areas. Additional issues include cost-effective marketing strategies, promotional campaigns, seasonal fluctuations in demand, training of guides, data collection models and methods, and optimal entrance fees. Apparently, few of these matters are adequately addressed in Peru at present.

Distribution of Benefits and Costs

The preceding sections illustrate that the key questions of wildlands valuation and allocative efficiency are difficult to resolve analytically, especially with regard to a country as large as Peru. The issue of benefits for low-income households is similarly complicated. Here, only a broad hypothesis can be advanced from general principles.

First, it should be possible to choose biodiversity interventions in which low-income people are clearly the primary beneficiaries. The maintenance of traditional cultures has a strong synergism with the maintenance of genetic diversity, based on our inadequate but increasing understanding of traditional agroecosystems (Norgaard 1987). An example in Peru is Salick's ethnobotanical work, suggesting how the maintenance of genetic diversity in plants such as cassava and peach tomato directly benefits the Amuesha of Palcazu. Conversely, interventions to improve the socioeconomic status of the Amuesha simultaneously help maintain diversity in cassava and peach tomato, plants of central importance in Amuesha culture. Viewed in this light, timber harvesting and attention to "minor" forest plants are complementary, not competing, activities.

Similarly, benefits from interventions that maintain or improve the mix and stocking of species for non-sport hunting, fishing, and plant collection probably flow primarily to indigenous groups and other low-income forest dwellers. The Central Selva Resources Management Project is intended to maintain forest species diversity -- by simulating natural-forest gaps for regeneration -- while putting harvesting income into the hands of the Amuesha. The maintenance of large natural areas, to the extent that access by the local population is not restricted, is also generally thought to be advantageous for indigenous welfare (World Bank 1982).

On the other hand, the beneficiaries of on-site preservation and "lock-out" strategies are not as easily identified. In the long run, the discovery of biological materials for new pharmaceutical, the development of new foods and timber species, and similar activities distribute benefits widely. In the short run, however, economic displacement falls most heavily on local people who have been using the newly reserved areas. A problem here is scale of exploitation. The indigenous population may be an integral part of the environment and have little impact on it, or they may be driven by reductions in their habitat or the demands of a market economy to increase the intensity or scale of their exploitation of the area. Moreover, it may be difficult to find an economic role for indigenous people in non-consumptive activities -- such as nature tourism -- that does not compromise their cultural autonomy (World Bank 1982). Hence, the economic aspects of indigenous welfare as related to biodiversity are also tightly bound with sociological and anthropological issues.

CHAPTER THREE
IMPACT OF DEVELOPMENT ACTIVITIES

INTRODUCTION

Development activities in the selva alta and the selva baja encompass highway construction, the extraction of timber, some petroleum exploration, and planned and spontaneous colonization. Because development of the selva areas of Peru was a priority of the previous government, this chapter will concentrate on the various development projects planned and implemented -- with emphasis on the Central Selva Resource Management Project. Finally, the factors responsible for the presence of -- or lack of -- sustainable development of Peru's tropical resources will be examined.

Special Projects in the High Selva

These eight projects, designed, implemented, and financed mostly in the early 1980s, have the following objectives (APODESA 1984):

- The steady increase in production and productivity through rational exploitation of natural resources and advancement of the agricultural frontier;
- The planned occupation of territory and regional link-ups by means of the Carretera Marginal;
- The improvement in the standard of living of the local population; and
- The conservation of natural resources and the maintenance of ecological balance.

The affected area totals 7.6 million hectares, with an estimated population of 1 million. Overall investment is planned to be in the area of $400 million, of which 56 percent already has been disbursed (INADE 1987). These projects are financed by various donors including the World Bank, BID, AID, and the governments of Spain, Switzerland, and Canada. The basic strategy followed has been integrated rural development, with a heavy emphasis on infrastructure. At the end of 1986, financial resources had been distributed as follows (INADE 1987):

- 57 percent for the development of economic infrastructure -- principally the construction, maintenance, and improvement of roads;
- 33 percent for the development of agricultural production;
- 6 percent for the development of social infrastructure; and
- 4 percent for land titling and the environment.

To develop the high selva, penetration roads must be constructed. With their construction -- or even before -- colonists will start arriving and will advance outward from the road. There is little information readily available about the benefits of these projects, their impact on the environment and on biological diversity, and their impact on the local population -- both indigenous and settler.

This is not the case for the Upper Huallaga special project, financed by AID. A 1985 environmental impact study indicated that deforestation -- accelerated by the opening of the Carretera Marginal -- continues unabated with the increasing cultivation of coca, which is grown on steep slopes that have been stripped of forest cover (Penaherrera 1985). Recent estimates indicate that coca cultivation in the area has increased 10-fold over the past five years. According to the local population, the primary health problem is pesticide poisoning -- followed closely by gunshot wounds.

For the special projects as a whole, a careful reading of the documents and interviews with key individuals indicate that:

- In many cases, the construction of roads into the selva stimulates an influx of settlers -- the majority of whom farm on the least appropriate lands for agriculture -- on the steep, eastern slopes of the Andes where rainfall is high;
- Many settlers have to learn new farming techniques because their Andean practices are inappropriate in their new environment;
- Nothing has been done to control or limit the deforestation that accompanies road construction in the selva. There is currently neither legislation nor regulations prohibiting such actions;
- Little attention has been paid to the issue of sustainability. When external assistance ends, the assumption is that the respective government ministry will continue to support it. This has not always happened;

- Most of the projects are behind schedule -- for both administrative and financial reasons; and

- Little mention is made of the role of the indigenous population. In the case of the Alto Mayo project, settlers invaded communal lands in spite of the fact that the Amerindians had legal title to the land (CRC 1987).

The Central Selva Resource Management Project

This AID-financed project was designed as another typical development activity for the high selva -- emphasizing road building, agricultural production, and the opening up of new lands. Subsequent field investigations revealed not only that the area is already populated, but also that it is unsuitable for intensive agricultural use. Heavy rainfall, acidic and mostly infertile soils, and rolling to steep terrain limit productive activities to forestry. Some agriculture is possible along the alluvial plain, and grazing can be practiced in adjacent foothills. As a result, the project was redesigned to emphasize sustained production consistent with land capability through appropriate land use. It still emphasizes production, but with environmentally sound methods (Brown 1986).

Of particular interest are the forestry, agriculture and livestock, and conservation components of this project. The forestry component consists of the following two integrated activities:

- The testing, adaptation, and management of a new system of forestry management -- natural gap regeneration -- which consists of a 30- to 40-year rotation system of strip clearcutting, using all harvested material between 2 and 12 inches as poles or posts, and sawing all material 12 inches and above into lumber; and

- The establishment of a producer cooperative by the Amuesha, the local indigenous group, to control and perform the extraction from Amuesha forests, move the logs to the processing center, and process and market the output.

Research has shown that the clearcut strips have rapidly regenerated and produced an exceptionally complex species mixture. These strips simulate "natural gaps" in the forest, permitting an abundance of natural regeneration of forest species from the seed source in the undisturbed forest on the border of each strip.

In 1986 the Yanesha Forestry Cooperative was established, with an initial membership of 80 individuals. Members were made up of Amuesha and Campa Amerindians from the associated communities, who joined by paying a small fee. To join, the native communities had to designate a percentage of their forest holdings for natural-forest management. The long-term goal of the cooperative is to create local capability to undertake the management of the forest and the processing and marketing of the timber at a profit so that the enterprise becomes financially sustainable (WWF 1987). Indications are that this may be the first indigenous forestry cooperative in Latin America.

With the agriculture and livestock component, the principal objective is to stabilize the existing crop and livestock systems to meet local demand under sustained-use criteria. Several ecologically sound ways have been found to increase diversity and improve productivity. Among the more promising are the following (Brown 1986):

- Shortening the traditional bush fallow systems;
- Successful introduction and evaluation of system components -- such as forage, animal species, and tree crops -- which are adapted to the high rainfall and acid soils; and
- Incorporation of these species in fallow rotations and pasture improvement to protect the soil and to speed recovery.

The final component for this assessment is preservation, the objective of which is to protect those lands in the Palcazu watershed that cannot sustain long-term agricultural or forestry use. This activity is supported by a grant from AID/Washington's Biological Diversity Fund, with a matching grant from the Nature Conservancy International. This fund was established in 1986 to finance biological diversity activities.

Land-use capability classification determined that most of the Yanachaga and the San Matias mountain ranges were too steep for use and should be designated as protection forest. These two mountain formations are essential to the integrity of the entire watershed. Forest cutting or other disturbances of these steep slopes along the bounding ridges of the valley will quickly lead to erosion and landslides.

This in turn causes siltation in the rivers of the valley floor and consequent flooding of the only lands in the valley suitable for agriculture (Clark 1987).

In addition, the Yanachaga range includes extensive areas of essentially virgin ecotypes characterized by exceptional species diversity. Hence, its designation as a national park was sought and obtained. The San Matias range is no less important as a protection forest, but less qualified for park status. According to plans, indigenous community and other Palcazu valley residents will be employed in park management, conservation, park border protection, and related activities. An ecological research station will be established to enhance understanding of the unique biological diversity of this area.

This project is viewed by many as being at the cutting edge of sustainable development in the humid tropics. It is supporting research and undertaking development activities that integrate biological diversity, tropical-forest management, conservation, low-input livestock and agricultural development, and integration of the indigenous population. Still, the project is not without its problems, among the more serious of which are the following:

- **Natural gap regeneration:** Critics claim that there is little, if any, direct scientific evidence for implementation of this system as a sustained yield system under the conditions prevailing in the Central Selva (Bauer 1987). It will take upwards of 30 years to substantiate this claim. However, these critics have generally been unable to suggest viable alternatives.

