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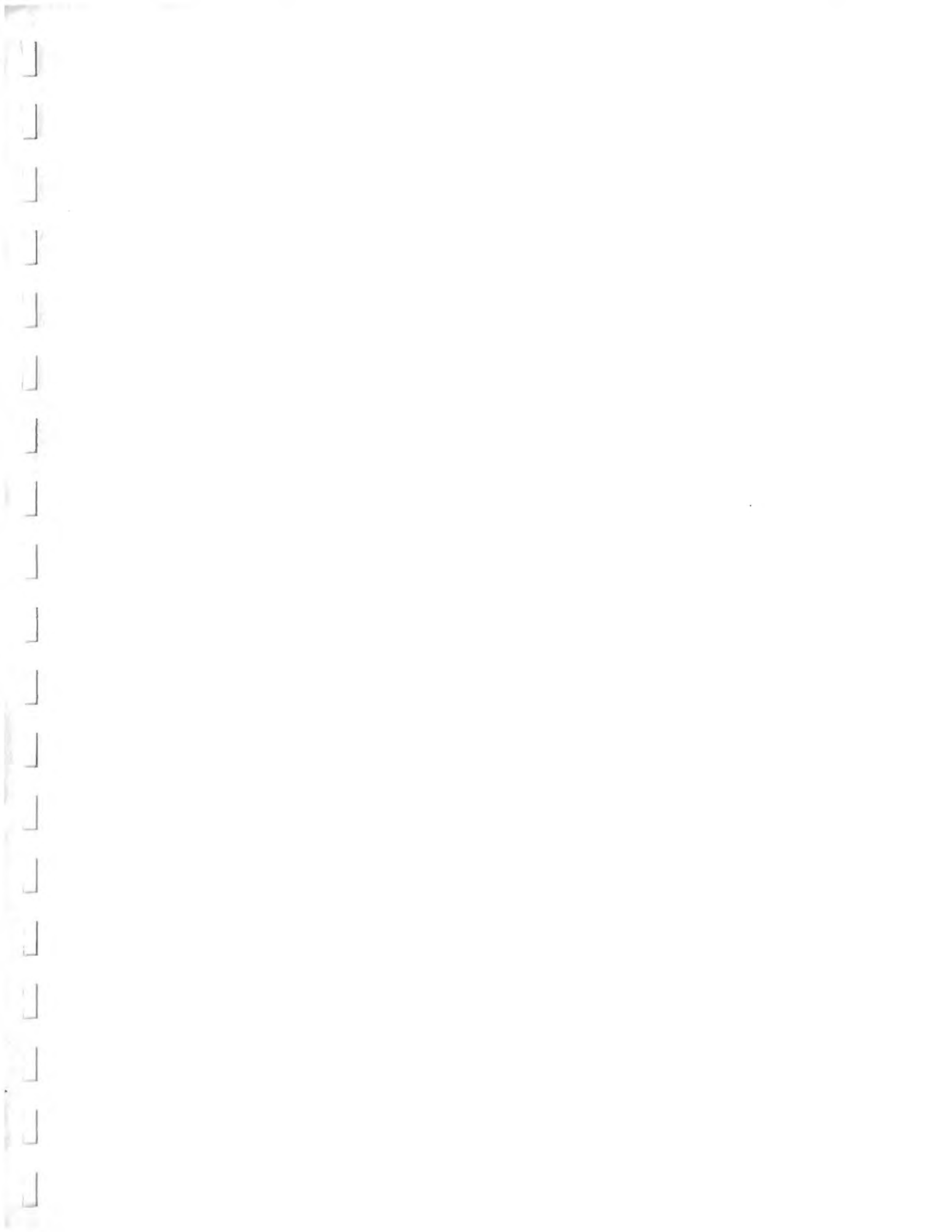
REPORT NO. 5

**PERU:
NATURAL RESOURCES ASSESSMENT:
1993 UPDATE**

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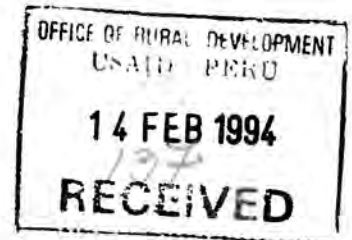


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Prepared for the U.S. Agency for International Development
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ACRONYMS

ACORENA	Conservationist Association for Amazon Natural Resources
ACPC	Cutivireni Heritage Conservation Association
ACSS	Southern Jungle Conservation Association
ADARI	Environmental Law Association for Inca Region
ADEFOR	Forestry Research and Development Association
AGUA	AGUA Development Institute
AID	U.S. Agency for International Development
AIDER	Research and Rural Development Association
AIDSEIP	Interethnic Development Association for the Peruvian Selva
APECO	Peruvian Nature Conservation Association
BIOMANU	Manu Biosphere Reserve Ecodevelopment Study Center
CAAAP	Amazon Anthropology and Practical Application Centre
CAME	Andean Ecological Management Council
CC	Conservation Data Center
CDSS	Country Development Strategy Statement
CF	Conservation Foundation
CI	Conservation International
CIDA	Canadian International Development Agency
CIED	Research, Documentation and Development Centre
CIP	International Potato Centre
CIPUR	Research and Urban and Regional Project Centre.
CITES	Convention on International Trade in Endangered Species of Wildlife and Flora
CNF	National Forestry Chamber
CODENA	Departmental Councils for the Environment
COFYAL	Yanesha Forestry Cooperative
CONAP	Confederation of Amazon Peoples of Peru
CONCYTEC	National Council for Science and Technology
COITSU	Swiss Technical Cooperation
CORAH	Special Project for the Control and Reduction of Coca Growing in the Upper Huallaga
CSRM	Central Selva Resource Management Project
DAI	Development Alternative Inc.
DISCO	Development Promotion and Study Centre
DGF	General Directorate for Forestry and Wildlife
ECOX	Ecology and Conservation Association
ECODEMAR	Peruvian Marine Eco-development Study Centre
EIA	Environmental Impact Assessment
ELAW PERU	Environmental Law Alliance World Wide-Peru
EMDEPALMA	State-owned oil palm Complex
EORI	Eori Center
FAO	Food and Agriculture Organization
FEP	Peruvian Ecological Front
FENEMAD	Agrarian Federation of Madre de Dios Department
FONCODES	National Fund for Social Compensation and Development
FONAMA	National Fund for the Environment - Bolivia
FONANPE	National Fund for State Protected Nature Areas
FPCN	Peruvian Nature Conservation Foundation
GEA	Environment and Consumer Association

GEF	Global Environmental Facility
GIZ	German Technical Cooperation
IAF	Interamerican Foundation
IDB	Interamerican Development Bank
IDEFE	Ecological Feasibility Studies Institute
INDERENA	National Institute of the Natural Resources
IDMA	Conservation and Environment Institute
IAP	Peruvian Amazon Research Institute
IMA	Water and Environment Management Institute
IMARPE	Peruvian Ocean Institute
INADE	National Institute for Development
INCOMA	Environmental Conservation Institute
INFOR	National Forestry Institute
INIA	National Agrarian Research Institute
INIAA	National Agrarian and Agroindustry Research Institute
INP	National Planning Institute
INRENA	National Institute for Natural Resources
IITO	International Tropical Timber Organization
IUCN	World Conservation Union
IVITA	Institute for Tropical and Highland Veterinary Research
JICA	Japanese International Cooperation Agency
NCTI	Local Nature, Science and Technology for Social Service
NGOs	Non-Governmental Organizations
NRC	National Research Council
OACA	Environmental Advisory and Consultancy Office
ONERN	National Office for Natural Resource Evaluation
OIS	Pan American Health Organization
PLAH	Upper Huallaga Area Development Project
PEPP	Pichis-Paleazu Special Project
PNAI	The Tropical Forestry Action Plan
PREDES	Disaster Prevention Study Centre
PROFONANPE	Administrator of FONANPE
PRONADRET	National Land Reclamation Program
PRONAMACHCS	National Program for Watershed Management and Soil Conservation
RAAA	Action Network for Agrochemical Alternatives
RAE	Ecological Farming Network
RAIZ	RAIZ Regional Development Centre
REDFOR	National Andean Forestry Development Network
SASE	Follow-up, Analysis and Evaluation for Development
SENAMA	National Agricultural Mecanization Service
SENMA	National Secretary for the Environment
SEPIA	Permanent Agrarian Research Seminar
SINANPE	National System of Natural Areas Protect by State
SINUC	National System of Conservation Units
SPDA	Peruvian Environmental Law Association
TNC	The Nature Conservancy
TR&D	Tropical Research and Development
UNAP	Unit Nations Development Programme
UNESCO	United Nations Education Scientific and Cultural Organization
UNEP	United Nations Environment Programme

VICON

Atmospheric Pollution Surveillance Project for Metropolitan
Lima

WB

World Bank

WCNC

World Conservation Monitoring Centre

WWF

World Wildlife Fund.

EXECUTIVE SUMMARY

INTRODUCTION

The 1986 amendments to the Foreign Assistance Act, Sections 118 and 119, require that each AID country development strategy statement provide information on the status of host-country efforts to conserve biological diversity and tropical forests, on the actions that AID missions could take to conserve them, and the extent to which proposed actions meet the needs identified.

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

- . Sufficient information and analysis to satisfy the congressional mandate on biological diversity and tropical forests,
- . An assessment of the present status of Peru's renewable resources, and
- . A proposed strategy including ideas for significant projects and programs that could be funded during the next five years.

BIOLOGICAL DIVERSITY

Biological diversity refers to the variety and variability among living organisms and habitats. Its importance lies in the potential it offers for adaptability and evolutionary fitness.

THE ECOLOGY OF PERU

It is generally agreed that Peru is among the three biologically richest countries in Latin America, together with Brazil and Colombia. Its three distinct geographical regions - Coast, Sierra and Selva - contain a varied array of habitat types, and the country can be divided into 11 eco-regions, 16 biogeographical provinces, and 101 life-zones and transitions.

SPECIAL IMPORTANCE OF PERU'S BIODIVERSITY

This diversity of habitats embraces one of the greatest variations in flora and fauna on earth, with more than 20 percent of Latin America's recorded floral diversity. Peru is considered to be the world's third most diverse country in terms of mammals. There are more bird species - over 1,600 - than in Brazil, a country considerably larger. The inland waters of the country support a wealth of fish species, believed to be as many as 900, while estimates of the number of invertebrate species run into hundreds of thousands.

Nearly 60 percent of Peru is covered with forests, mostly moist tropical forests in the Selva region. Although much of this area remains unstudied, inventory work has already identified some 2,000 species of vascular plants native to Peru.

The degree of endemism - species unique to Peru - is also high. The number of endemic plant and animal species is currently put at 333 and 523 respectively.

THREATS TO BIOLOGICAL DIVERSITY

Threats to biological diversity, to tropical forests and to natural ecosystems in general come from an often complex combination of social, cultural, economic, demographic and political factors, among which migration, poverty, lack of viable economic options and sometimes mistaken government policies, are commonly present.

Migration from the Sierra follows highway construction and often leads to widespread deforestation in the High Selva. Most damaging is the growing of coca which occupies the land longer than annual food crops, and pushes the degradation process further. Coastal region soils are under threat from salinity due to poor water management, the extensive high Andean pastures are suffering from degradation caused by unsuitable grazing management, and several other important ecosystems are threatened.

According to well-authenticated reports (e.g. ONERN, 1986), Peru has over 100 endangered animal species, including the yellow-tailed woolly monkey, the tapir and the spectacled bear.

DESIGNATED PROTECTION AREAS

Since its first National Park was declared in 1961, Peru has established 7.2 million hectares of protected areas, including parks, reserves and sanctuaries. The first communal reserve was set up in the Palcazu valley for the native Yanasha communities to carry on their traditional, sustainable extraction practices. It would appear that the present extent of national protected areas is more than sufficient for the limited financial resources available for their management.