- **Economic sustainability:** A market survey has found a demand for sawn lumber, charcoal, posts treated with preservative, poles, and railroad ties. But the volume and net return projections are for primary forest stands, which will be harvested during the first cutting cycle. No one knows if the second, or subsequent, rotations will attain the volume and value of the first. If the volume and quality of the products decrease, so will the value and net gain (Bauer 1987).

- **Low-input agriculture:** Agricultural improvements should be oriented to improving the level of subsistence, with sustainable harvests, without introducing permanent degradation of the limited suitable soils. Several years of controlled trials and economic analyses of new agricultural systems should be conducted before their rational introduction (Clark 1987).

- **Role of the settlers:** To date, the forestry component has concentrated on the Ameusha and their cooperative. It is naive to think that the settler population, both settled and more recent, will continue indefinitely to watch resources being allocated to an ethnic minority.

- **Beyond AID:** AID will not support the project indefinitely. Once this assistance finishes, who will replace AID: regional authorities, another donor, the international PVO community, or no one?

CAUSAL FACTORS IN TROPICAL DEFORESTATION

Structural Factors

It is common to blame the victim -- in this case, the recent settler -- for deforestation when the real causes are much deeper and structural in nature. There is a growing consensus that poverty, skewed distribution of land, low agricultural productivity, and lack of viable economic alternatives are the principal factors -- in both planned and spontaneous settlement (Caufield 1984; WRI 1985). Research on the colonization of the high selva in southern Peru supports this structural analysis. The Tambopata Valley has been the site of coffee cultivation by seasonal migrants from the sierra since the 1940s. Extremely steep slopes -- rarely less than 40-percent gradient -- make the region susceptible to erosion. Environmental degradation in the more accessible upper parts of the valley is already severe (Martinez 1973).

Farmers producing coffee in the valley face a variety of production and marketing constraints, including a lack of access to credit and to inputs such as fertilizers and pesticides. Other problems include poor transport, insecure titles, and a government-backed monopsony on the purchase of coffee. As a result of these constraints, the majority of coffee producers retain subsistence plots in the sierra to make ends meet and to provide security against crop loss, price drops, or loss of title (Collins 1986).

Political Commitment

Another important factor in Peru has been the changing political commitments of the government. Under the previous administration, development of the high selva was a top priority. President Belaunde subscribed to the last frontier/safety valve perception of the Amazon -- as a vast, underexploited resource that could help solve the country's development problems. This myth of the untapped Amazonian emptiness persisted in spite of evidence and arguments to the contrary (Guerrero 1983). Such a strategy also helped divert attention from more pressing problems.

From this belief followed the development paradigm pursued in most of the special projects: high-input agriculture with an emphasis on short-term gains. Such an approach is difficult to sustain over the long run because of the high financial and environmental costs. In addition, it is questionable just how much of this land is suitable for agriculture rather than for forestry. Where development has been more spontaneous, with settlers preceding or arriving with the road, methods brought from the highlands often have been inappropriate to the high selva environment.

Competing Paradigms

In Peru, there are competing development paradigms, pertaining not only to the Central Selva project, several of whose more innovative elements are as yet unproven, but also to the accumulating body of knowledge about local farming systems in the selva. Salick (n.d.) studied Amuesha agriculture in the Palcazu Valley and found it to be characterized by a diversity of cropping systems. Their land classification system incorporates soil type and fertility, natural vegetation, and cropping potential, and basically agrees with ecological plant community description (Foster 1981). Rhoades and Bidegaray (1987) studied the farming systems and strategies of the settler population in Yurimaguas, who practice a semi-permanent form of slash-and-burn shifting cultivation. Like the Amuesha, they have a rich local knowledge about the soils and plants in their environment. This growing body of knowledge offers promising alternatives to the conventional paradigms for high selva development.

Sustainability and Institutional Capability

The special projects are so designated because they function as semi-autonomous entities outside the regular line ministries that would normally be responsible for their management and implementation. Such a strategy has short-term advantages, but it bypasses the existing institutional structure and contributes little to either strengthening institutional capability or fostering sustainability. When the external support ends, so does the project; the capability built up over the years is dissipated, as has happened Peru. It may be argued that it is just as well, given the negative environmental impact that some of these projects have demonstrated. But what of

the more promising projects? Among these are the Central Selva and the Plan de Manejo Ambiental, which is soon to be implemented in the Alto Mayo, with assistance from the FAO and the Dutch government. With an emphasis on environmental education, its objective is to increase awareness on the part of project technicians and the local population.

In Chapter Six, details are provided on a proposed reorganization of the Ministry of Agriculture, with its emphasis on decentralization. Special projects also will be affected, falling under the responsibility of departmental jurisdictions. One of the arguments advanced for decentralization is that activities to be planned and implemented should involve much more local involvement -- both public and private -- and should respond to local priorities. This argument is a two-edged sword that could, if provided with the necessary support, strengthen conservation activities. On the other hand, it could mean the downplaying of such activities unless there is involvement and support from Lima.

The two institutions that have been most involved in overseeing development of the high selva, INADE (Instituto Nacional de Desarrollo) and APODESA (Assistencia a la Politica de la Selva Alta), are in a state of flux. INADE is responsible for all special projects, but because it is closely identified with the previous administration, its institutional future is uncertain. The same holds true for APODESA, which was created as a government institution responsible for planning and resource use in the high selva. Its role has changed over time to one of providing support services to the special projects (Shreiner 1986).

At present, APODESA's principal activities center on information collection and analysis -- particularly the use of GIS data supplied by ONERN and the preparation of thematic overlays for the Alto Mayo and Central Selva special projects. There is little indication that any institution is using this information for decision making or any other purpose. Indications are that INP (Instituto Nacional de Planificacion) will play an increasing role in natural-resource policy making, particularly as it refers to conservation and tropical forests.

CHAPTER FOUR
ENDANGERED PLANT AND ANIMAL SPECIES IN PERU

INTRODUCTION

This chapter will describe the status of endangered plant and animal species in Peru; address the major reasons for the loss of vertebrate species; describe the economic problems that have prevented major attempts to slow the loss of biological diversity in general; and, finally, identify and evaluate endangered plant species and habitats.

ENDANGERED ANIMALS

The richness and variety of ecosystems in Peru are reflected in the diversity of its fauna. The native Peruvian fauna is characterized by high levels of endemism--species restricted to a unique geographical area -- as demonstrated by the 90 bird and 69 reptile species found only in Peru (Brack 1987a). This diversity is a result of the exceptional variation in habitats and refugia in the coast, sierra, and selva. The estimated number of species of birds, mammals, reptiles, and amphibians in Peru is 2,539 (CDC 1987), indicating a high degree of biodiversity relative to other regions of the world. Yet this count is an underestimate in that it does not include such major groups as the fresh-water fishes, which alone include at least 730 species (Ortega and Vari 1986). In addition, it contains only the vertebrates, which are a minor component of the total fauna in comparison with the incredible invertebrate diversity. Many invertebrates, such as the Tumbes black mussel, are economically important.

The Peruvian vertebrate count is inadequate, but it already includes at least 241 species that are rare, threatened, or in danger of extinction (WWF 1987). In the Americas, this number is surpassed only by Colombia and Brazil. This list for Peru is heavily biased toward large, spectacular animals such as the spectacled bear, the vicuna, the Andean flamingo, and the Peruvian cock-of-the-rock. Thus, it does not reflect many less showy but ecologically important species such as bats, which often make up one-fourth to one-half of the mammalian species of tropical rain forests (Wilson 1983). The basic lack of information necessary to compile accurate inventory

of extant and threatened species attests to the magnitude of the problems surrounding the maintenance of biological diversity of the fauna of Peru.

MAJOR ISSUES SURROUNDING THE MAINTENANCE OF FAUNAL DIVERSITY

The two major causes of species extinction and rapid declines in animal populations are hunting and habitat destruction. Hunting of wild animals for food or commercial purposes has been cited as the primary cause of endangerment for species such as the vicuna (*Vicugna vicugna*), marine turtles (*Eretmocheles imbricata*, *Dermocheles coriacea*, *Caretta caretta*, *Chelonia mydas*, and *Lepidocheles olivacia*), river turtles (*Podocnemeis expansa and P. unifilis*), the Junin frog (*Batrachophrynus brachydactylous* and *B. macrostomos*), and the paiche (*Arapaima gigas*).

Some species, such as the spectacled bear (*Tremarctos ornatus*), suffer primarily because they are considered good hunting trophies. Many others have experienced alarming population declines recently because they are perceived to be pests or competitors for human food sources. In this category are the South American sea lion (*Otaria flavescens*) and the Andean condor (*Vultur gryphus*).

Habitat destruction, primarily a result of increased turnover of wildlands for agriculture or timber harvesting, is perhaps the most critical cause of species loss. Habitat destruction includes elimination of the species' food supply, as well as the introduction of exotics that out-compete endemic, locally adapted species. Deforestation has severely reduced populations of the yellow-tailed woolly monkey (*Lagothrix flavicauda*) and the Tumbes crocodile (*Crocodilus acutus*), both of which now are known only in very circumscribed areas of the Eastern Amazon region and the mangroves of Northwest Peru.

The Humboldt penguin (*Spheniscus humboldti*) is also threatened because of the extensive guano harvesting on the islands where these birds breed (AID 1979). Economically important endemic fish species of the genus *Orestias*, which inhabit lakes in the high Andes, are endangered by the introduction of trout species that threaten to out-compete them. Still other species, such as the Harpy eagle (*Harpi harpyja*) and the Andean condor, suffer indirectly from habitat destruction and resulting decreases in their major prey.