ECONOMIC ASPECTS OF BIOLOGICAL DIVERSITY

Biological diversity has been a source of strength to past civilizations in Peru, providing numerous crop alternatives and helping toward a balanced diet. For international agriculture, Peru is an unparalleled source of germplasm for the genetic improvement of a number of crops of Andean ancestry, notably the potato.

The economic importance of "wildlands industries" in Peru is unquestionable, although not easily quantified, since many plants, animals and products are consumed locally without being commercialized, while the official statistics on exports probably fall short of the real totals. Official figures for forest product exports during the 80's show a 154% increase, although timber exports declined in this period. Less than 40% of installed timber-processing capacity is currently utilized.

Non-timber exports include colorants such as carmine from the cochineal insect, flavors, essences, live animals as pets and for scientific purposes, also hides and skins.

Eco-tourism is a growth industry in present-day Peru and can be further developed, given the variety of ecosystems and the improving security situation.

A major constraint to fuller utilization of the rich Selva timber resource is the 1975 Forestry and Wildlife Law, still in force when this report was written. This law does not assign rights over forest land - only over the forest stand; consequently, there is no incentive to invest in efficient, sustainable logging and management systems. Drafts of a new forest law offer solutions to this problem.

Several projects are currently trying out methods for sustainable management of natural tropical forests, notably the system developed by the Central Selva Resource Management (CSRM) project in the Palcazu valley, now in the hands of the Yanasha forestry cooperative. The system, based on simulated natural regeneration in clearcut strips, may provide an important breakthrough if it can be technically and economically proven over a period of years.

The need to develop and test sustainable forest management systems in the Selva is underscored by Peru's commitment to the International Tropical Timber Organization (ITTO) to export timber only from managed forests by the year 2000.

THE IMPACT OF DEVELOPMENT ACTIVITIES

That development activities have an impact on natural resources and the environment is not a recent discovery, but observers are less prone than some years ago to take for granted that colonizations and road-based development projects are an unmitigated blessing. The Selva - particularly the High Selva, which is nearer to Lima and is more fragile than the Low Selva - has been seen by past governments as a natural settlement area for land-hungry Andean peasants and even as the future breadbasket for Peru's major cities. Much care is needed in routing access roads so as not to open up to agriculture land that is suitable only for less intensive uses.

Migration should as far as possible be checked at source by infrastructure, credit, marketing and technical support programs. By the time an Andean family joins the migration stream it is generally in no shape to meet the challenges of a new life in the Selva and will most likely end up practising slash-and-burn agriculture - or planting coca - and speeding up deforestation, currently estimated at 300,000 hectares a year.

Organized development activities in the High Selva since 1980 have been channeled through the Special Projects, multisectoral agencies with a certain measure of autonomy, under the National Institute of Development (INADE). Through these projects, it has been possible to step up and coordinate agricultural and social support programs in a way that would not have been possible through the regular programs of the line ministries.

Too much should not be expected of the Special Projects however, as there are many activities potentially harmful to the environment and natural resources that no agency without unacceptably dictatorial powers could prevent.

LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

The legislative and institutional framework for conservation has undergone sweeping changes under the present government, in keeping with its policy of reducing the role of the State to one of promoter. The Ministry of Agriculture has borne the brunt of these changes, with delegation of regulatory functions to

INRENA, a new institution embodying the former Natural Resources Evaluation Bureau (ONERN). New forestry and water laws are in draft and are expected to be promulgated soon. From information available, they are likely to remove some of the obstacles to sustainable resource management inherent in the existing laws, although some problems may still remain.

With the reduction in the government's role, the need for effective and concerted NGO action and for some form of national environmental authority -or, at least, a coordinating body - becomes more urgent. NGO's will be called upon to fulfil an important lobbying function in defense of the environment and natural resources, especially in view of the weakening of the Environmental Code and the delegation of responsibility for environmental surveillance and impact assessments to the different ministries, only one of which - Energy and Mines - has created an environmental office at a meaningful level.

RESOURCE MANAGEMENT NEEDS

Defects in resource management have been detected in most of the eco-regions, and undoubtedly there are many examples. Causal factors are often complex, but usually one or a few factors - economic, technical, legal, etc.- can be identified. This has been attempted in Chapter Eight, and the needed actions have been indicated.

STRATEGY

On the basis of the resource management needs identified in Chapter Eight, Chapter Nine suggests ideas for AID interventions at program and project level, and a tentative decision framework indicating factors to be considered in choosing among alternative lines of action.

RECOMMENDATIONS FOR PROGRAMS

Recommendations are grouped in five program areas and projects are defined within each:

- . Policy and Legislation;
- . Institutional Strengthening;
- . Conservation and Development;
- . Research and Technology Transfer;
- . Education and Training.

Program and project elements are presented separately so as to allow AID maximum flexibility in responding to uncertain budget and personnel levels. In some cases it will be possible to combine several elements in a larger, more comprehensive package.

PERU: NATURAL RESOURCES ASSESSMENT: 1993 UPDATE

CHAPTER ONE

OBJECTIVES AND SCOPE OF THIS ASSESSMENT

INTRODUCTION AND BACKGROUND

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.

These requirements reflect a justifiable congressional concern about these two areas, which are key elements in natural resource policy in tropical countries, within the wider context of natural resource management and conservation.

As set forth in the document "Strategic Guidelines for Programming Assistance for Agricultural Development and Natural Resource Management: Latin America and Caribbean," issued by AID in November 1992, the ways in which AID can support sustainable natural resource management include:

- Training and technical assistance to develop institutional capacity to plan for the sustainable management and regulation of forests, watersheds, coastal zones and other natural resources;
- Technical assistance to enable non-governmental organizations to conduct analysis, to sponsor informed debate, and to lobby constructively for policy reforms dealing with the definition of the state's and local communities' rights and responsibilities in regulating, managing and benefiting from public lands in ways that are environmentally and economically sustainable;
- Technical assistance in the development and application of appropriate economic evaluation and environmental impact assessment methodologies and in the design of natural resource policies, programs and projects.
- Organizational assistance to facilitate decentralization of authority for the enforcement of natural resource protection policies and management of community resources;
- Research and training in management practices for fragile lands (including soil conservation, water and watershed management, agroforestry and sustainable agricultural production systems) for both the public and private sectors;

Sponsoring innovative demonstration activities such as pilot natural forest management programs, integrated pest management programs, shrimp and lobster mariculture management and private sector quality assurance programs, with potential for replication and adoption on a larger scale.

These lines of action support the Latin America and Caribbean Bureau's strategic objective "To encourage preservation and sustainable use of the natural resource base."

In January 1988, the document entitled "Peru: An Assessment of Biological Diversity" was delivered as a collaborative effort between Development Alternatives, Inc. (DAI), Tropical Research and Development, Inc. (TR&D), the World Wildlife Fund/Conservation Foundation (WWF/CF), AID/Washington, under the leadership of DAI, (Team Leader David Gow). In December, 1990, AID/Lima received the document "Peru: Natural Resources Assessment," prepared by a team headed by Frank Low. This second assessment, as its title indicates, was wider in scope, covering renewable resources in general. Both documents were commissioned in compliance with the abovequoted FAA amendments and current policy directives, as inputs for the AID/Peru Country Development Strategy Statement (CDSS).

OBJECTIVES OF THIS ASSESSMENT

According to AID/Peru's Scope of Work, the primary objective of the present document is to assess Peru's present biological diversity and tropical forests in order to present data, analysis, conclusions and recommendations in a report that updates and expands the content of the 1988 and 1990 reports. An additional objective is to present strategies and recommendations for environmental programs and projects and a decision framework for the Mission.

METHODOLOGY

As required by AID/Lima, the 1988 report served as an initial basis for the update, which also is to include data and results of significant resource-related AID projects in Peru, as well as a comparison of Peru's, neighboring countries' and U.S. legislation on natural resources and the environment and the significance of the Rio Earth Summit to Andean countries, and that of the recent reorganization of the Ministry of Agriculture.

Specific data and information were gathered from institutions and individuals in Lima, through interviews, local visits, and review of literature.

CHAPTER TWO

BASELINE DATA ON PERU'S NATURAL RESOURCES, ECOLOGY AND DIVERSITY

INTRODUCTION

In this chapter, Peru's main ecological regions are described in terms of climate, physical characteristics and biotic component. Mention will also be made of the major use capabilities of the different regions, and of the constraints affecting their sustainable use and management.

THE MAIN ECOLOGICAL REGIONS OF PERU

Several authors have produced ecological classifications of Peru. The most complete is the Holdridge Life-Zone System applied by Joseph Tosi Jr. (Tosi, 1960), which identifies 84 life-zones and 17 transitions. This system is eminently predictive and, although at first sight complicated, it is not hard to apply with a little practice and it has the merit of scientific soundness and simplicity as far as its basic principles are concerned. It has been widely applied in resource use planning in Peru. It uses climatic parameters, viz.: biotemperature, precipitation and relative humidity, recognizing 7 altitude strata and 8 humidity provinces.

Udvardy's system of biogeographical provinces (Udvardy, 1975) combines orographic, geographic and floristic aspects, but is somewhat superficial as it was intended for worldwide coverage.

The eco-floristic map of Latin America produced by the International Vegetation Map in Toulouse, France (1988) is a predictive model based on climatic parameters including precipitation, temperature and duration of the dry season. It has permitted the identification in Peru of 14 eco-floristic zones.

Zamora (1990) described a 15-region system which is virtually an attempt to simplify the Holdridge system.

Finally, the system developed by Brack (1986) recognizes 8 continental and 2 marine eco-regions based on climate, soils, hydrology, flora and fauna, showing a marked degree of uniformity within regions. This system is somewhat similar to the Holdridge and Udvardy systems. Because of its reliability in defining biotic communities, the Brack system will be used in the following analysis.

THE PACIFIC DESERT ECO-REGION

This region runs along almost the whole coastal zone in a strip from around 20 to 100 kms. wide. Rainfall is nearly non-existent, but there are frequent mists during the winter months. In general, the climate is hot and dry. Relief is flat to rolling, with 40 of the 53 rivers that cross the coast forming oases in the desert. Soils are varied in depth, with saline and calcareous horizons fairly frequent; with suitable irrigation and drainage practices they are often highly productive. 50% of Peru's agricultural output comes from this region.

The principal ecosystems of this region are:

The Coastal "Lomas"

These are peculiar ecosystems which occur from 8° S. latitude to the Chilean border; they are associated with the mist-belt that covers the Costa mainly in May through September. The moisture deposited on the sea-facing slopes between 50 and 1000 m.a.s.l. gives rise to a typical vegetation dominated by Carica candicans, Capparis prisca (shrubby species), and in the moister lomas there are trees such as Prosopis pallida and Acacia macrocanthus. Typical fauna includes carnivores, rodents, several bird species and endemic reptiles.

The Tillandsia Formations

Consist of bromelids of the genus Tillandsia which rest on the surface of the desert practically without roots. These plants have adapted to the extremely dry conditions by developing a leaf structure which is highly succulent and permits optimal moisture economy, the mists being sufficient to keep them alive.

Use Potential and Limitations

This region's greatest economic potential lies in the numerous and extensive valleys which are either irrigated or in process of being placed under irrigation, and which account for around 50 percent of Peru's agricultural production.

A particularly favorable feature is the climate, which is uniformly warm nearly the whole year, permitting almost year-round harvesting of sugar-cane, as well as the obtainment of two harvests of several other crops.

The principal constraint concerns water, which is available in usually sufficient total quantities but often in an erratic and unpredictable manner and in general is not well managed. Owing to over-watering, frequently combined with poor drainage, there is a tendency for salts to accumulate, leading to loss of agricultural land due to salinity. The total area affected is currently estimated at around 300,000 hectares. Lack of watershed management in the valleys providing irrigation water contributes to irregular flows in downstream areas.

The coastal "lomas" have served since early times as a source of firewood and grazing for the local peasant communities which live in adjacent areas and which in some cases hold traditional rights over the land. Tighter control is needed, especially of grazing by goats and of tree-cutting, the aim being sustainable use, which can include eco-tourism, given the scenic and ecological attractions offered by this unique ecosystem.

THE DRY EQUATORIAL FOREST REGION

This region stretches from the northern limit of the Pacific Desert region, around 5° S. lat., to the frontier with Ecuador. to the east it reaches into the department of Cajamarca. Its altitude range is from sea-level to between 2,500 and 2,800 m.a.s.l. Precipitation is from 300 to 1,200 mm./yr, mean temperatures 18-24 deg. C, relief varies from flat to rugged in the western Andean slopes. Soils are mainly sands, loams and clay-loams. It is much more diverse biologically than the desert region. Among its main macro-ecosystems are:

The Algarrobales

These associations are typical of the northern departments of Tumbes, Piura and Lambayeque where they cover an area of approximately 1.3 million hectares. Mean annual temperatures vary from 19 to 24 C, with maxima of up to 40 C in the areas flanking the desert. Rainfall is between 80 and 250 mm./yr. on the average, but the periodic occurrence of the "El Niño" phenomenon with abundant rains sustains a water-table that allows germination of a varied flora in which Prosopis, Capparis, Parkinsonia and Acacia spp. predominate, with a varied herbaceous flora.

The fauna includes, among the most noteworthy species identified to date, 46 bird spp. 10 reptiles and 4 mammals; conspicuous bird species include several species of doves; mammals include the Sechura fox (Dusicyon sechurae) and a squirrel (Sciurus stramineus).

The most noteworthy feature of this association is the presence of large stands of Algarrobo (Prosopis pallida) which provides a rich and varied harvest: pods containing fruit of high food value for humans and livestock, as well as flowers which are a source of honey. Unfortunately the timber makes excellent charcoal, which has meant widespread deforestation to meet fuel needs of urban centers as far afield as Lima.

Hualtaco Forests

On the border of Tumbes and Piura departments, this community is dominated by Hualtaco (Loxopterygium huasango), a valuable timber tree which provides excellent parquet.

Mangrove Swamps

Mangroves in Peru are confined to the extreme north of Tumbes department, at the mouths of the Tumbes & Zarumilla rivers and nearby areas; a tiny proportion is found at the mouth of the Piura river. The total area in Peru is about 5,800 has.

The association comprises typically a three-tier vegetation dominated by several mangrove species, Rhizophora mangle, R. harrisoniae, Avicennia germinans, A. nitida, Laguncularia racemosa and Conocarpus erectus. (WWF 1986). Soils are saline, very poor in oxygen and the vegetation is maintained by a uniform level of water salinity. The shrubby understory serves to stabilize the shore and provides a suitable habitat for the coastal aquatic fauna.

In the higher, less salty areas, small trees of the Prosopis, Acacia and Scutia genera are found, together with Cereus cacti and several grasses.

Mammals include the rat (Rattus rattus), the Sechura fox, and the nutria (Lutra sp). Reptiles of note are the American crocodile (Crocodylus acutus) and several turtle species.

Among aquatic invertebrates are a number of species including snails, decapods and clams. (WWF 1986).

Scrub Forests

These are found on the first foothills of the Western Cordillera between 200 and 1,000 m.a.s.l., in the departments of Tumbes, Piura, Lambayeque and Amazonas, covering an area of about 480,000 has. Mean temperatures vary from 24.8 °C to 25.5 °C and precipitation between 300 and 650 mm./yr. Topography is rolling to broken; soils tend to be saline in depressions; texture is variable. Canopy height is only 4 - 5 meters, with a shrubby understory which sometimes becomes dominant. Main woody species include Caesalpinia, Loxopterygium, Tabebuia, Capparis, Erytheca, Chorisia, Cordia and Acacia spp.

Low Deciduous Forests

In areas with rainfall between 400 and 1,000 mm/yr. with a pronounced dry season, on the lower Andean slopes, this association is characterized by the presence of deciduous woody species such as Erytheca discolor (Pasayo), Ceiba pentandra (Ceibo), Bursera sp. (Palo santo) and others. In some deep gully areas there are some evergreen species such as Cariacra sp. Epiphytes (Tillandsia spp.) commonly cover the branches of the main woody species.

Use Potential and Limitations

This eco-region includes about 40 percent of the irrigated land in the coastal zone, producing a wide variety of cash-crops.

Apart from the soil salinity constraint shared with the previous region, another major limiting factor for agriculture in this northern eco-region is the "El Niño" phenomenon which brings heavy rainfall, flooding and crop destruction every few years. Conversely, this phenomenon favors the natural ecosystems, stimulating and extending the growth of "algarrobo" and other tree species which are much valued in the area.

As these tree formations have only moderate timber volumes, their exploitation should be on an integral basis, producing meat, dairy products, honey and "algarrobina" as well as firewood and lumber.

The limited area of mangroves in Peru should be conserved in defense of their biodiversity and scientific interest.

PACIFIC TROPICAL FOREST

This formation is essentially an outlier of the Amazon tropical forest which stretches along the Pacific coast from Tumbes through Ecuador and Colombia to Central America with rainfall of up to 9,000 mm; in Peru this does not exceed 1,200 mm. in Tumbes department. Mean maximum temperatures are around 25.4 °C. Soils are ancient and include latosols, ultisols, podsols (spodosols) and laterites. They have little to offer for agriculture. Only one macro-ecosystem is recognized in this formation. It is the

Pacific Rainforest

This ecosystem coincides with the above-mentioned eco-region. It is a typical rainforest with a canopy height of 20-25 meters but with relatively slender bole diameter and with abundant epiphytes, although there are a few fairly well-shaped trees of Hualtaco, Cedro (Cedrela sp.), Laurel (Cordia sp.) and Triplaris sp.

The fauna of this ecosystem is very similar to that of the Amazon plain but populations are smaller. Primates include Alouatta palliata and Cebus albiformis; typical carnivores are Lutra annectens, Felis concolor, Felis onca, Felis pardalis. Arthodactyls include Tayassu tajacu, Odocoileus virginianus, and Mazama americana. Noteworthy bird species include the orders: Tinamiformes, Ciconiformes, Falconiformes, Columbiformes and Cuculiformes. Reptiles include crocodiles and ophids.

Use Potential and Limitations

As was stated above, this region has little agricultural potential. Also, owing to poor bole formation of most tree species, the forest has little timber value. On the other hand, as the only example of tropical forest on the Peruvian coast, with numerous endemic and at least two endangered species, use of this formation should be limited to the extraction of non-timber forest products. Given the scanty human population, this should not be hard to achieve.

THE ANDEAN STEPPE ECO-REGION

This region occurs on the Andean slopes along nearly the whole length of Peru from the department of La Libertad south, at altitudes between 1,000 and 3,800 m.a.s.l. This wide range of altitudes is reflected in the temperature range, with means from 6 to 18 C. Rainfall varies from 125 to 250 mm./yr., with local variation up to 500 mm.

Characteristic of this region is its highly broken topography with steep slopes and narrow, gorge-like valleys. Soils are typically shallow and stony.

Vegetation ranges from scrub to prairie, with areas of gallery forest which are monospecific stands of quinal (Polylepis sp.).

Fauna is of Andean origin with elements from the High Selva, the desert and the puna (see below). Typical species are Felis concolor, the spectacled bear (Tremactis ornatus); the guanaco (Lama guanicoe), deer (Odocoileus virginians) as well as more than 10 species of reptiles and amphibians. The main ecosystems are:

Brushlands Ecosystem

This ecosystem extends from 1,500 m.a.s.l. to 3,800 m.a.s.l. in the middle and upper western flanks of the Andean range and in the innumerable valleys of this region. Its total area is 8 million hectares. Mean temperatures vary with altitude from 4 to 18 C; rainfall likewise varies widely, from around 125 mm. to 1500 mm./yr.

Vegetation in the drier sections is scrubby with candelabra cacti (Cereus candelaris), Croton sp., Berberis sp., Carica candicans and Armatocereus sp. In the gulleys, willow (Salix sp.) and alder (Alnus sp) are frequent.

Above 3000 m.a.s.l. where humidity is higher the vegetation becomes denser with more perennials and evergreens, although cacti are always present.

Typical species include Escallonia sp., Schinus molle, Sambucus peruviana, Polylepis sp., Lupinus sp. and the prickly pear cactus or tuna (Opuntia ficus), economically important as host to the cochinitilla, source of carmine colorant.

Grasses include Stipa, Calamagrostis, Festuca and Lepidophyllum spp. with vigorous rainy season growth.

Quinuales

Situated between 3000 and 4500 m.a.s.l., these formations are scattered through the departments of Cuzco, Arequipa, Moquegua and Tacna, and in lesser extent in the center and north, with an estimated total area of 43,000 has. They get their name from the dominance of quinal, (Polylepis sp) which forms pockets in less accessible spots in the quebradas. Eleven species of this genus have been identified. Associated species include quishuar (Buddleia sp.), Ccasi and Gynopsis sp. Grasses grow in the open areas.

Use Potential and Limitations

This is one of the most densely populated eco-regions of the Sierra, in which are situated its main cities and the greater part of its agriculture, which is mainly rain-fed and is frequently combined with animal husbandry. It is here that most of the Inca bench-terraces (andenes) were built and where there is considerable scope for terrace-rehabilitation which will help to increase and stabilize agricultural production.

Current terrace-rehabilitation programs should be intensified and there is a need to extend recent successful reforestation projects.

THE PUNA ECO-REGION

The puna or high Andean moorland is situated above 3800 m.a.s.l. from 7° lat. S. to Puna and Tacna in the south. Farther north it is not found as altitudes are insufficient. Mean temperatures vary from 3° to 7° and precipitation from 150 to 600 mm./yr. The topography ranges from gently rolling to hilly with typical U-sectioned valleys formed by glacial action. Soils have a pronounced black surface horizon rich in organic matter, resting on unconsolidated volcanic ash (Andosols, cambisols, leptosols, and histosols mainly).

The fauna of this region is varied and specific. It includes the vicuña (Vicugna vicugna), the South American camelid with the finest and most sought-after wool in the world, also the guanaco (Lama guanicae) and Hippocamelus antisensis. Typical carnivores are the puma (Felis concolor), E. colocolo and Dusicyon culpaeus. Conspicuous rodents include Chinchilla (Chinchilla brevicaudata), Cavia tschudii and Laguidium peruvianum. Prominent bird species include the condor (Vultur gryphus) and numerous migratory species.

The principal ecosystems of this region are:

High Andean Pastures

This ecosystem is situated in the highest part of the Andean steppe and is composed mainly of herbaceous vegetation and some small trees. It covers around 19 million hectares and offers the greatest potential for livestock development in Peru.

Typical plant cover consists of Festuca, Calamagrostis, Poa, Bromus and several species of Stipa, known popularly as "ichu", found mainly in poor, stony sites. In the poorest areas the lowgrowing shrub "tola", (Lepidophyllum sp) takes over. There are some scattered clumps of quinal (Polylepis sp.)

Through poor range management, this formation has suffered serious deterioration. According to ONERN (1986), this has been going on since Colonial times with the introduction of sheep which select the tender, low-growing grasses, letting coarser, woody and thorny species get the upper hand. Improvement should be built around the native camelids whose grazing habits are compatible with the vegetation. With rotational managed grazing and the elimination of burning, this formation can make a large contribution to Peru's livestock industry.