Many threatened species inhabit areas that are now protected. Yet inadequate enforcement of hunting laws and increasing human encroachment and disturbance in reserve areas continue to be major problems. The areas in Peru that are the least protected but that harbor a great diversity of ecosystems and species are the Parque Nacional Cerros de Amotape, Reserva Nacional Pacaya-Samiria, Parque Nacional Titicaca, Reserva Nacional Junin, and Parque Nacional Yanachaga (Brack 1987b).

Despite the establishment of conservation units that represent many of the ecosystems in Peru, many more are needed to preserve those species with broad ranges or that are highly adapted to particular habitats. Conservation units also are necessary to increase the representation of unique life zones in Peru. Areas that contain high levels of faunal endemism, and are not currently protected but deserve attention, are the following (Brack 1987a):

- Northwestern coastal mangroves;
- Pacific tropical forest;
- Inuria wetlands;
- Zarate coastal cloud forest (lomas);
- Marine fisheries;
- The transition zone between tropical marine habitat and the Humboldt Current;
- Peninsular Ilescas;
- The paramo in the altiplano, wetter than puna and extending from northern Peru into Venezuela; and
- The area in Lobos de Tuma.

The three major issues that must be addressed to increase protection of endangered species and maintain faunal diversity in Peru are:

- Inventories of species and investigation of the status of species, including distributions, behavior, and ecology. This is particularly important for fishes, less "spectacular" species, and economically important species;

- Improved management of existing parks and reserves and identification and establishment of new conservation units that will increase on-site conservation of faunal diversity and endangered species; and

- Increasing enforcement capabilities in areas of high faunal diversity.

ENDANGERED PLANT SPECIES AND HABITATS

Identification and evaluation of endangered plant species is complicated because of the broad distributions of many species, despite the sharp ecological limits of their distribution. The status of any species must be considered in terms of its total range and the level of habitat destruction. An important consideration is that plant species diversity, at least for lowland tropical communities, appears directly related to local rainfall. In general, the wetter a lowland tropical area, the richer its flora. Destruction of tropical wet forest habitats threatens more plant species than does comparable destruction of moist or dry forest habitats (Gentry 1977).

Though a lack of floristic knowledge in Peru restricts a direct assessment of endangered plant species, sufficient information is available for a comparison of habitats. An assessment of endangered habitats offers the best available information on threatened species. Among the most crucial are the following:

- **Amazonian Peru:** Preliminary results from the "Flora of Peru" project in Amazonia, near Iquitos, revealed a tentative figure of about 300 tree species out of 600 individuals in a one-hectare study site at Yanamono. These and other results indicate that the wet Peruvian forests near Iquitos may indeed be the richest in the world, contrary to reports in the scientific literature that this distinction belongs to the Dipterocarp forests of Southeast Asia. Similar, spectacular results, though with differing species composition, are emerging from Manu National Park. Thus, from the standpoint of conservation, the exceptionally species-rich forests of Amazonian Peru merit worldwide emphasis;

- **Mangrove Ecosystem in Northwest Peru:** A conservation unit has been proposed in the coastal mangrove forests near Tumbes that would preserve their role as primary breeding areas for many commercially valuable marine organisms, and as feeding grounds for juvenile marine species. This important ecosystem and its associated wildlife are threatened because of uncontrolled forest extraction, hunting and fishing, and destruction of the mangrove ecosystem by shrimp farmers for pond construction;

- **Western Andean Lomas:** This exceptional habitat is formed by the interception of fog against the otherwise dry coastal hills and ridges, resulting in a unique assemblage of plant species and communities. Some of these communities are crucial for seasonal grazing of livestock;

- **National Sanctuary of Ampay:** This sanctuary was established in 1987 to protect forests of *Podocarpus glomeratus*, the only native conifer growing in Peru and considered to have excellent wood characteristics for future economic development (DGFF 1987a); and

- **National Sanctuary of Calipuy:** Established in 1981 to protect the largest Peruvian population of the unique giant bromeliad, Puya raimondii.

Given the current knowledge of Peruvian plants, basic floristic inventory remains perhaps the outstanding botanical need. Until the basic identification of Peruvian plant species and communities is completed, it will be difficult to assess the plant diversity in Peru. Without inventories, it is impossible to determine how these might be utilized, or which species may be threatened with extinction.

CHAPTER FIVE

CONSERVATION OF ECONOMICALLY IMPORTANT SPECIES AND GERMPLASM

ECONOMICALLY IMPORTANT PLANTS

There are numerous examples of newly discovered uses of plant species in Peru with great economic potential. There are also significant uses recognized among native peoples for scientifically unknown Peruvian plants. One such plant is Fevillea cordifolia, a liana in the family Cucurbitaceae. The oil from this plant is used by the Campa Indians in the Pichis-Palcazu region in place of candles. This species represents a potential new oil seed and has stimulated interest because of its prolific seed production and capability of growing in second-growth and forest-edge habitats (Gentry 1977).

The Missouri Botanical Garden's Flora of Peru Project, working with staff from the Universidad Nacional de la Amazonia Peruana and the Museo de Historia Natural of the Universidad Nacional Mayor de San Marcos in Lima, has discovered several economically important plants throughout the Amazon region of Peru. *Martinella obovata* (Bignoniaceae), whose roots are used as an eye medicine in different countries, is found throughout Amazonian Peru. Numerous species within the Apocynaceae in the genus *Pacouria* have been identified as possessing a latex nearly identical to that of some commercially important African species (*Landolphia* spp.) Thus, it is possible that cultivated or semi-cultivated *Pacouria* could produce economically significant quantities of both fruit and latex. Other examples are reported in Foster (1981) and Drew and Rehnberg (1985).

ECONOMICALLY IMPORTANT TIMBER TREES

Some economically important timber trees have been exploited in Amazonian Peru almost as heavily as have many large game animals. Gentry (1981, unpublished manuscript) reports that Manu National Park is the only location where extensive pure stands of large cedro (*Cedrela)* trees, once common along Peruvian rivers, can still be found. In addition, the mature forest near Cocha Cashu in Manu is unique, due to the presence of the giant emergent tree, aguano (mahogany, *Swietenia).* This

valuable timber species has been virtually eliminated elsewhere in Amazonian Peru and throughout most of the neotropics.

The liana family, Menispermaceae, is represented in the Cocha Cashuforest by more species than in any equivalent sample from elsewhere in the world (Gentry, unpub. manuscript; Krukoff 1982). This plant family is famous as the source of curare and other pharmacologically active alkaloids.

In contrast to the rich alluvial soils of Manu, the sandy river terraces that predominate in much of the Palcazu Valley demonstrate a different timber potential. The commercially valuable Meliaceae (mahogany and cedro) so common in Manu are not present. Rather, the most common emergent tree is tornillo (*Cedrelinga cateaeformis, Leguminoseae)*, which has timber properties similar to those of cedro. Because mahogany and cedro have been overexploited by extraction activities throughout much of Amazonian Peru, tornillo is quickly becoming the main timber wood of the Central Selva region.

Because such a valuable timber tree is so common in the poor soils of Palcazu forests, a well-planned program of commercial exploitation might provide a more profitable and sustainable resource than the lower-quality crops or pastures that could be grown if the forest were cut. Drew and Rehnberg (1985) suggest that efforts to develop a timber industry in the Palcazu on all but the richest alluvial soils should focus on tornillo and other naturally occurring species.

DOMESTICATED PLANTS

The tropical Andean region of Peru is the center of diversity for the plant family Solanaceae, which includes world food staples such as potatoes, peppers, tomatoes, and tobacco. Potatoes were first grown domestically in the Peruvian sierra, where more than half of the wild species are restricted to the tropical and subtropical Andes. These wild types provide a vital source of breeding stock for the more than 5,000 potato varieties in the world. The tomato is the second most widely grown vegetable crop in the United States, and wild tomato varieties from the Andean region have been critical in improving the nutritional quality and disease resistance of domesticated varieties.

Many of the early native plants of economic importance in Peru were grains, such as quinua (*Chenonopium quinoa*), kaniwa (*Chenopodium pallidicaule*), kiwicha (*Amaranthus caudatus*), and tarwi (*Lupinus mutabilis*). Tubers also formed the basis for a rich and varied diet, including oca (*Oxalia tuberosa*), olluco (*Ullucus tuberosus*), isano (*Tropaeolum tuberosum*), papa amarga (*Solanum juzepezukii*), and maca (*Lepidium majini*) (Fries and Tapia 1985). Because certain of these plants also were used in pagan rituals and human sacrifices, the Spanish conquistadors caused them to fall into disuse. Other crops, such as corn and beans, increased in importance, effectively ending the use of many native grains and tubers as a staple food (National Research Council 1984).

GERMPLASM BANKS FOR NATIVE ANDEAN CULTIVARS

The government of Peru, together with several Peruvian and foreign universities, is in the process of actively rescuing native Andean cultivars. Listed below are the principal sites for investigation and location of germplasm banks in Peru for native Andean cultivars. Information, where available, indicates the native Andean species and the monthly tonnage of seed produced and number of hectares planted for July 1987:

- **Centro de Investigacion de Cultivos Andinos, Universidad Nacional de San Antonio Abad del Cuzco:** This project, funded by BOSTID, is developing appropriate varieties of grain amaranth with good agronomic characteristics for Peru. The first objective is to revive cultivation and use of amaranth in Peru by evaluating 16 promising lines that might be grown in the coast, sierra, and selva. The second objective is to help reduce Peru's dependence on imported wheat and other grains. The project is being implemented in collaboration with the National Kiwicha Program. Initial results suggest that amaranth will make an important comeback in Peru as a food supplement, provided it can be sold at a competitive price. Achievement of these objectives will be a long-term effort, extending well beyond the project time frame of three years.
  Other cultivars: potatoes (production - 105 tons; area planted - 52.5 ha).