Tolares

In the southern part of the puna region where temperatures are lower (3 to 6 C) and rainfall scantier (200-500 mm/yr.) several species of the genera Parastrephia & Baccharis predominate; they are known locally as "tola" and, like Lepidophyllum, are thorny and of no feeding value, though they are commonly used as domestic and bakery fuel. They grow in association with a scanty sward of Festuca, Stipa and other gramineas.

Use Potential and Limitations

While crop husbandry in this region is a high-risk, essentially subsistence activity carried on by smallholders, it is animal husbandry that is dominant, in accord with the nature of the resource base.

The high Andean pastures are the basis of Peru's livestock raising activity, with rich pastures in the northern departments - Cajamarca and La Libertad, on which a flourishing dual-purpose cattle operation is conducted, and in the central and southern sections joint grazing of cattle, sheep and camelids. Over-grazing, particularly by sheep, has led to impoverishment of central and southern pastures, and there is a need to redress the balance in favor of the native camelids which are better adapted to the species mix. Rotational grazing and elementary range improvement measures are also advisable and would help to increase substantially the value of livestock production.

THE PARAMO ECO-REGION

This region, according to Brack, lies beteen 3500 and 4500 m.a.s.l., thus including parts of Zamora's Paramo and Tundra regions. As such it has much in common with the Puna eco-region just described. It is found over a greater area in Ecuador and Colombia than in Peru, where it is limited to the headwaters of the Chinchipe, Quiroz and Huancabamba rivers in the north -higher than the High Selva.

The climate is similar to that of the Puna, though rather more humid, with precipitation up to 600 mm/yr. Soils are mainly of the Paramosol group with high soil moisture right down the profile, forming swamps in some areas. In other sections soils tend to be stony to rocky.

The vegetation is rather similar to that of the previous region; it is mainly herbaceous with isolated stands of Polylepis, Alchimilla, Escallonia and other woody species.

The fauna is of Amazon tropical origin with Andean influences; it includes ursids, canids, mustelids, felids (E. concolor & E. tigrina) It is home to the only insectivore in Peru, Cryptotis sp. Bird species are numerous for such a small formation. At least six Orders have been identified.

Use Potential and Limitations

In view of its biological endowment and of its role in watershed stabilization, this region should be conserved intact, as far as possible.

THE YUNGA OR SELVA ALTA ECO-REGION

This eco-region is situated on the eastern slopes of the Andes between the Puna and Amazon Tropical forest eco-regions. Its altitude varies between 500/600 m.a.s.l. and 3,500/3,800 m.a.s.l. depending on the latitude. As the altitude increases, mean annual temperatures fall from 17-25°C to 8-12°C. Precipitation patterns are complicated by altitude and orographic effects, with easterly exposed slopes receiving as much as 8,000 mm/yr. (or more) of rainfall. Where the altitude gradient dominates, mean annual rainfall totals tend to vary between 2,000 and 400 mm/yr., except in the highest section where it diminishes.

Relief is complex with very steep slopes and dissected valleys. Soils vary according to the site; they include inceptisols and ultisols at lower altitudes, ranging to histosols and spodosols in the cloud forest-moorland transition.

The vegetation in the higher sections consists of a low forest with 4-6 meter canopy, with shrubby elements common in the Sierra. Lower down the canopy height increases, with up to 4 stories of woody species and a herbaceous understory; lianas and epiphytes abound. Canopy height commonly reaches 35-40 m.

The fauna is much influenced by the Amazon region, notable spp. being Tayassu, Tapirus, Mazama, Panthera, Lutra and Hydrochoerus. In an abundant avifauna the Gallito de las Rocas (Rupicola peruviana) is noteworthy. Also typical are the spectacled bear and the dwarf deer (Pudu mephistopheles).

The principal ecosystems of this region are the following.

Mountain Rain Forests

These forests are found between 1,800 and 3,800 m.a.s.l. The rainfall on these eastern slopes of the Cordillera is as much as 8,000 mm/yr. in some locations. The zone between 2,000 and 3,000 m.a.s.l. is cloud forest.

Vegetation is extremely dense, with shallow soils and near vertical slopes covered with many biota such as mosses, lichens, bromeliads and climbing plants. The canopy is low - 6 to 8 meters except at lower altitudes where it can reach 15 to 25 meters. There have been few studies of the flora of this ecosystem, but the genera most noteworthy are Myrcia, Clusia, Alnus, Piper, Polylepis, Gynoxis, Weimania, Ocotea and Eugenia spp.

This ecosystem has little timber value but its non-timber potential is considerable. Most of the area should be protected against deforestation.

Lower Montane Forests

This forest ecosystem is found between 600 - 800 and 1,300 - 1,400 m.a.s.l. It includes a considerable part of the Central Selva - Pichis, Palcazu (middle reaches), Satipo, Chanchamayo and parts of the Huallaga valley. The climate is warm, with mean temperatures between 17 °C and 25 °C. Precipitation varies from about 1,600 to over 4,000 mm/yr. (the latter in piedmont sites where orographic effects predominate).

The flora of this ecosystem is highly diverse, comprising typically a closed-canopy mixed evergreen tropical forest with tree height 30 m. or over and abundance of lianas and epiphytes, giving a dense, almost impenetrable understory. The floristic composition is far more diverse than that of the cloud forest, with as many as fifty species in one hectare and wood volumes between 80 and 130 m³/ha

Among the commercial species are the moenas (Lauraceae), such as Aniba, Ocotea, Persea; also Nectandra, Cedrela, Virola and Chorisia spp.

The fauna is varied, reflecting Amazon influence, though many species are adversely affected by hunting and migrant agriculture. This region represents the frontier between the Andes and the Low Selva and has received numerous migratory flows, mostly damaging to this essentially fragile environment.

Podocarpus Forests

In some of the moister locations in the Selva Alta there are heterogeneous forests dominated by various species of the genus Podocarpus. They occur between 1,800 and 3,500 m.a.s.l. and cover a total area of about 153,000 has., mainly in the Jaén and San Ignacio provinces of Cajamarca and, less conspicuously, in Oxapampa, Chanchamayo, Abancay and between the Yanatile and Ilavero rivers. Podocarpus is known by several local names such as Romerillo, Ulcumano and Diablo Fuerte. The only native conifer in Peru, Podocarpus is a valuable commercial species which can yield as much as 120 m³/ha.

Use Potential and Limitations

Potential for economic or commercial exploitation of this region diminishes as the altitude increases. The highest section, known as the "Ceja de Selva", situated between 2,500 and 3,800 m.a.s.l., consists of very steep terrain forming the headwaters of Amazon tributaries; most of its area should be kept under protection against deforestation.

The middle and lower portions of the region contain increasing areas of production forest as the altitude diminishes. They include the well-known forests which have for many years been the mainstay of the wood-processing industries of Oxapampa, Villa Rica, Tingo María, Chanchamayo and parts of the Huallaga. Most of these forests have been depleted, partly by migrants from the Sierra who have converted them for shifting agriculture purposes. Limited areas remain available for commercial timber exploitation, requiring sustained-yield management.

Agricultural soils comprise less than 7 percent of the area, but crops are planted extensively on land suitable only for forestry or protection. This is particularly true in the case of coca, which is highly erosive and gives rise to serious pollution due to chemicals used in its processing.

There are tracts of relatively fertile riverain soils in the lower parts of the region, including parts of the Huallaga and Mayo valleys, where sustainable crop rotations - typically based on irrigated rice - are practiced. In areas of less fertile soils such as the Palcazu valley, low-input, semi-subsistence farming is most appropriate. Extensive cattle-raising has proved to be unsustainable in most of this region. Agroforestry in its various forms offers considerable promise in several areas.

More experience and analysis are need with regard to sustained yield management of heterogeneous tropical forests.

AMAZON TROPICAL FOREST ECO-REGION

This is one of the biggest eco-regions of Peru, lying to the east of the Yunga, and generally known as Selva Baja. It lies between 100 and 600 m.a.s.l. There is little temperature variation, with monthly means between 24oC and 27oC. Precipitation varies from 1500 to 2000 mm./yr. In the southern portions (Madre de Dios) the precipitation drops to between 1600 and 1200 mm/yr. with a dry season of more than 3 months.

Relief is much flatter than that of the Yunga, with extensive level areas and occasional hills of up to 500 meters above the surrounding terrain. Standing water is common in depressions and oxbows. Soils fall into two distinct categories: alluvial, characterized by fluvisols (FAO) with gleysols in wetter areas and a second scenario based on older sediments with inceptisols and ultisols predominant.

Vegetation consists typically of a 4-story forest in the moist areas and up to 5 stories in the wettest areas. Canopy heights regularly reach 35-40 meters. with emergent trees up to 50 meters.

A rich and diverse fauna includes at least 5 genera of primates, other mammal genera include Tapirus, Tayassu, felis, Leo and Lutra. Reptiles include crocodiles and several turtle species.

The principal ecosystems of this eco-region are:

Riverain Forests

This macroecosystem occurs beside the rivers and presents a diversity of vegetation according to the site, from savannalike open areas to forest with a 20-25 meter canopy height. The total area of this formation is around 3,250,000 has, of which the higher sites (restingas) offer quite fertile soils which are intensively cultivated by the local population.

It is a dynamic ecosystem with frequent changes; pioneer heliophytes quickly colonize abandoned farmland; typical species are retico (Cecropia sp.), oje (Ficus anthelminthica), requia (Guarcea sp.), cumala (Virola sp.) capirona (Calophyllum sp.) and in swampy areas aguaje palm (Mauritia flexuosa)

Timber yield is not high, and this ecosystem should be allowed to serve as first line of defense for the river-banks in times of floods.

Swamp Forest and "Aguajales"

These typical Low Selva ecosystems occur near the Marañón and Ucayali rivers and in the confluence zones of the Tigre and Pastaza rivers; smaller areas are found near Pucallpa and in numerous other points in the Low Selva. The total extent of these two closely-related formations is put at about 6,300,000 has., of which 1.6 million has. are "aguajales" characterized by the aguaje palm (Mauritia flexuosa) which is valued for its fruits which are eaten directly and are used in preparing soft drinks and ice-cream. According to Salazar (1967) the aguaje fruit is a rich source of oil which has considerable industrial potential. In the better stands there are up to 500 of these palms in one hectare.

Associated species include renaco (Ficus sp.), cumala (Virola sp.), requia (Guarea sp.), huasai (Euterpe spp.) and Jessenia spp. The Pacaya Samiria National Park is located in this macroecosystem, in one of its richest sections.

Terrace Forest

This system is found on the level to slightly rolling land on the alluvial terraces of important rivers; it covers a little over 8 million has. Soils are normally fertile, with fluvisols the most frequent order (FAO). They offer the best possibility for agriculture.

The forest consists typically of climax vegetation with a canopy height of 30-35 meters; Timber production is estimated at around 55 m³/ha. but most of it has been high-graded.

Typical species include:

Catalina	<u>Hura crepitans</u>
Machimango	<u>Lecythis sp.</u>
Oje	<u>Ficus anthelminthica</u>
Quinilla	<u>Manilkara sp.</u>
Requia	<u>Guarea sp.</u>
Ubilla	<u>Pourouma sp.</u>
Castaña	<u>Bertholletia sp.</u> (In Madre de Dios)
Cumalas	<u>Trianttera sp.</u> , <u>Virola sp.</u>
Moenas	<u>Aniba spp.</u>
	<u>Ocotea sp.</u>
	<u>Persea sp.</u>
Lupuna	<u>Chorisia sp.</u>
Tornillo	<u>Cedrelinga catanaeformis</u>
Marupa	<u>Simarouba amara</u>
Azúcar Huayo	<u>Ilymenaea palustris</u>
Tulpay	<u>Clarisia racemosa</u>

Upland Forests in the Low Selva

Situated on old terraces and hills which have suffered varying degrees of denudation and dissection, this is the most extensive forest type in the Low Selva with an estimated area of 26 million hectares. Typical soils are dystic inceptisols, ultisols (all infertile) and, in the drier areas in Madre de Dios, luvisols and alfisols.

Canopy height is from 35-40 m., with often two lower tree stories and a rather open underbrush permitting good visibility. Species diversity is extremely high, both in woody and herbaceous species. Typical timber trees include:

Tornillo	<u>Cedrelinga catanaeformis</u>
Quinilla	<u>Manilkara spp.</u>
Shihualnaco	<u>Coumarouma sp.</u>
Cedro	<u>Cedrela odorata</u>
Caoba	<u>Swietenia macrophylla</u>
Ishpingo	<u>Amaburana cearensis</u>
Chinicua	<u>Perebea sp.</u>
Copal	<u>Protium sp.</u>
Zapote	<u>Matissia sp.</u>
Quillobordon	<u>Aspidosperma sp.</u>
Shumbillo	<u>Inga sp.</u>
Copaiba	<u>Copaifera sp.</u>
Shiringa	<u>Hevea sp.</u>

Timber volumes are high - between 90 and 140 m³/ha., but the high species diversity means small volumes of any given species. Until more species become recognized in world markets, extraction costs will tend to be high.

Bamboo Forests

These stands of bamboo (Merostachis & Guadua spp.) occur in rather similar sites to the upland forest and cover nearly 1,5 million has. in the Low Selva. The bamboo plants, which often present up to 4,000 canes per ha., of 15 - 20 cms. diameter, are a rich potential source of cellulose for pulping. The forest contains from 10 to 50 trees per ha. of typical Low Selva species; it is of little value as a timber source.

Use Potential and Limitations

This region contains the most extensive, diverse and rich ecosystems in Peru with a great productive and commercial potential both in timber and non-timber forest products.

Commercial exploitation of these forests goes back a long time, but we are still little nearer to establishing viable and sustainable management systems. The most serious efforts toward the preparation of inventories and volume-tables were made in the 1970's in the Von Humboldt national forests, where silvicultural trials, phenological studies and other valuable technical and scientific studies were carried out, only to be cast aside due to high-level decisions.

The Central Selva (Palcazu) experiment, based on the strip-cutting system, aimed at achieving sustained-yield management of tropical forests, is promising but is still in its early stages and requires continued perseverance in order to assess its real potential.

There are two important obstacles to good forest management in this region: firstly, the general existence of a short-term outlook regarding investments and returns, and, secondly, legislation which tends to favor early gains at the expense of long-term investments in forest management.

The new forest law expected out shortly is believed to contain provisions recognizing rights over forest land which will provide an incentive for sustainable management. Much technical work remains ahead, however, in order to establish viable management systems: up to the present, Peru has no tropical forests under management.

THE CHACO SAVANNA ECO-REGION

This outlier of the savannas of Bolivia, Paraguay and Brazil is situated mainly in the Pampas del Rio Heath in Madre de Dios department. It is a typical palm savanna, with palms and shrubby species.

Typical palms include Mauritia flexuosa and other members of this genus. Grasses include Andropogon sp.

This ecosystem is the habitat of the Swamp Deer (Odocoileus dichotomus), the "lobo de crin" (Chyrocyon sp.) and several bird species of the genera Ara, Buteo, Arantiga, Rhynchous and others.

Table 2.1

DIFFERENT ECOLOGICAL CLASSIFICATIONS OF PERU

Holdridge Ecological Map	Brack Ecoregions System 1986	Udvardy Biogeographic Provinces 1975	Toulouse Ecofloristic Zones 1988
84 Zonas de vida natural 17 transiciones ZONAS NATURALES			
Desierto	Desierto Pacifico	Desierto Pacifico	Desertica
Matorral desértico	Bosque Seco Ecuatorial	Bosque Seco Ecuatorial	Tropical Muy Seca
Monte Espinoso			Tropical Seca a Muy Seca
Bosque Muy Seco	Bosque Tropical del Pacifico	Andes Meridionales	Tropical Seca
Bosque Seco			Tropical Submontana
Estepa Espinosa	Serrania Esteparia	Andes Septentrionales	Tropical Húmeda con una estación Seca
Estepa			Tropical Sub Humeda
Paramo Humedo	Puna	Puna	Tropical de Alta Altitud sobre límite Boscoso
Paramo Muy Humedo			Tropical Montanosa Muy Humeda
Tundra Seca	Paramo		Tropical Montanosa Húmeda
Tundra Húmeda			Tropical Montanosa Sub Humeda
Tundra Muy Húmeda	Selva Alta o Yunga	Yunga	Tropical Montanosa Seca
Tundra Pluvial			Tropical Muy Húmeda
Paramo Pluvial	Selva Baja o Bosque Tropical Amazónico	Amazonia	Tropical Húmeda
Bosque Pluvial			
Bosque Muy Húmedo		Lago Titicaca	
Bosque Húmedo	Sabana de Palmera		
PISOS ALTITUDINALES			
Basal (Tropical)			
Premontano	Mar Frio		
Montano Bajo			
Montano	Mar Tropical		
Subalpino			
Alpino			
Nival			

CHAPTER THREE

THE PRESENT STATUS OF CONSERVATION

INTRODUCTION

In this chapter - as in the whole document - the term "Conservation" refers to natural resources in general, although special emphasis is given to biological diversity. The following is a definition of what is currently meant by this term.

DEFINITION OF BIOLOGICAL DIVERSITY

As quoted in Gow et al (1988), biological diversity refers to the variety and variability among living organisms and among the ecological complexes in which they occur. Its importance lies in the potential it provides for enhanced adaptability and evolutionary fitness, in both biological and cultural terms. Biological diversity occurs at different levels, as is shown by the following.

Ecosystem diversity

This refers to the number and variety of ecosystems that occur within a given area. It is closely related to diversity of climate, landforms and other natural site-conditioning factors.

Species diversity

This term refers to the total availability of genes of a given species, whether or not they are expressed in the phenotype. This genetic variety, and its ability to mutate, are the main elements that determine a species' ability to adapt and evolve. An environment where both a domestic crop variety and its wild ancestors are present has more genetic diversity than one in which only the domesticated variety is present.

THE BIOLOGICAL IMPORTANCE OF PERU

Long before scientists began listing species, ancient civilizations in Peru both knew and made use of its rich diversity. Before 1800 there were records of many domestications, notably potatoes, maize, tuna, olluco, quinua, oca, mashua, cañihua, beans, kiwicha, arracocha, achiote, peppers, sweet potato, lúcuma, avocado, pacae, custard-apple and many more, which have been regular items in the Andean diet. Likewise, domesticated animal species, although less numerous, have been no less important, examples being the guinea-pig, llama, alpaca and guanaco. These are apart from the hundreds of wild plant and animal species which have had to do with the survival of Peru's ancient inhabitants. Nowadays the megadiversity of Peru is widely recognized, sharing with Brazil and Colombia first place in biodiversity in Latin America, and reflecting the great diversity of climates Peru enjoys.

Gentry (1988) identified the most diverse forests in the world in the department of Loreto: he found more than 300 species of trees in the Yanamono area and 289 in Mishana. The longest inventories of mammals in the world were recorded at Balta on the Curauja, tributary of the Purús river (CDC, 1991). In the Manu Biosphere Reserve, between 3450 and 365 m.a.s.l., 190 species of mammals were identified, including 48 rodents, 79 bats, 17 carnivores, 13 primates and 6 artiodactyls among others (Pacheco, 1993). Peru has around 1700 of the 9400 bird species described in the world, a tenth of the 4,000 mammals and 500 of the 6300 reptile species. (UNEP-ONERN, 1992). (See Table 3.1)

In order to get a picture of the orders of magnitude in biodiversity, about 500,000 species of plants and animals have been described in Amazonia, of an estimated 1.5 to 2 millions in this region. However, recent estimates based on the increasing number of discoveries, especially of tree-living insects, speak of more than 30 millions, far in excess of the currently held idea of 5 to 6 millions in the world. (Sioli, 1992)

Endemisms

Much of the importance of Peru's biodiversity lies in the endemic nature of many of its species. According to present knowledge, there are 333 animal species and 523 plant species that are endemic to Peru - i.e. are found only in this country. Endemic animal species include 46 mammals, 105 birds, 95 reptiles, 87 amphibians and 50 fish species. (Brack, 1986; UNEP-ONERN, 1992).

This high level of endemism reflects the extremely varied biogeography of the country and, particularly, the existence of many enclosed valleys forming natural refuges for flora and fauna.

THREATS TO ECOSYSTEMS AND TO SPECIES

Threats to biodiversity come from a variety of sources. Changes in social behavior patterns and in economic priorities are among the commonest factors involved. This is nowhere more apparent than in the Sierra where the conquistadores replaced the stable Inca agriculture with "civilized" crops grown by methods often unsuited to the environment, under an economic system based on the exploitation of mineral resources. In Andean valleys where, under the Incas, crops had been grown on bench-terraces with the hillsides largely under forest, the Colony allowed the terraces ("andenes") to fall into disrepair and farming spread out along the hillsides bringing deforestation and erosion.

Biodiversity has a clearly important role to play in watershed protection: replacing a mixed forest with a single crop often brings erosion, landslides, and upsets in the river regime that may be extremely costly in property and lives.

The building of penetration roads into the Jungle, heralded as a step towards solving the problems of Sierra land-hunger and tapping the vast potential of the Selva, has been a mixed blessing. Whether accompanied by a conscious colonization policy or not, the immediate result of these road construction programs has been the creation of agricultural settlements often on land suitable only for forestry or protection (Only 5 to 6% of the Selva's land surface is classed as suitable for annual crops).

During the 80's this situation worsened drastically with the increase of illicit coca-growing. Because of its illegality, and especially with forcible eradication, coca has

moved out onto the steeper hillsides, destroying forest and upsetting river regimes, not to mention the contamination caused by the chemicals used in coca-paste processing.

Since over 90% of Peru's forests are in the Selva, it is there that most of the wood processing plants are located. The national market accepts only a few species of timber and these are got by primitive logging methods which are damaging to the forest but which, more seriously, open trails which are subsequently used by slash-and-burn farmers who finish off the forest.

The high Andean pastures are under threat from overgrazing by sheep which select the tenderest shoots, leaving the coarser, less palatable species untouched. This is a direct consequence of replacement of native camelids with a less suitable European species. Common sense suggests a return to the camelids which are completely adapted to the environment.

The ever-growing demand for firewood and mine lumber has contributed to the destruction of Andean and coastal forests. Also, according to Dourojeanni (1990) the initial cause of Andean deforestation was burning for pasture. In the Costa, one of the gravest threats is what has been termed "urban erosion" the expansion of cities on to prime agricultural land, notably in Lima. Also in the Costa, poor irrigation and drainage practices have led to soil salinity which has thrown some 300,000 has. of good farm land out of production - a virtually irreversible process due to the prohibitive cost of reclamation.

DESIGNATED PROTECTED AREAS

Peru's first National Park was set up in 1961 in Cutervo, Cajamarca, with an area of 2,500 has. Four years later the Tingo Maria National Park was established, with an area of 18,000 has. It was after 1971 that establishment of protected areas known as "conservation units" began as an organized process. There are now 25 of these units, made up of 7 National Parks, 8 National Reserves, 7 National Sanctuaries and 3 Historical Sanctuaries, making up the National System of Conservation Units (SINUC), with a total area of 5,513,426 has. (See Table 3.2)

Apart from the Conservation Units, there are other protected natural areas which, together with SINUC, form the System of Natural Protected Areas (SINANPE). These are 5 National Forests, 6 Protection Forests, 2 Hunting Preserves, 1 Communal Reserve and 7 Reserved Zones, giving a total protected area of 7,207,716 has.