- **Estacion Experimental, Universidad Nacional Agraria, La Molina, Lima.**
  Cultivars: potatoes, rice, peanuts (no data available).

- **Estacion Experimental de Cacamani, Universidad Nacional Tecnica del Altiplano, Puno.**
  Cultivars: native beans (14 tons, 17 ha), quinua (3.11 tons, 389 ha).

- **Estacion Experimental Santa Ana, Huancayo, Junin.**
  Cultivars: native beans (0.03 tons, 0.5 ha), potatoes (7 tons, 389 ha), kiwicha (5 tons, 600 ha).

- **Universidad Nacional del Centro, Huancayo.**
  Cultivars: potatoes (463 tons, 231.5 ha).

- **Los Banos del Inca, Cajamarca.**
  Cultivars: potatoes (1.02 tons, 0.5 ha), beans (2.53 tons, 36.8 ha), quinua (0.03 ton, 3.75 ha), kiwicha (0.12 ton, 24 ha).

NATIVE GRASS SPECIES

Since 1981 the National Soil and Water Conservation Program within the Ministry of Agriculture has maintained an active program of investigation and reintroduction of native grass species in the sierra. Funded through 1986 by AID, this project has utilized native species of the grasses *Poa, Stipa, Bromus,* and *Festuca* intermixed with a nitrogen-fixing clover, *Trifolium peruviano.* Working in the departments of Huancayo, Lima, Pasco, Cusco, Puno, and Junin, the project has involved the use of enclosures, extensive nursery activities, and experimentation with seed viability and longevity, and has had a significant impact on many sierra communities by involving local promoters in seed distribution, incorporation of native grasses into soil conservation, and techniques of terrace management.

ECONOMICALLY IMPORTANT WILDLIFE

Conservation of economically important wildlife in the sierra has concentrated on the vicuna (*Vicugna vicugna),* an animal that offers one of the finest fur fibers in the world. Because of its importance as an Andean species and the drastic reduction in its overall numbers, the vicuna became the focus of special protection programs, which involved the establishment in 1966 of the Pampas Galeras National Reserve, where the number of vicuna increased from 5,000 in 1966 to almost 38,000 in late 1978. In 1979 a second National Reserve, Salinas-Aguada Blanca, was established to expand conservation efforts. Today there are more than 100,000 vicuna protected in Peru (DGFF 1987a). A more modest protection effort for another wild cameloid, the guanaco, was begun with the establishment of the Calipuy National Reserve in 1981 (ONERN 1986).

The importance of the vicuna, besides the value of its wool and meat, is that its native habitat is the rocky, marginal, high elevations where living conditions are extremely hard. This species represents a potential resource for the area. An adult vicuna produces 20 kg of meat worth $30, a skin worth $150, and 250 grams of wool worth $120 (DGFF 1987), but its economic use has been a subject of controversy within Peru and the international conservation community. While protected under the CITES treaty, the vicuna populations have recovered to the extent that Peru wishes to utilize the resource more fully. This debate continues, although the government was recently allowed under the CITES treaty to begin selling vicuna wool under controlled conditions (DGFF 1987a).

Prior to 1972, non-human primates were trapped and used for human consumption, the pet trade, exhibition in zoos, and biomedical research. In 1973 trapping, holding, and commercialization of non-human primates were banned by the Peruvian government, and special trapping permits were granted only for scientific purposes. In 1972 the government and the Pan American Health Organization (PAHO) created the Peruvian Primatological Project (PPP). This project treats non-human primates as a renewable natural resource that, under proper management techniques, can provide for the needs of the biomedical research community while ensuring the long-term survival of these species in their natural habitats (Ministerio de Agricultural/UNMSM/OPS).

The principal objective of the PPP is to develop methods for the captive breeding of non-human primates to provide subjects for biomedical research, thereby reducing pressure on natural populations and contributing to their conservation. At present there are six species of non-human primates being bred and managed, of which four are common species and two endangered. Three of the six species are not found in any national park or reserve, so these efforts are doubly important for their conservation benefits.

MARINE RESOURCES

The coastal waters of Peru support as many as 600 species of marine fish, crustaceans, mollusks, and marine mammals. Anchovies and sardines form the major

focus of Peru's fishing industry. Guano from the country's offshore islands is an important fertilizer produced by the millions of guano birds that inhabit the coast.

AID/Washington is funding a study of the benthic invertebrate communities and the associated fish populations, with a focus on economically or ecologically important species. This study is examining the effects of El Nino and related events on the population structure of bottom-dwelling marine organisms. El Nino causes changes in the populations of marine resources, reducing the economically important anchovy and sardine populations and increasing the bottom-dwelling populations of clams, scallops, crabs, and flounders, which cannot be harvested with the type of fishing equipment generally present on Peruvian vessels. The study will help predict the nature and magnitude of these changes in marine organisms, providing essential information for planning their sustainable use.

CHAPTER SIX
THE INSTITUTIONAL CONTEXT FOR CONSERVATION IN PERU

INTRODUCTION

This chapter will review the current institutional context for addressing problems of managing biological diversity and tropical forests in Peru. Rather than attempting to assess all the organizations, both public and private, addressing such issues, pertinent legislation will be discussed. The key agencies, institutions, and organizations will be highlighted; the proposed reorganization of the Ministry of Agriculture will be described; and the Tropical Forestry Action Plan, together with international assistance efforts, will be summarized. For a more comprehensive analysis of this institutional framework, an extensive literature should be consulted, including the following: AID 1979; Brack 1987a; DGFF 1987a; Dickinson et al. 1985; El Peruano 1987; ONERN 1974 and 1986; Ponce 1983; WWF 1987.

RELEVANT LAWS AND RESOLUTIONS

Peru has a relatively comprehensive package of legislation dealing with various aspects of natural resources, conservation, and biological diversity. These include supreme decrees, legislative decrees, organic laws, ministerial resolutions, treaties, bilateral agreements, and signatories to international conventions. While some are more enforceable and therefore more effective than others, AID should not invest a great deal of time or energy attempting to convince the GOP to enact additional legislation. However, the suggestion has been made that critical support is needed in the private sector to develop improved lobbying capabilities, especially for a new environmental law that has been bogged down for several years.

What follows is a list of some of the major legislation affecting biotic resources in Peru. Although somewhat difficult to evaluate, the various elements have been arranged in order of priority, based on interviews with leading conservationists.

- **The Peruvian Constitution (1979):** This prescribes the conservation and wise management of Peru's natural resources. Special attention is given to the issue in Title III, Chapter II, Articles 118-123, which emphasize that Peru's natural resources belong to the state. It is the state that is responsible for their protection, conservation, and evaluation. A key component is Article 120, which addresses Amazonian development and conservation;

- **Forestry and Wildlife Law (1975):** This is the major piece of legislation on the conservation of flora and fauna. Initially, the focus of the law was forestry and forest utilization. The law states that lands suitable for forestry should remain as such. The Ministry of Agriculture is given the responsibility for policy development and implementation within the sector, as well as the jurisdiction for the control and protection of forest and wildlife products. Later sections establish conservation units, reforestation conditions, management of settlement areas, and penalties for violation. For the most part, this law has not been effectively implemented;

- **Supreme Decree No. 160-77-AG (1977):** This is an addition to the 1975 law and facilitates the establishment, regulation, and management of the various conservation units including: national forests, open-access forests, protection forests, national parks, national reserves, national sanctuaries, and historical sanctuaries. This amendment has been one of the most effective conservation tools in Peru and has led to the establishment of 23 protected areas;

- **Supreme Decree No. 157-77-AG (1977):** This amendment specifically develops regulations for the utilization and management of wildlife. It has been less than effective due to the difficult nature of its enforcement;

- **Supreme Decree No. 158-77-AG (1977):** This establishes the specific regulations for the conservation of flora and fauna.

- **Supreme Decree No. 953-73-AG (1973):** This establishes a strict ban on the hunting of wildlife in the Amazon region, except for a select group of species that are regularly hunted for food. Given the remoteness of the area and the lack of infrastructure, this is a difficult law to enforce;

- **Decree Law No. 21670 (1976):** This facilitates the agreement between Brazil and Peru to conserve the biological diversity of the Amazon region;

- **Ministerial Resolution No. 01710-77-AG/DGFF (1977):** This establishes the endangered species list for Peru for both flora and fauna by dividing species into four categories: endangered, vulnerable, rare, and unknown status. According to Brack (1987), the current list is obsolete and in need of revision;

- **Native Communities Law (1978):** Articles 61-63 cover the role of forestry and wildlife in native communities. This is the Law on Native Communities, and the Agricultural Development of the Selva and the High Selva (AID 1979); and

- **Decree Law No. 18810 (1971):** This is the critical law dealing with marine-fisheries resources. No specific information is readily available on its relevance in terms of endemic species or mangroves -- an area in need of further investigation, as mangrove areas continue to be under serious threat.