There has been considerable argument as to how effective protected areas are in conserving biodiversity. Some authors, including Dourojeanni and Rios (1981) and CDC (1991), have made overlays of life-zone or biogeographic maps on the map of SINUC, but were not able to draw very satisfactory conclusions. A basic problem would seem to be that the protected areas are defined in terms of very broad climatic parameters like biotemperature and precipitation; in this connexion more study is needed on ecosystem diversity as related to more specific climatic parameters.

Some years back, attempts were made to define protected areas as Pleistocene refuges (Lamas, 1979), but the view now prevails that the whole Amazon region is a Pleistocene refuge, and that differences in the distribution of certain taxonomic groups can be explained rather by soil and microclimate differences, with the roles of plant and animal species being closely related in the working network of the

ecosystem, (Sioli 1991). For the purpose of defining these processes, including phenomena such as coevolution, mutualism and competition, more complete inventories of flora and fauna are needed.

The merits and limitations of nature reserves as a means of defending biodiversity have given rise to an extensive literature.

While not against conservation projects as such, the present authors believe that, in less-developed countries where generally biodiversity is highest, economic and human resources are hard put to it to control such reserves; furthermore, the role and attitude of existing populations in a designated protection area require careful study in order to establish common objectives. Finally, when the choice lies between declaring a new park and helping to increase sustainable agricultural production on land suitable for this purpose, the latter may often be the better alternative. At least, the two solutions can be complementary.

SOCIOECONOMIC IMPORTANCE OF PERU'S BIOLOGICAL DIVERSITY

Peru has been described as one of the four centers of origin of world agriculture. During Inca times at least 160 plant and animal species were domesticated, including the potato, maize, sweet potato, coca, beans, tomato, cotton, kiwicha & quinoa, to name only a few. Several of these crops entered into world-wide production, but relatively few varieties were adopted, which means that in order to improve them recourse must be had to the rich and varied Peruvian germplasm.

Apart from domesticated species, at least 1,200 wild plant species are known to be in use for almost every conceivable purpose, notably food, fiber, oil, tannin, colorants, dyes, seasonings and flavors, perfumes, and a variety of medicinal uses. Animal species with known uses number thirty or more, and the literature is undoubtedly short in its estimates. Studies now underway in more than a dozen Peruvian research centers including the Cocha-Cashu biological research station in the Manu National Park, the IIAP centers in the Selva Baja and the INIA (National Agrarian Research Institute) stations, are constantly adding to the store of knowledge about known and newly-found species of potential economic value.

A study commissioned by the U.S. National Research Council (NRC, 1989) identified 31 Andean crops - some of them on the point of extinction - which could be a valuable addition to the diet of several distant countries, not to mention the pharmaceutical and other industries. Notable examples are achira (*Canna edulis*), ajipa (*Pachyrhizus tuberosus*), maca (*Lepidium meyerij*), mashwa (*Tropaeolum tuberosum*), oca (*Oxalis tuberosa*), olluco (*Ullucus tuberosus*), kañiwa (*Chenopodium pallidicaule*), kiwicha (*Amaranthus caudatus*), quinoa (*Chenopodium quinoa*), tarwi (*Lupinus ballianus*) and lúcuma (*Lucuma obovata*). These are typical of a large group of protein-rich or otherwise attractive crops as diet supplements or regular food items. Several of these Andean crops are already becoming popular in countries as far afield as New Zealand and Britain.

Native groups in the Selva customarily get most of their protein from wildlife and fish. According to Pierret and Dourojeanni (1966, 1967), thanks to hunting and fishing, the diet of Amazon natives is not protein-deficient. Another study (PNAF, 1991) showed that the average native inhabitant consumes 49 animals annually and these provide 50% of his protein input. This source accounts for more than twice the amount of protein provided by domesticated livestock in the region. Skins,

fibers, guano, pets and experimental animals are just a few of the products obtained from wildlife in Peru. With suitable management, wildlife could play an even more important role in the future.

Official production figures often omit products handled informally or within the producing or gathering families. As an example, a recent study in northern Peru gives production of 204,100 MT/yr. of algarrobo fruit (*Prosopis sp.*), of which 159,900 is used as feed supplement for cattle and goats and for the production of algarrobina essence. The study indicates a value of US\$ 2.4 millions which does not show up in the official figures. Similar observations can be made concerning numerous Selva plants. Some examples of wild plants which enter the informal economy are listed in Table 3.3.

CONSUMPTION AND SALE OF WILD PLANTS AND ANIMALS

Despite urban concentration, the majority of Peru's inhabitants depend on wild plant and animal species for many necessities of their daily life. Food, energy, medicines and many other articles used by a large section of the rural population - and many urban residents too - are provided mainly by the wild flora and fauna. The greater part of this production comes through an informal economy in which labor from the family or from small enterprises is harnessed; sometimes a portion of this production finds its way into the formal market.

Wildlife is the main source of protein for many rural populations, especially in the Selva. Energy needs are met, as far as possible, by firewood and charcoal obtained from trees that, in the Sierra, are now scarce. It has been calculated that this source covers one-third of Peru's primary energy consumption. Medicinal plants are the first -and often the only-source of medication for rural dwellers.

Official figures show a 154% increase in forest product exports during the 1980's. As Table 3.4 shows, this increase was in nontimber products and wildlife, while timber exports declined, in part because of the artificially high exchange rate during the 1985-90 period, which hit the high-cost timber industry hardest. Principal foreign-exchange earners are the cochinilla bug, or the carmine extracted from it, Brazil nuts, seeds and powder from tara (used for tanning), medicinal materials such as quinine and curare, and palmito (*Bactris gasipaes*). Cochinilla (*Engl. cochineal*) sells for US\$ 15.2/kg. FOB and carmine at US\$ 111.2/kg, showing the advantage of obtaining the value added in the place of origin. Peru provides 95% of the world's cochineal/carmine. Its production is important in several Sierra departments, where bugs from wild or planted "tuna" cacti (*Opuntia sp.*) are harvested. Incidentally, this cactus is now being sown in contour rows for soil conservation purposes. The prohibition of synthetic colorants in the food industries of several industrialized countries has helped to stimulate demand for natural colorants, such as carmine and bixina, obtained from achiote (*Bixa sp.*), which grows wild and under cultivation in the High Selva of Peru.

Consumption of wildlife products follows similar patterns. An estimated 13,000 tons of meat from this source is consumed annually by Selva inhabitants, about equal to the quantity of beef consumed in the region.

Exports of wild birds in 1982-86 averaged slightly under 48,000 specimens a year, equivalent to US\$ 440,000 FOB. In 1991 the value of exports was US\$ 356,000.

According to PNAF (1991) the Peruvian vicuña population, two-thirds of the world population, has considerable economic potential; An annual shear of 60,000 animals is feasible and would yield 6 MT of fiber worth US\$ 7 millions, an amount which could be doubled in the medium term with suitable management.

Official figures for 1991 indicate production of nearly 100,000 hides of animals hunted in the Selva. Earlier figures quoted in Gow et al (1988) speak of a registered 300,000 hides exported annually, considered to be about 60% of the true total, over a 20 year period. In the same period, the legal export of live animals through Iquitos averaged 250,000 specimens annually. At least 150 species of live animals have been captured for export, mostly as ornamental birds, and primates as pets and for medical research. It is generally recognized that illicit exports are considerable, though unquantifiable.

NON-CONSUMPTIVE USES OF WILDLANDS: NATURE TOURISM

The rapid recent growth of nature tourism is no doubt a reflection of the stressful conditions under which people in the so-called developed countries live. In fact, it is becoming an integral part of their lives thanks to the accessibility of long distance travel. Among the world's venues for nature tourism Peru is one of the most attractive ecologically, historically and culturally.

The Machu Picchu historical sanctuary, the Paracas Natural Reserve, the national park of Huascarán and the recently- created reserved area of Tambopata-Candamo are internationally recognized for their attraction for visitors with scientific, cultural or recreational interests.

According to official figures, 317,000 foreign tourists visited Peru in 1990, spending US\$ 351 millions, up 6% from the 1985 figures. Most visitors combine several places of interest but the most favored is Cuzco for its archeological, historical and cultural attractions and as a center for visiting the Urubamba valley, Sacsahuamán, Ollantaytambo and Pisac. Cuzco also is the springboard for a visit to the Manu National Park, the Tambopata-Candamo Reserve and the Pampas del Heath Sanctuary. In 1987, four companies operated in the Manu National Park, catering for nature tourism, attending 500 visitors; in the same year, 3 agencies operated in Tambopata-Candamo and areas near to Puerto Maldonado, catering to 6,500 visitors. Income generated by this activity totalled US\$ 1.5 million, an amount far in excess of the value of rubber production and equal to 45% of the value of Brazil nut exports from the same zone.

The activities of tour operators in the Iquitos area, the Colca Valley, the Callejón de Huaylas & Cañete to name a few have contributed to the growth of scientific, adventure and recreational tourism in recent years.

One area with short-term growth potential is the department of Madre de Dios where, in 1990 and 1991 two new lodges were built in the Manu National Park where there is much that is of interest to scientists, in particular the work going on at the Cocha Cashu biological station, recognized as one of the most important laboratories in the world for the study of tropical ecosystems.

There is good reason to believe that, as internal peace returns to Peru as a result of the current government's pacification campaign, the flow of tourists will increase significantly, an outcome both the tourism industry and the authorities should be prepared to embrace.

INVESTMENTS AND RETURNS IN NATURAL FOREST MANAGEMENT

In May 1990 Peru subscribed to the commitment by the member countries of ITTO - the International Tropical Timber Organization - to have their tropical forests under sustainable management by the year 2000. This was a courageous move considering that, at the present time, there are no tropical forests in Peru which can be said to be under management. The forest areas designated by the State as production forests are subject to high grading - selective logging - conducted mainly (80%) by small loggers who assume no responsibilities for management. Under the 1975 Forest Law - still in force when this document was prepared - concession areas of less than 1000 has. required no management plan; concessionaries get round this by opting for slightly less than this area, often bulking up concessions into larger areas.

The timber industry is not integrated with the forest; the industrialists feel no incentive to integrate as they get 80 percent of their raw material from the small loggers who either poach timber or log it under concessions of less than the statutory 1000 hectares.

Three serious management trial projects are under way at this time. ITTO is funding a three-year reforestation and sustainable management program in the von Humboldt National Forest, formerly funded by FAO and JICA. It is jointly managed by the National Forestry Chamber (CNF), FPCN and INRENA, with a 1992 budget of US\$ 516,000. The Peruvian Amazon Research Institute (IIAP), with the support of COTESU, the Swiss government's technical assistance agency, is conducting a study of enrichment plantation at Jenaro Herrera in Loreto department. Thirdly, AID funded and provided technical support to the experimental strip-cutting system of natural forest management now in its tenth year in the Palcazu valley, with administration by the Yanesha Forestry Cooperative, COFYAL. In the Pachitea valley rural settlement project, plots of 400 has. are allocated to settlers, who are allowed an annual cut of 13 has. with processing of the produce and regeneration through a combination of natural recovery and replanting. This project has now entered the pilot stage under a corporate system based on the COFYAL model.

Although none of these projects has completed a full rotation cycle, some preliminary observations can be made. Concerning the Palcazu strip-cutting paradigm, early expectations that regeneration in the clear-cut strips would be accompanied by stand enrichment due to early dominance of light-seeking, high value tree species have not been borne out; it appears that this process does not differ much from regrowth in natural clearings, with high early species diversity which has to be reduced by periodic thinnings, which push up costs. Another aspect which needs more study is marketing. The use of preservation does allow small-diameter material to be offered, while recent studies-notably the ITTO-funded study of 20 promising species not yet recognized in the world market- has broadened the range of timber potentially marketable. More work is needed, however, on market demands, prices and costs. On the management side, COFYAL has suffered setbacks, largely due to doubts concerning the technical and economic viability of the system. Follow-up action must be intensified if this promising initiative is to bear fruit.