INTERNATIONAL TREATIES AND CONVENTIONS

Peru is a signatory to the following:

- **Convention for the Protection of the Flora, Fauna, and Scenic Beauty of the Countries of America (1940):** Ratified by Peru in 1946;

- **Convention on the International Trade of Endangered Species (1974):** Peru became a signatory to CITES in 1974, and this convention was approved by Decree Law No. 21080 (1975). As a result of the vicuna issue, Peru's participation in CITES has assumed a certain prominence in the world of conservation;

- **Accord for the Conservation of the Flora and Fauna of the Amazon Territories of Peru and Brazil:** This was signed in 1975;

- **Treaty of Amazon Cooperation (1978):** Signed by the nations that share the common watershed of the Amazon River Basin, this treaty focuses on the integrated management of the natural resources of the region;

- **Accord for the Conservation of the Flora and Fauna of the Amazon Territories of Peru and Colombia:** This was signed in 1979;

- **Agreement for the Conservation and Management of the Vicuna (1979):** This was signed by Peru, Chile, Bolivia, and Ecuador and approved by Decree Law No. 22984 (1980), replacing a 1969 agreement between Peru and Bolivia. This recovery program has been one of the great success stories in conservation worldwide, and was primarily facilitated by this legislation;

- **UNESCO Convention on Natural and Cultural Heritage of the World (1972):** This was signed by Peru in 1982; and

- **International Tropical Timber Agreement (1986):** This made Peru a member of ITTO, the International Tropical Timber Organization. This is a new agreement, and could possibly be of great importance to Peru. Although ITTO is perceived to be an Asian organization, the hope is that countries such as Brazil, Peru and Bolivia will become active participants. Voting power is based on a formula of timber exports and tropical forest area. Additionally, there is a Project Fund that could eventually support research and innovative forest management activities of broad interest in Peru.

It would appear that Peru has done a commendable job of introducing and passing legislation related to conservation. At present, there is a proposed natural-

resources and environmental-sector law that will attempt to strengthen current legislation on protected areas and tropical-forest utilization. In the case of the vicuna and recent environmental battles in Huascaran and Paracas National Parks, these laws were invoked and proved to be very helpful. In Huascaran, the local development corporation tried to authorize the building of a mining road into the park. In Paracas, local politicians tried to take over upwards of 60 percent of the park on the grounds that it was too degraded to conserve. However, most of the laws are difficult to enforce, given the shortage of personnel, the low salaries of enforcement agents, and the opportunity for corruption.

Public and private institutions that manage critical biotic resources must redirect their efforts by demonstrating through public participation the importance of these legally protected resources. Local populations must have an active role in the planning and management of protected areas and receive some direct economic benefits or there will never be an interest on their part to protect biological diversity.

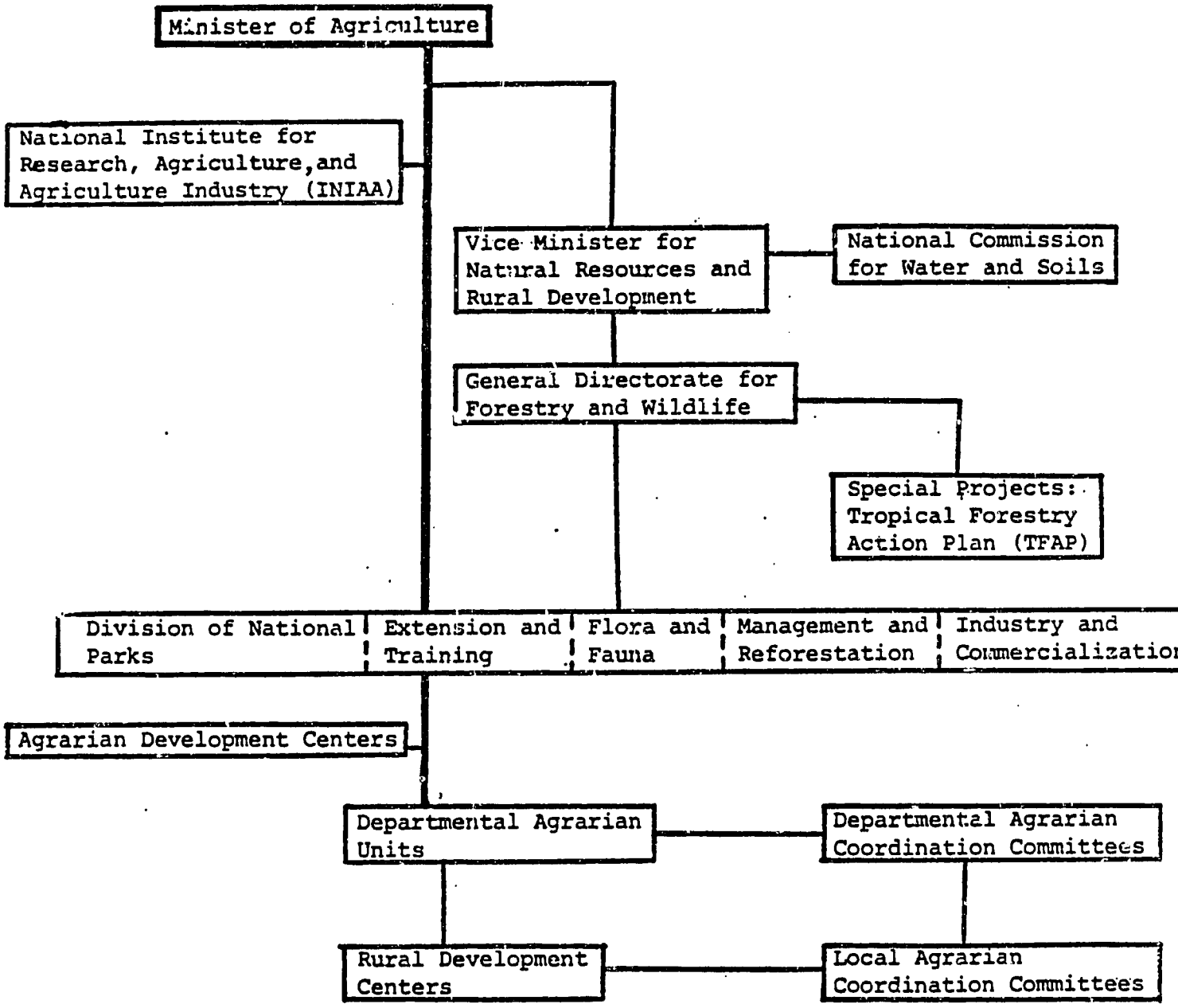
KEY PUBLIC SECTOR INSTITUTIONS

DGFF and the Reorganization of the Ministry of Agriculture

The mission of DGFF (Direccion General de Flora y Fauna) is to establish natural-resources policy for Peru. It is responsible for long-range planning, protected areas, reforestation, forest management, research, and monitoring CITES regulations. Unfortunately, the agency continues to be underfunded, suffers from severe problems of "brain drain" due to low salaries and limited opportunities, and has image problems. It is hoped that, with the changes discussed in this chapter, DGFF's effectiveness will be enhanced. But unless greater priority is given the sector by the government, it is doubtful that things will change.

From the beginning, the Garcia government has placed its strongest development priority on the southern sierra. One major effect of this policy has been the decentralization of the public sector and the services offered, thereby putting greater burdens on regional and local authorities to implement federal programs. As a result, the Ministry of Agriculture is to be reorganized and decentralized, with the departmental corporations assuming more responsibility for agricultural development

Figure One
The Place of DGFF in the Reorganization of the Ministry of Agriculture



and conservation. Figure 1 provides an abbreviated organizational chart of the working draft of the restructuring as it pertains to conservation. It focuses only on the agencies that will have direct authority over biotic resources and conservation units. It should be emphasized that this information was given to the team as an unofficial working draft. The key changes in terms of conservation include the following:

- The creation of a new office of Vice-Minister for Natural Resources and rural development, who will report directly to the Minister of Agriculture;
- INFOR, the National Forestry and Fauna Institute, will cease to exist, and many of its duties will be transferred to DGFF;
- The DGFF will have five subdivisions including: national parks; forestry extension and training; flora and fauna; forest management and reforestation; and forest industry and commercialization;
- A Special Projects Office will be created within DGFF, whose role will be the coordination of international assistance and the monitoring of the TFAP (Tropical Forestry Action Plan);
- Field activities such as national park management will be carried out by DGFF personnel under the auspices of the Departmental Corporation through the Agrarian Units and the Rural Development Centers; and
- All forestry and conservation research previously conducted by INFOR and DGFF specialists will now be done by scientists at INIAA, the National Institute for Agrarian and Agroindustry Research.

It is impossible to say what effect these changes will have on biological diversity and conservation. A study by FPCN, the Fundacion Peruana para la Conservacion de la Naturaleza, will be looking at possible impacts. However, a variety of opinions were expressed by professionals contacted by the team--including the following positive comments:

- The presence of a Vice-Minister for Natural Resources will afford DGFF greater access to the minister and other higher political authorities;
- By combining INFOR and DGFF, management will become more efficient;
- There will be more technical people in the field, and consequently, greater attention will be given to local problems;
- Control of violations will be easier; and

- Local leaders will now be able to take pride in conservation units. The competition among department heads will allow for the creation of additional protected areas.

Among the negative comments:

- Forestry research will be neglected in INIAA;
- DGFF personnel will require substantially more training in community development, economics, lobbying, and sociology; and
- This reorganization will not last two years!

The Tropical Forestry Action Plan

The Tropical Forestry Action Plan (TFAP) began on a global scale some three years ago when FAO's Committee on Forest Development in the Tropics began to prepare a plan to increase the political awareness needed to confront the problem of tropical deforestation. Simultaneously, the World Resources Institute, in collaboration with the World Bank and the United Nations Development Program, launched a major effort to develop a strategy for the conservation of tropical forests worldwide (WRI 1985). The principal objective was to put forestry on the political agenda of both tropical nations and the donor community. It went one step further and specified that total funding amounting to $8 billion would be required to start tackling the problem effectively.

The first step in the implementation was to put together a world committee including members from the tropical nations, the donor community, private industry, and key international NGOs. This committee suggested that a series of enhanced country strategies be developed. Because Peru had demonstrated interest in the process, it was eventually selected as one of the initial countries to develop such a strategy. Under the leadership of DGFF and CIDA (Canadian International Development Agency), 11 organizations contributed to the process, including AID/Peru, which supported the wildlife and forest management components. The resulting plan, which is in the final draft stage, has the following five major components:

- The integration of forestry into rural development;
- Support for the production and conservation of biomass energy;
- The management and development of the forest-products industry;
- Forest ecosystem conservation and wildlife management; and
- Institutional support.