In contrast to the Palcazu-COFYAL project which was modestly funded, the von Humboldt project will spend US\$ 2.67 millions in three years in order to prepare and implement a management plan for 105,000 has. as a demonstration model of management oriented to ward the timber industry and compatible with

sustainability. This year will be devoted to the making of an inventory, demarcation of protection forests, design of a road system and the granting of logging permits through public bids.

In none of these projects or studies has there been a completed rotational cycle, so it is still too early to forecast which system, if any, will prove successful in combining profitable forestry with sustainability.

INVESTMENTS IN GERMPLASM BANKS

Agricultural species diversity worldwide has decreased greatly in recent years with concentration on an ever-smaller range of species and particularly, of varieties. Of the 3,000 or so crop species that have been grown by man, only 200 are now significant. Genetic improvement of modern cultivars benefits from access to their wild ancestors, and Peru has a good share of these, including potatoes, tomatoes, beans, tobacco, guava, squash, cinchona and coca to name a few.

The National Institute for Agrarian Research (INIA) maintains 34,761 collections, corresponding to 103 species, located at its different experiment stations. Thirty species have been given priority as a crop pool for the 1992-94 program, at a factor cost of approximately US\$ 110,000. Crops chosen include quinoa, oca, tarwi, several grain legumes, oilseed crops including native cotton, tropical fruit species such as camu camu, arazá, guaraná, banana and pijuayo, root crops and native fruits from the Andes and others. Banks include conservation in situ and in vitro.

Crop improvement programs require, as a general rule, from US\$ 1 to US\$ 2 million dollars spread over 7 to 8 years of research and product development. The cost depends on the nature of the crop, particularly its growth cycle: for instance, Peruvian wild, colored cotton, with a life span of 5 to 7 years, would need an investment of around US\$ 4 millions over a period of 8 years to improve fiber quality and double the yield - an investment that could be recovered in 3 to 5 years' commercial production. The development of a new potato variety with hairy leaves transmitted from a wild parent through a crossing recently made in the International Potato Center (CIP) will produce for commercial use a potato plant free from insect pests, permitting, according to CIP estimates, a worldwide saving of US\$ 300 millions annually in pesticides.

The INIA in conjunction with universities has developed four new potato varieties with yields between 25 and 50 MT/ha. and with marked disease resistance, as well as tolerance of adverse climatic conditions.

A tree germbank with both native and exotic species is maintained by ADEFOR, the Cajamarca NGO in charge of planting programs in that department; it includes among native species aliso, quinal, queñua, algarrobo, cedro, molle and tara. Exotic species include pines, eucalyptus, cypress and casuarina. Total stock currently stands at 340 kg.

DISTRIBUTION OF BENEFITS AND COSTS

For many years the advocates of sustainable development in the humid and wet tropics have been trying to establish some common ground with economists in order to express, value and recognize the functions and services of natural ecosystems.

The economist frequently utilizes private market transactions to establish the value of goods and services in market terms, and may also use value in a non-market sense. (Farnworth *et al.* 1981). The ecologist, on the other hand, will frequently accept value in the above contexts but may also refer to value in intangible terms, such as the value inherent in an ecosystem in the performance of a free service to man. These authors go on to cite examples of market (assignable), non-market (non-assignable) and intermediate goods and services obtainable from a natural ecosystem but leave open the question of how to value each category in a manner satisfactory to both disciplines. It is clear that the market-place is not equipped to value society's view of benefits -especially intangible ones - that may be derived from an undamaged ecosystem in the future. Likewise, present-value and benefit-cost analyses underestimate what the ecologist conceives as society's evaluation of the future worth of benefits to be derived from an undamaged ecosystem, because the normal, market opportunity cost of money used as the discount rate reduces the present value of such benefits more than it reduces the present or short-term cost of foregoing consumption by adopting sustainable management. Planners tend to choose conservation projects that show net present values (NPV) of incremental benefits greater than zero when discounted at the opportunity cost of capital. However, because of externalities or intergenerational equity considerations decision-makers may choose projects with negative NPV's. (Sfeir-Younis, 1982). Such choice may not meet with the approval of either present land-occupiers or neoliberal governments however. The literature does show some encouraging efforts to reconcile ecological and economic thinking on these matters, as is seen from Farnworth *et al.* (1983) and other publications.

In the case of Peru, several authors have produced figures to demonstrate the comparative benefits of sustainable resource use consisting of, for instance, the gathering and consumption and/or sale of wild plants and animals, non-destructive logging, etc. versus conversion to pastures, to slash-and-burn farming or destructive logging. Brack (1989) compares three production alternatives for an area of 1000 has. with 10 has. of river or standing water. Alternative 1 is the "natural" or conservation alternative consisting of wildlife and fish exploitation, renewable timber harvesting, latex, medicinal and ornamental plants, construction materials, firewood and tourism, yielding US\$ 8,038 net annually. Alternative 2: Conversion to pasture, shows a net loss of US\$ 51,640/yr., while the third alternative -agroforestry, shows a net income of US\$ 30,000/yr., evidently far superior to the other two. This comparison makes some assumptions regarding effective demand and real farm-gate price for wildlands products that may need checking out, while the third alternative may be sitespecific to the extent that it depends on levels of soil fertility that may not be typical of large areas in the humid tropics. Two other references to this subject are worthy of mention. Peters, Gentry and Mendelsohn (1989) tell of an area supplying wildland produce to the city of Iquitos, quoting a net income of US\$ 400/ha./yr., a figure that no doubt reflects proximity to the city (Southgate and Clark, 1993). Padoch *et al.* (1985) describe the Tamshiyacu agroforestry system which is one of the few market oriented traditional forest-management systems that are evidently both sustainable and profitable.

Several attempts have been made to evaluate the income and expenditure for the COFYAL (Palcazu) strip-cutting system with natural regeneration. In the original theoretical model described by Tosi (1982) and based on prior work by Hartshorn (1980), gross returns per hectare were estimated at US\$ 3902.92, for an average clear-cut volume of 175 m³/ha. in old growth natural forest. Total per hectare costs were put at US\$ 984.70, of which \$ 688.05 would be recoverable as family labor, leaving net proceeds to operator-family of US\$ 3606 per hectare. These figures have

not been realized in practice, largely because they rely heavily on sale of hitherto unknown species and polewood, for which no demand or price has been found to date. Also, these figures refer to old growth natural forest, not to regrowth, for which figures will not be available until year 40. The urgent need at this time is for in-depth market analysis backed by trials of new species.

It should be noted that it was only in 1988 that the COFYAL project passed from the basic research stage to that of a pilot forest cooperative and that there are some positive findings, e.g.:

- (1) The strip-cutting system has trebled the customary industry-oriented extraction rate and has doubled the extraction rates of the von Humboldt forest cooperative.
- (2) The inclusion of non-timber products and on-site processing of sawn lumber will help profitability.

CONSTRAINTS

The most serious constraint to profitable, sustainable resource use in the Selva of Peru is its distance from markets and sources of inputs, coupled with a poorly-maintained road system that traverses exceptionally mountainous and difficult terrain, making for high transportation costs, a disadvantage some previous governments tried to mitigate of means of tax and other incentives.

A second important constraint is legislative and institutional. It concerns firstly the 1975 Ley General Forestal y de Fauna, which states that all land classed as forestry land belongs to the State and that concessions and logging contracts give no title or possession rights over the land, but only over the forest that is on it. This gives no incentive to care for or invest in forest land. (This was the main reason for choosing the Yanasha native communities as cooperators in the Palcazu forestry project, as these communities have their traditional rights in their communal land enshrined in their title). Secondly, the Ministry of Agriculture proved unable to supervise or control the use of forest land under the organization existing before the 1993 reorganization; it remains to be seen whether the new responsible agency, INRENA, can do better.

Inherent in the economic evaluation of biodiversity are a number of constraints which arise from socio-cultural, technological and political factors which are directly or indirectly related to the economic aspects of the problem. The valuation of the goods and services derived from Peru's recognized megadiversity does not entirely conform to the traditional laws that govern the market; rather, it requires knowledge and treatment of an interdisciplinary and systematic nature involving the theory of externalities in order to gain a clear understanding and attempt a quantification.

Externalities, which are germane to the economic analysis of the environment, occur when the activities of certain economic agents affect the consumption and production of other agents, but when their costs and benefits do not obey the system of market prices (R. Barrantes, 1993). In light of this concept, as many as four types of value for biodiversity can be identified:

- a) the direct use value of goods and services produced from the components or functions of the ecosystem, which may be commercialized or not, but whose consumption is tangible.
- b) the indirect use value which is derived from the environmental functions which protect human lives, specific natural resources, and such activities and physical and economic infrastructure as prevent losses and which can be quantified.
- c) the "stock-value" or value of a good that exists but is not utilized, and which represents the degree to which society is prepared to pay in order to conserve the resources independently of their use for producing consumer goods.
- d) the option or potential value related to future benefits that derive from research and from technologies developed from the existing biological diversity (UNEP, 1993).

Direct use goods which enter the market include timber, medicinal plants, fruits, non-timber forest products, wildlife for food and for industrial and artisanal uses; those which are not marketed include firewood, charcoal and timber for domestic use, as well as fruits, food and other items consumed domestically.

Indirect use services include watershed protection, climate control, dune stabilization, soil conservation, nitrogen and nutrient fixation, and the preservation of bird habitats.

Examples of stock or non-consumption goods are those that derive from esthetic, cultural, spiritual or altruistic considerations and those related to local or national heritage.

Typical of option or potential-value goods are the development of new crop varieties resistant to pests and diseases or goods with special consumer-appeal features.

The measurement of the economic value of biodiversity requires a vast amount of information and the use of sophisticated techniques. Although it is easier to value market goods and services, even this presents problems, especially when goods come from ecosystems located far away from centers of consumption. More difficult still is the task of calculating indirect, stock and potential values in a megadiverse country like Peru.

An interesting interdisciplinary effort has been made by the National Soil Conservation Program in valuing the direct and indirect benefits of the use of soil and water resources in watersheds treated by the Program.

Direct benefits include agricultural, livestock and forestry production, foreign exchange earnings to the country and the generation of hydro - and bio - energy. Indirect benefits include savings in the cost of maintaining irrigation canals, of groundwater extraction, of treatment of drinking water, and of road maintenance; also, reduction in the frequency of so-called natural disasters. (J. Alfaro & A. Cárdenas, 1988).

Table 3.1
PARTIAL COMPOSITION OF PRESENT WORLD
AND PERUVIAN BIODIVERSITY

Categories	World	Peru	
	Total No. of Species	Total No. of Species	No. of Species Described
Plants			
Dicotyledons	170,000	23,000	18,000
Monocots	50,000	7,500	6,500
Gymnosperms	529	26	22
Animals			
Mammals	4,000		362
Birds	9,400		1,703
Reptiles	6,300	500	297
Insects	751,000	23,000	10,800

Source: UNEP-ONERN, 1992

Table 3.2
PERU: PROTECTED AREAS ADMINISTERED BY SINUC
(SISTEMA NACIONAL DE UNIDADES DE CONSERVACIÓN)

	LOCATION	AREA HA.	PRINCIPAL ECOSYSTEMS
NATIONAL PARKS			
1. Cerro de Amotape	Tumbes y Piura	91,300	Deciduous forests of the Dry Equatorial Forest.
2. Cutervo	Cajamarca	2,500	Upland forests of the Selva Alta. Andean steppe scrublands.
3. Huascarán	Ancash	340,000	Polylepis forests Objective: conserve flora, fauna, landscape.
4. Manu	Cuzco Madre de Dios	1'532,806	Upland forests of the Selva Alta (Yunga) and Amazon Tropical forests.
5. Tingo María	Huánuco	18,000	Upland forests, Selva Alta.
6. Río Abiseo	San Martín	274,520	Selva Alta cloud forest Objective: Conserve endemisms, espy. <u>Lagothryx flavicauda</u>
7. Yanachaga-Chemillen	Pasco	122,000	Upland forests of the Selva Alta.
NATIONAL RESERVES			
8. Calipuy	La Libertad	64,000	Puna grasslands Objective: Conserve the Guanaco.
9. Junín	Junín y Pasco	53,000	Grasslands and natural springs of the Puna. Objectives: Conserve natural scenery of Lake Junín.
10 Pacaya-Samiria	Loreto	2,080,000	Swamp and riverine forests of the Low Selva. Objective: Conserve paiche and other animal species.
11 Pampa Galeras	Ayacucho	6,500	Puna grasslands. Objective: Conserve vicuña.
12 Paracas	Ica	335,000	Coastal areas of the Pacific desert & cool ocean.
13 Salinas & Aguada Blanca	Arequipa & Moquegua	366,936	Grassland, scrub and springs in the Puna.