Regional Agricultural Agencies

Prior to the restructuring, each department had a Regional Agricultural Directorate, an office of DGFF, and a Forest District. From all indications, these offices are poorly staffed and suffer from limited resources (Brack 1987a).

National Office for Natural Resource Evaluation (ONERN)

This agency forms part of INP, the Instituto Nacional de Planificacion. Its principal objective is to monitor and evaluate the status of natural resources in Peru for social and economic development. As such, it has performed well. ONERN conducted the environmental profile published in 1986. According to Brack (1987a), however, ONERN has neglected wildlife resources.

National Council for Science and Technology (CONCYTEC)

This institution is in charge of coordination and policy development for Peruvian science. It has a small grants program but is poorly funded.

Peruvian Ocean Institute (IMAPRE)

Under the jurisdiction of the Ministry of Fisheries, IMARPE conducts research on the marine resources of Peru.

Local Committee for the Development of the Pacaya-Samiria (COREPASA)

COREPASA is based in Iquitos and represents a consortium of 13 state agencies from several sectors including agriculture, forestry, health, education, and fisheries. The group was established in 1985 in an effort to enhance the coordination for protection, research, and management of the national reserve at Pacaya-Samiria, and is viewed as a potential model for other protected areas.

Peruvian Amazon Research Institute (IIPA)

Article 120 of the 1979 Constitution established IIPA. During the period of abundant oil money, IIPA conducted valuable research, especially with the Institute of Tropical and Highland Veterinary Research (IVITA) and the Pan American Health Organization (PAHO) through the Primate Project. However, with the decline of oil monies, IIPA has suffered from budget cuts.

Academic Institutions

National Agrarian University (La Molina)

La Molina is the most important center of conservation training in the country. Through the Forest Science Department, the university has conducted important forestry, forest ecology, and wildlife studies. Currently, CIDA is supporting a master's program in forestry, and the World Wildlife Fund is helping with the master's program in wildlife management. Most of Peru's scientists and environmentalists received their initial training there. La Molina also houses the CDC, the Conservation Data Center, supported by the Nature Conservancy. The CDC is attempting to consolidate and disseminate the relevant biological data available in Peru. It has a fine cadre of young professionals and has successfully identified outside sources of funding.

National University of San Marcos

The Department of Biology conducts research in ecology, plant taxonomy, and wildlife. The Javier Prado Natural History Museum is located there. Several

individuals have noted that the herbarium and display collection in the museum are in desperate need of help. The potential for the museum to become a center for environmental education is good.

National University of San Antonio Abad

Located in Cuzco, the university is the site of a small yet well-organized herbarium, which also is in desperate need of support. The university itself is potentially important because it could serve as a center for conservation activities by the several environmental NGOs in the area.

Other Institutions

Other academic institutions working in some aspect of ecology and wildlife include: Cayetano Heredia (Lima), San Agustin (Arequipa), the University of Trujillo, and the National University of the Peruvian Amazon in Iquitos (Brack 1987). Forestry schools -- besides that at La Molina -- offering various levels of university training include: Huancayo, Iquitos, Pucallpa, and Tingo Maria. There are three vocational training schools in Tarapoto, Pucallpa, and Cuzco (DGFF 1987a).

Non-Governmental Organizations (NGOs)

An earlier study by Leiberman and Swift (1984) took a close look at the level of NGO interest and capability in Peru. The authors concluded that because there were relatively few NGOs working in the natural-resource/environmental field, there was a need for additional support and institution building. This is no longer the case. It is estimated that as many as 200 conservation NGOs are working in Peru, many of which are simultaneously looking at socioeconomic issues and biological diversity. Because of the many problems in the public sector, many outstanding Peruvian professionals have turned to the NGOs to accomplish their personal and professional goals. The more important NGOs working in conservation are listed in Table 3.

It appears that elite groups of Lima-based NGOs dominate the politics and resources of the sector. There are problems of institutional immaturity and professional infighting among the various groups, hindering their effectiveness. This

situation may not be bad, because the sector must prove itself in the eyes of the public. Similar circumstances exist in other countries, especially in the United States, and they are part of the development process of any professional sector. Fortunately, when critical problems arise, as in the recent environmental battles in Paracas and Huascaran, differences are put aside and the NGOs collaborate in the achievement of a common goal.

During the assessment, several key points were raised in reference to NGOs:

- Many of the groups are sorting out their niches, and a broad spectrum of issues is being addressed;
- Most of the groups live off the dynamism and voluntary commitment of a small group of dedicated individuals. Although this is laudable, it does not bode well for organizational sustainability;
- Certain groups have done well at finding "out of country" money and are financially well off. Others are in serious financial difficulty; and
- There is only limited interest in some sort of central, coordinating body to represent the interests of the NGO community as a whole.

TABLE 4

SOME PERUVIAN NGOS ACTIVE IN CONSERVATION ISSUES

Asociacion Arbol de la Quina (AAQ)
Asociacion Cultural "Labor" 710
Asociacion de Conservacion de la Selva del Sur (ACSS)
Asociacion para la Conservacion de la Naturaleza Amazonica (ACONA)
Asociacion para la Investigacion y Desarrollo Rural (AIDER)
Asociacion Peruana para la Conservacion de la Naturaleza (APECO)
Asociacion de Ecologia y Conservacion (ECCO)
Asociacion de Ecologia, Desarrollo, y Conservacion (ECODESC)
AUXILIA
Biosfera Asociacion Cultural
Centro Amazonico (CAAP)
Cooperativa Americana de Remeses al Exterior (CARE)
Centro Canadiense de Estudios y Cooperacion Internacional (CECI)
Centro de Datos para la Conservacion (CDC)
Centro de Desarrollo Agropecuario (CEDAP)
Centro de Estudios Naturalistsas y Educacion Conservacionista (CENEC)
Centro de Estudios y Prevencion de Desastres (PREDES)
Comite de Defensa del Parque Manu
Equipo de Produccion y Desarrollo de Ica (EPRODICA)
Fundacion Mariluz Injoque
Fundacion Peruana para la Conservacion de la Naturaleza (FPCN)
Grupo Talpuy
Instituto de Desarrollo y Medio Ambiente (IDMA)
Instituto Regional de Ecologia Andino (IRINEA)
Naturaleza, Ciencia, y Tecnologia Local para el Servicio Social (NCTL)
Taller de Desarrollo y Promocion Andino (TADEPA)
WANKAPECO

INTERNATIONAL AGENCIES

Several of the major international donors are working on issues of biological diversity and tropical forestry. For a more complete list of the specifics of the organizations, see DGFF (1987a) and Bauer (1987).

Multilateral Support

The more important agencies include the following:

- **Food and Agricultural Organization:** Reforestation in the sierra; fuel-wood plantations; conservation of genetic diversity of both arid and tropical species; forestry education; environmental education in primary schools; support to the TFAP. Some bilateral support has been provided by Holland and Sweden;
- **World Bank:** Financial support to the Alto Mayo special project in the high selva;
- **Inter-American Development Bank:** Financial support to the Pichis-Palcazu special project in the high selva, particularly in the social forestry and research areas;
- **UNESCO:** Support to the Man and the Biosphere Program, particularly biosphere reserves;
- **World Food Program:** Agricultural development in poor areas; food-for-work for reforestation; and
- **European Economic Community:** Support to private forest industry, reforestation, and silviculture.

Bilateral Support

- **Canada (CIDA and IDRC):** Support to the master's program at La Molina, line of credit for forest industrial development in the selva, institutional support to DGFF, research, leading the TFAP process, interest in enhanced support to national parks through NGOs, support for vocational training in forestry in Tarapoto;
- **Switzerland (COTESU):** Research, botanical work, model project for forestry management, technical training, social forestry in the sierra, information dissemination at La Molina, environmental education;

- **Japan (JICA):** Research in forest regeneration, silviculture, taxonomy of commercial timber species in the Von Humboldt National Forest;
- **Belgium:** Reforestation, training, and fuel wood in the sierra, technical assistance in forestry management to the Pachitea special project in the high selva; and
- **West Germany (GTZ):** Ecosystem recovery through reforestation in upper selva, agroforestry, and forestry production.

Private International Support

- **Worldwide Fund for Nature (WWF-Int.):** Financial support to Manu National Park, Paracas Reserve, and Mejia National Sanctuary;
- **World Wildlife Fund (WWF-US):** Institutional support, baseline data collection, support to master's program La Molina, support to national parks, environmental education, training. Currently supporting some 25 projects, and will be supporting a forestry extension effort in the Palcazu;
- **The Nature Conservancy (TNC-INT.):** Institutional support to FPCN and APECO, project development in Yanachaga-Chemillen National Park, support for the CDC La Molina.
- **Conservation International:** Support to Peruvian in-country adviser;
- **Wildlife Conservation International (WCI-New York Zoo):** Support for in-country scientist, research in Manu National Park, institutional support to ACSS;
- **New York Botanical Gardens (NYBG):** Basic taxonomic work, training, support to local herbaria, economic botany;
- **Missouri Botanical Gardens (MBG):** Basic taxonomic work, training, support to local herbaria, economic botany; and
- **Smithsonian Institution:** Support for Manu National Park through the Man and the Biosphere Program.

Finally, several private development organizations such as CARE have active programs in reforestation and small-scale agriculture. Various American universities, such as North Carolina State and the University of Colorado, have active programs in training, research, and scientific exchange.

CHAPTER SEVEN
STRATEGY AND RECOMMENDATIONS

STRATEGY

AID/Peru has the opportunity to work closely with the government of Peru and the country's non-governmental organizations to strengthen natural-resources management, specifically in relation to biological diversity and sustainable development of tropical forests. The strategy calls for describing options, defining priorities, and identifying specific interventions best suited to AID's policies, resources, and project portfolio.

The definitions of policies, programs, and projects to favor biological diversity vary for agriculture, natural resources, indigenous peoples, and rural integration. Various issues cut across and integrate the natural and social sciences. Some benefits are immediately recognizable, while others are difficult to identify, quantify, or even qualify. Some goods and services flow through the marketplace, while others are inherently intangible and non-marketed. Some interventions will have near-term impacts. Others, especially basic science, are aimed at a long time horizon, but may ultimately produce substantial benefits.

The different emphases that can be placed on the issues suggest a wide array of interventions. This variety works to AID's advantage, providing flexibility in the face of funding uncertainties and a weak information base. Five guidelines for defining program directions in biological diversity are as follows:

- Relate interventions for biological diversity to existing AID projects -- for example, the Central Selva Resource Management Project and the Agricultural Technology and Transfer Project -- thereby minimizing the proliferation of new projects;
- Use the concept of "comparative advantage" to define and promote Peru's strengths for attracting resources and support from a variety of sources;
- Harmonize AID's strategy with other institutional structures in Peru -- for example, the Tropical Forestry Action Plan, the non-governmental organization (NGO) environmental community, and the IUCN/WWF National Conservation Strategy -- to achieve maximum good will and impact;

- Concentrate on clearly identifying and quantifying the economic benefits to be derived from the maintenance of biological diversity and sustained tropical-forest management. State interventions as opportunities for "wildlands industries and enterprises" rather than as restrictions that limit action. Give priority to interventions in which the beneficiaries belong to disadvantaged groups; and

- Appeal to Peruvian national pride to protect endangered ecosystems, species, and germplasm that are unique to Peru and could disappear in the near future without the interest and participation of the local population. Interventions that favor threatened endemic ecosystems and species -- that is, those found only in Peru -- should receive priority over those that are threatened but are not unique to Peru.

"Comparative advantage" and national pride are closely linked. Peru's comparative advantage is defined by the following four themes:

- Richness of diversity, ranking first in the world in life zones;

- Young but very active and growing NGO environmental community;

- Position as major stakeholder in the selva of western Amazonia, a region commanding world attention because of the critical social and environmental issues that converge there; and

- Germplasm base as one of the world's historically outstanding sources of wild plants and animals for domestication and commercialization.

These four themes distinguish Peru as a highly appropriate country for projects in biological diversity. AID/Peru should stress these four themes in its deliberations with the government of Peru, AID/Washington, and external offices and organizations.

AID should also stress the fact that Peru has begun to take conservation seriously. Three impressive achievements to date are: the protection of the vicuna; the reaction against proposed development activities in the Huascaran and Paracas national parks; and the establishment of the Manu National Park. Because of the great diversity found there, Manu is one of the most important of its type in the New World. The details to support these themes are presented earlier in the report and in the references cited.

RECOMMENDATIONS FOR PROGRAMS AND PROJECTS

Of many alternative frameworks to define interventions and indicate priorities, the structure of these recommendations is organized under four program areas:

- Conservation policy and education;
- Conservation and development;
- Research; and
- Training and institution building.

Projects are defined within each program area. A decision framework with which to compare these projects is presented in a subsequent section.

Program Area: Conservation Policy and Education

Peru's policy on environment, biological diversity, and economic development is unclear. It consists of the total set of actions and inactions, with a view to evaluating their consistency and significance for moving the country toward particular national objectives. Information presented earlier in this report shows that agriculture and grazing extend onto marginal lands, while forestry and other protective land uses are largely undeveloped. The current political leadership favors government attention on the southern sierra, while Amazonian issues receive far fewer resources in relation to problems. Because the public is not adequately informed, the misperception of the selva as a large agricultural frontier continues. Various pieces of legislation nominally protect particular land units and unique flora and fauna. Yet, due to political and fiscal realities, the real problem is lack of resources and commitment for enforcement.

At present, there is little political motivation for sustainable development of tropical forests. This situation is explained by factors including a lack of lobbies and of strong constituencies and a reliance on legislative restrictions in place of positive activity. Moreover, the economic role of forests and related wildlands is not widely understood. Another deficiency is the absence of a regular and systematic review procedure for assessing the environmental impact of new development projects

-- for example, in the case of roads and infrastructure. Legislation is being proposed to address this oversight, but timing and implementation are uncertain.

Governmental reorganization will affect environmental issues, but it is difficult to forecast the particular structure and impacts. The proposed reorganization of the Ministry of Agriculture will shift budgets and responsibilities in directions that could be critical for wildlands resources and biological diversity. However, the reorganization is not necessarily driven by conservation policy, and the new structures and budgets will require careful monitoring from that perspective.

- **OPPORTUNITY FOR AID INTERVENTION: Enhance conservation policy-making capabilities and increase efforts to promote public awareness of environmental issues in Peru, especially those most closely related to biological diversity.**

Project 1: Dissemination of Progress on the Central Selva Resource Management (CSRM) Project.
The forestry work being done there requires the greater attention of political leaders, development professionals, and conservationists. This goal can be advanced through publications, study tours, workshops, seminars, and presentations at public meetings.
Locations: Lima, Palcazu, and other parts of Peru.
Collaboration: DGFF, FPCN, WWF-US, CIDA, and DESFIL.
Funding: $20,000-$100,000 per year for three years.

Project 2: Lobby for Conservation in Peruvian Government.
Political edification about Peruvian conservation needs and biological diversity will be advanced substantially with the presence of one or more lobbyists from selected conservation NGOs. This person will dedicate full-time effort to educating politicians about environmental concerns.
Location: Lima and one or more regional capitals.
Collaboration: NGO community.
Funding: $15,000-$30,000 per year for five years.

Project 3: Environmental Education in the Public Schools.
An environmental curriculum incorporated into primary and secondary public schools will give young Peruvians an understanding of natural resources conservation, including issues of forest clearing and biological systems. This project is part of the Tropical Forestry Action Plan for Peru.
Location: Lima.
Collaboration: Ministry of Education, FAO/Switzerland, FAO/Holland, and NGOs.
Funding: $100,000-$200,000 per year for five years.

Project 4: Environmental News Reporting by Newspapers and Television. The contracting of one or more news journalists and filmmakers will take environmental issues to a broad cross-section of Peruvians.
Location: Lima and regional centers.
Collaboration: NGO community.
Funding: $20,000-$50,000 per year for five years.

Program Area: Conservation and Development

Both internationally and in Peru, the environmental community increasingly realizes and accepts that conservation and economic development are complementary concerns. Secondly, environmental organizations and dozens of other groups in Peru are under pressure to show that their interests coincide with those of local populations, often among the poorest residents in remote rural zones. Many of the economically poor are indigenous groups, introducing a particularly complicated set of problems and constraints.

Several individuals in Peru commented that local expectations were built up when national parks and reserves were declared, but these expectations turned into frustrations when it was perceived that few or no benefits were forthcoming. A whole set of issues depend on rectifying that problem by helping local enterprises derive their incomes from the existence of protected lands. In Peru, the field of potential activities to do this includes nature tourism, natural-forest management, game cropping, sustainable extraction of minor forest products, and a number of other enterprises. Through the Central Selva Resource Management Project, AID is taking the lead on some of these issues. However, there is an enormous amount of work still to be initiated for CSRM and elsewhere.

Another dimension of harmonizing conservation with development is identifying and testing competing paradigms. Of the several theories and models for sustainable development of tropical wildlands, which ones are most viable in Peru? Under what circumstances is cropping of wild fish and game a more rational strategy than captive breeding? What kinds of agroforestry enterprises yield adequate financial and economic returns while advancing the objectives of biological diversity? What enterprises take advantage of the strengths of indigenous populations for maintenance of the forest environment? Despite a few articles and reports on some of these themes, knowledge is still deficient and poorly integrated.

- **OPPORTUNITY FOR AID INTERVENTION: Establish and enhance activities that show that economic enterprise is consistent with maintaining biological diversity.**

Project 5: Forestry Extension and Training, Yanesha Forestry Cooperative. A forestry extension and training effort will help the Yanesha Forestry Cooperative (YFC) manage the forests under its jurisdiction. As capabilities improve, the cooperative could also serve as a training center.
Location: Selva-Palcazu and Lima.
Collaboration: YFC, WWF-US, FPCN, TNC-Int.
Funding: $50,000-$100,000 per year for five years.

Project 6: Producers' Cooperative for Non-Timber Forest Products, Tamshiyacu. A cooperative for small producers of non-timber forest products will demonstrate that selva agroforestry can be economically viable. Help is needed with market studies and organization of the cooperative.
Location: Selva-Iquitos.
Collaboration: IIAP, NY Botanical Garden, and DESFIL.
Funding: $35,000-$50,000 per year for three years.

Project 7: Nature Tourism in Manu National Park.
International visitation already brings income into the region. A strategy is needed to enhance local benefits while protecting the park. This strategy requires market studies, enterprise profiles, impact studies, market promotion, and personnel training. It also requires the active participation of both the tourist industry and the local population.
Location: Cuzco and Madre de Dios.
Collaboration: ACSS and private companies.
Funding: $50,000-$100,000 per year for five years.

Project 8: Area Management Plan for Amazonian Wildlife.
Amazonian wildlife will be produced for meat and skins in three indigenous reserves, the areas of Tahuayo-Yarapa, Nanay, and Maniti. This plan requires choosing the areas, implementing wildlife inventories and management plans in each zone, and providing technical assistance for management and improvement of skin preparation. This project is proposed as part of the Tropical Forestry Action Plan for Peru.
Location: Selva.
Collaboration: DGFF, IIAAP, UNA-La Molina.
Funding: $300,000-$1 million per year for ten years.

Project 9: Management of Opuntia Cactus for Production of Carmen.
The opuntia cactus represents great economic and ecological potential for the arid and semi-arid regions of the sierra. The native plant provides protection from soil erosion, forage for animals, food in the form of the prickly pear fruit, and revenue from the export of carmen, a type of dye. This project is part of the Tropical Forestry Action Plan for Peru.

Location: Ayacucho, Apurimac, Huancavelica.
Collaboration: DGFF, CIDA, FAO/Holland.
Funding: $500,000 per year for ten years.

Program Area: Research

The preceding sections on policy and development suggest a number of questions and projects that have to be addressed before Peru can move ahead to conserve wildlands and protect and manage biological diversity. They raise a number of applied research problems for social scientists and economists. Key issues are policy analysis, research of administrative structure, valuation of wildlands goods and services, models of costs and returns in wildlands enterprises, and models of indigenous integration.

However, enhancing the socioeconomic situation cannot proceed without supporting research in the natural sciences. In Peru, basic biological inventories are weak or lacking in the face of increasing land-use pressures on many of the zones most critical for biological diversity.

- **OPPORTUNITY FOR AID INTERVENTION: Expand current taxonomic, ecological, and economic knowledge of Peru's wildlands, especially as related to the status of endangered species.**

Project 10: Flora of Peru.
The continuation of the floral inventory of Peru will provide new data on species and their distributions and habitats. The floristic composition of selected critical areas will be analyzed through permanent plots in key florula. One or more Peruvian botanists will be trained; collections in the five principal herbaria will be supported; and efforts will be coordinated with other floral work in Iquitos and Palcazu.
Location: Nationwide.
Collaboration: IIAP, several Peruvian universities, Missouri Botanical Garden, NY Botanical Garden, WWF-US, and TNC-Int.
Funding: $150,000-$250,000 per year for ten years.

Project 11: Biological Station, Manu.
A biological research station will be established and operated at Manu National Park to inventory and evaluate the great variety of flora and fauna in southeast Peru. This station will complement the one being established at Yanachaga under the auspices of AID and the Nature Conservancy International.
Location: Madre de Dios.

Collaboration: TNC-Int., WWF-US, AID/W, Princeton University, FPCN, DGFF, and UNA-La Molina.
Funding: $200,000 per year for ten years.

Project 12: Native Tree Species in the Sierra.
Applied research will identify native tree species disappearing from the sierra under land-use pressures. Questions concern economic or potential economic importance; germination possibilities; and practical diffusion of knowledge and seed to sierra communities.
Location: Various parts of the sierra.
Collaboration: DGFF, FAO/Holanda.
Funding: $20,000-50,000 per year for ten years.

Project 13: Facilities Improvement for Natural History Museums and Herbaria.
Modest amounts of funding will greatly improve facilities for bird/mammal collections at the Javier Prado Natural History Museum; for plant collection at five Peruvian botanical institutions; and for holdings in natural history and natural resources at university libraries.
Locations: Javier Prado in Lima, several botanical institutions, and various libraries.
Collaboration: Javier Prado -- LSU Museum of Natural History.
Botanical institutes -- Missouri Botanical Garden.
Libraries -- IIAP, FPCN, and various universities.
Funding: Javier Prado -- $60,000 per year for five years.
Botanical institutes -- $150,000 per year for five years.
Libraries -- $20,000-$50,000 per year for five years.

Project 14: Ethnobotanic and Economic Research of Secondary Forest Products.
Economic valuations will be combined with ethnobotanic investigations of wild plants and animals used by native peoples in Palcazu-Yanachaga. The work will contribute to the understanding of production and consumption of wildlands products other than commercial timber.
Location: Palcazu.
Collaboration: PEPP, NY Botanical Garden.
Funding: $30,000-$50,000 per year for five years.

Program Area: Training and Institution Building

None of the interventions proposed in the preceding parts of this section can be accomplished in the long run without building up Peru's system of conservation units (SINUC) and human capital to manage them. At present, many of the conservation units are little more than lines drawn on maps. They require master plans, operational plans, materials and construction, and training of personnel. Moreover, data management systems need strengthening and coordination.

At the professional and scientific levels, there is a desperate need for advanced training at the masters and doctoral levels. Particular disciplines that fit well with many of the project proposals are wildlife management, natural-resources economics, botany/taxonomy, ecology, and agroforestry.

- **OPPORTUNITY FOR AID INTERVENTION: Assist with the strengthening of Peru's system of conservation units and data centers. Improve the research and managerial capabilities of Peruvians who will be working on problems of wildlands conservation and protection of biological diversity.**

Project 15: Strengthening the System of Conservation Units.
Selected national parks and reserves will be identified as priority units for the development of master plans, operational plans, and appropriate investments in infrastructure and personnel training. This project is part of the Tropical Forestry Action Plan for Peru.
Location: Various units of SINUC nationwide.
Collaboration: DGFF, CIDA, and NGOs.
Funding: $200,000-$300,000 per year for five years.

Project 16: Enhancing Data Management Centers.
Data collection and management at CDC, ONERN, and other institutions will be analyzed for opportunities to strengthen and possibly integrate the systems for mutual benefit. This project is part of the Tropical Forestry Action Plan for Peru.
Location: Lima.
Collaboration: UNA-La Molina, ONERN, TNC-Int., and DESFIL.
Funding: $50,000-$150,000 per year for five years.

Project 17: Master's and Doctoral Education for Peruvian Specialists.
A maximum of ten qualified individuals will be selected for post-baccalaureate education at UNA-La Molina and US universities for management and research of the SINUC and the CSRM project.
Location: UNA-La Molina, US universities.
Collaboration: CIDA.
Funding: $20,000-$80,000 per year for five years.

Decision Framework for AID

The projects identified in the preceding section are not to be regarded as proposals, but rather as ideas or concepts requiring further testing and development. In Peru, project ideas for wildlands conservation and management are abundant. This

situation is explained by the intersection of a great deal of biological diversity with much poverty, making an easy case for "needs."

Another, very important factor is the large number of development institutions -- public and private, domestic and international -- that are active in Peru's natural-resources sector. Their existence and experience lead to off-the-shelf project ideas that are good to very good. The implication for AID/Peru is not to work in isolation, but rather to participate actively within the framework of existing ideas and institutions. In particular, a criterion for AID intervention should be to work under the umbrella of the Tropical Forestry Action Plan, e.g., taking the lead on components related to protected areas, wildlife, ecosystems, and genetics.

A second factor for AID is its involvement with the Central Selva region through the CSRM Project. Three reasons why CSRM must be kept in the forefront of discussions for interventions related to biological diversity are:

- AID already has a major commitment in the region;
- The Palcazu Valley supports a tremendous amount of biological diversity; and
- The indigenous groups are worthy beneficiaries of protected diversity in that region.

It would be difficult to justify the decision to support biological-diversity activities if AID did not consider Palcazu one of its priority areas for work in this domain.

Yet the case for Palcazu can be overstated. In light of the uncertainties and pessimism sometimes expressed over CSRM by consultants and other observers, it would seem imprudent to ignore opportunities outside the CSRM framework. This is especially the case in view of the many alternative project ideas competing for attention. The decision for AID is reduced to tradeoffs among loyalty, risk taking, and administrative and political issues.

Priorities among the three major geographical regions are impossible to set. This report gives examples of important threats to biological diversity in all three regions. Are "X" threatened habitats in the selva worth more to science and

economic development than "Y" habitats on the coast? How many insect species should be allowed to go extinct while efforts are devoted to the conservation of a primate? These questions cannot be satisfactorily answered. AID may choose to work in just one region or another, but would not be able to sidestep the critical problems elsewhere. The choice of areas is avoided only by selecting project ideas that focus less on geography than on policy, education, and institution building at a national level.

Perhaps the most integrative of the four program areas is the one called "Conservation and Development." The proposed interventions are at the cutting edge of issues pertaining to biological diversity and tropical-forest management. This is because they test the essential proposition of interest to AID: Are the maintenance of biological diversity and the advancement of economic development compatible goals?

Within "Conservation and Development," five interventions are proposed that can be arranged in priority according to the following criteria:

- The extent to which the proposed intervention addresses the problems of species/areas/habitats that are subject to severe threats;
- The extent to which the intervention can be integrated into ongoing AID activities and/or other similar activities. In this way, there will be greater possibilities for replication and sustainability;
- Funding levels;
- Financial and economic returns;
- Equity: distribution of both direct and indirect benefits; and
- The extent to which the intervention contributes to enhanced individual and/or institutional capability.

Institution building can stand alone or become integrated with any other proposal AID might consider. As noted several times in this report, especially in Chapter Six, Peru's environmental NGOs are young and numerous, and many are quite vigorous. Additionally, the proposed reorganization within the Ministry of Agriculture may offer new opportunities for expanding conservation activities in the

public sector. This is an exciting period in which to consider both training and institution building, as well as environmental policy and education.

Research is often given low priority by AID because of long pay-back periods and the common perception that research is esoteric. Yet in the case of biological diversity, research is the key to understanding and taking action in favor of protection and management. At the heart of biological diversity is biological science. Because there is still so much to learn about the extent and detail of biological diversity in Peru, sound ecological and biological research must be given serious attention.

Program and project elements have been presented separately to give AID maximum flexibility in responding to uncertain budget and personnel levels. A few key interventions are possible without large inputs of AID resources. On the other hand, should resources permit, AID will be able to combine a number of these elements into a larger, more comprehensive package.

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ANNEX A

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ANNEX A

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