14	Titicaca	Puno	36,180	Grassland and spring areas of the Puna Objective: Conserve flora, fauna and scenery of Lake Titicaca.
15	Iachay	Lima	5,070	Coastal lomas. Objective: Protection of typical vegetation.
16	Ampay	Apurimac	3,635.5	Gallery forest and Podocarpus of the Yunga; puna grasslands. Objective: Conserve Podocarpus.
17	Calipuy	La Libertad	4,500	Puna grass and scrublands. Objective: Conserve Puya raimondii.
18	Huayllay	Pasco	6,815	Puna grass- and scrublands. Objective: Protection of geological formations.
19	Lagunas de Mejía	Arequipa	690.6	Lagoons in Pacific desert. Objective: Protect rare birds.
20	Manglares de Tumbes	Tumbes	2,972	Mangrove swamps of the Dry Equatorial Forest.
21	Pampas del Heath	Madre de Dios	102,109	Chaco - Low Selva. Objective: Protect the swamp deer.
22	Tabaconas Namballe	Cajamarca	29,500	Podocarpus, Upland forests of High Selva & Puna. Objective: Protect spectacled bear, tapir, etc.
HISTORICAL SANCTUARIES				
23	Chacamarca	Junín	2,500	Grassland Objective: Protect site of Battle of Junín.
24	Pampas de Ayacucho	Ayacucho	300	Grassland Objective: Protect site of Battle of Ayacucho.
25	Macchu Picchu	Cuzco	32,592	Upland forest of Yunga. Objective: Protect archeological remains, flora, fauna and scenery.
TOTAL			5513,426	

Table 3.3

SOME WILD PLANTS WHICH ENTER THE INFORMAL ECONOMY

Species		Use
Aguaje	<i>Mauritia flexuosa</i>	Confectionery, oil
Pijuayo	<i>Bactris gasipaes</i>	Food
Huarango	<i>Acacia sp.</i>	Food
Umari	<i>Praqueiba sericea</i>	Food
Anona	<i>Anona muricata</i>	Food
Breadfruit	<i>Artocarpus altilis</i>	Food
Sauco	<i>Sambucus peruvianus</i>	Medicine, food
Yacon	<i>Smallanthus sp.</i>	Medicine, food
Paca	<i>Guadua sarcoparpa</i>	Fiber
Faique	<i>Acacia macrocantha</i>	Medicine
Palo verde	<i>Cerecidium praecox</i>	Firewood
Sapote	<i>Capparis angulata</i>	Food
Yunto	<i>Capparis cordata</i>	Medicine
Bichayo	<i>Capparis ovalifolia</i>	Firewood
Overo	<i>Cordia ovalifolia</i>	Firewood
Uña de gato	<i>Uncaria tomentosa</i>	Medicine
Sangre de grado	<i>Croton palanostigma</i>	Medicine
Cola de caballo	<i>Isoetes giganteum</i>	Medicine
Chancapiedra	<i>Phyllanthus niruri</i>	Medicine
Cascarilla	<i>Cinchona calisaya</i>	Medicine
Ajos sacha	<i>Pseudocalyma alliaceum</i>	Medicine
Ojé	<i>Ficus anthelmintica</i>	Medicine
Matico	<i>Piper elongatum</i>	Medicine
Chuchuhuasi	<i>Erythroxylum catuaba</i>	Medicine
Shiringa	<i>Hevea brasiliensis</i>	Various
Bamboo	<i>Bambusa sp.</i>	Construction, etc.

Source: Pérez, Oscar, 1989.

Table 3.4
EXPORTS OF FOREST PRODUCTS AND WILDLIFE
(U.S.\$,000)

ITEMS	1980-81	1985-86	1990-91
Timber products	6.3	3.6	4.7
Non-timber products	3.0	3.3	12.7
Wildlife	1.3	7.2	9.5
	10.6	14.1	26.9

Source: DGFF, 1990, 1991, 1992.

CHAPTER FOUR

IMPACT OF DEVELOPMENT ACTIVITIES

INTRODUCTION

In keeping with AID's concern for tropical forests and biodiversity, this Assessment devotes considerable attention to the problems of the Selva, which occupies a special place as Peru's supposed last frontier area which, in the minds of some past leaders, can readily absorb surplus populations from overcrowded areas, a belief which has contributed to the serious environmental degradation which affects the Selva - and particularly the Selva Alta - to - day.

Development activities which have an impact - often adverse - on resources and on biodiversity in the Selva include highway construction, slash-and-burn agriculture, (especially where land for bush fallow is limited), selective logging, some oil exploration activities, and the production of row crops on unsuitable land, often associated with migration and colonization, either directed or spontaneous.

The State's role in Selva development has evolved during the last 50 years from that of spectator to tax-collector, to road-builder, then broadening to include some technical and social support activities and to exercise a measure of control. In 1979 the Special Project model, first applied in Coastal irrigation systems, was introduced in the High Selva and was to strengthen the State's hand in steering development in that region.

Long before that time, however, governments had conducted colonization projects as a means of settling landless Sierra farmers and others in the Selva, along the penetration roads that were being built at that time.

COLONIZATION PROJECTS IN THE SELVA

During the late 30's and early 40's of this century the first colonization project was implemented, along the Huánuco-Pucallpa highway. Of greater impact were the Apurímac valley, Tingo María - Tocache - Campanilla and Alto Marañón colonization projects undertaken in the 1960's. They were based on the construction of main and secondary roads and included some investment in social and technical services in support of agriculture. Their purpose was to extend the agricultural frontier; in the case of Alto Marañón there was an additional motive, that of peopling a frontier area. Despite some differences among these three schemes, a few general comments can be made:

- a) In all three projects, extending the agricultural frontier was a central objective.
- b) In Apurímac and Marañón where there are native communities, these were not taken into account. (The Native Communities Law safeguarding the interests and rights of these communities was passed later).
- c) Natural resource use was oriented solely toward agriculture: forestry and protection were disregarded.

- d) Particularly in the Tingo María - Tocache - Campanilla project, road infrastructure building was a priority item; in the project named, 33.78% of the budget was for this purpose.
- e) Although it was the intention to settle farmers on land suitable for agriculture, spontaneous settlers overflowed on to forestry and protection class land.
- f) In all three projects, production was foreseen in terms of technological and crop packages based on soil and other studies. But, for various reasons - chiefly insufficient orientation and control of settlement - farming ended up as a typical unenlightened slash-and-burn system, dependent on widespread deforestation. Contributing factors included lack of market studies and orientation for promising industrial crops like cacao, coffee, cashew, etc. One positive feature of the Tingo María-Tocache scheme was that it demonstrated the feasibility of oil palm in the area, leading to the establishment of an agroindustrial complex by the Romero group.
- g) Budget cut-backs - notably in the Tingo María-Tocache project - caused a gradual fade-out and a return to the normal level of public sector support.

THE SPECIAL PROJECTS IN THE HIGH SELVA

Conceived as an instrument for a more effective orientation and control of rural development than the colonization schemes, or than the routine services of the Ministry of Agriculture, these projects were initiated in the High Selva between 1979 and 1984.

The Special Project idea had been tried out in some of the coastal irrigation schemes which needed a more or less autonomous entity to integrate and coordinate their different activities.

The Selva special projects were funded by various international agencies: IDB, AID, World Bank, etc.

Although generally similar, these projects can be separated into two types: a) projects principally aimed at extending the agricultural frontier, and b) rural development projects, the main difference being the breadth of the services provided; the rural development type projects were supposed to be integral in nature. However, this difference became less marked in the implementation stage.

From Table 4.2 it will be noted that:

- a) In both types of project there was a clear preponderance of road construction investment, notably in the Central Huallaga and Pichis projects.
- b) Agricultural support services received more resources in the rural development types projects.
- c) Funding for forestry was either deficient or totally absent, as in the Central and Upper Huallaga projects.
- d) Funding for studies and activities in natural resources and the environment were insignificant.

In regard to natural resources and biodiversity, even where they were considered, action was mostly confined to declarations of intent. Some wishful thinking can be detected in the frequent statements by project leaders to the effect that the project had the power to make land-use correspond to land capability, and so to ensure rational use of natural resources, a claim that was not in accordance with the facts.

The Land Classification Regulation of 1975 had been devised as a guide to help the Agrarian Reform Office parcel out land in accordance with its major capability, but no law prevented users from cultivating land classed for other uses once parceled out. In general, the official attitude to this problem reflected little understanding of the social and economic motivations that determine the use of natural resources. Consequently in all of these projects, similar problems were encountered, viz.:

- Spontaneous settlement;
- Deforestation of land classed as forestry or protection land;
- Use of customary, incorrect resource use methods, e.g. slash - and - burn agriculture and selective logging;
- Expansion of unforeseen and undesirable crops, especially coca.

Some significant investments were made in irrigation infrastructure in three development-type projects located in areas with seasonal moisture deficiencies: Jaen-Bagua, Central Huallaga and Alto Mayo.

In these projects there was investment in social infrastructure, such as schools and dispensaries, as well as in access roads to serve areas apt for agriculture; unfortunately, these helped to spur spontaneous settlement by agriculturists who proceeded to cut and burn forest on land classed as unsuitable for agriculture.

Evaluations carried out on the Special Projects say little about social aspects; they do however, testify to important increases in production of cash-crops such as rice, corn and coffee, as part of a general elevation of the level of economic activity. Terrorism adversely affected all projects, especially Upper Huallaga, Pichis Palcazu and Chanchamayo-Satipo. A change in central government attitude to the Selva took place in 1985 when Alan Garcia assumed the presidency and assigned priority to the Sierra; his attitude to creditor agencies caused the suspension of disbursements by the World Bank and IDB half-way through his term of office (1987-88).

For different reasons, related to its austerity and reinsertion policies, the present government has assigned meager resources to these projects.

One of the concerns inherent in the nature and funding of the Special Projects has been that of their future operation once international funding has ceased. Unless the project office can be kept in place, activities will either cease or return to the minimal level consonant with that of the line ministries, and the synergy of integration achieved under the direction of the Special Project Office - whatever its shortcomings - will be lost.

One solution, the transfer of project responsibilities to the regional governments, did not work owing to scanty regional budgeting, especially under the present government. In fact, since 1988, the special projects have been in a strictly survival mode, only Alto Mayo and Upper Huallaga having foreign financing. (See Table 4.3)

There are studies for new investments in some project areas, including one for an extension of the Alto Mayo project, presented to the German Government (US\$ 21.8 in 3 years), a study to incorporate 20,000 has. under irrigation in the Central Huallaga and Bajo Mayo project area, a development program in the area of the

Jaén-Bagua project including a 16,000 ha. irrigation project (IDB); the AID-supported Selva Economic Rehabilitation Project in San Martín and part of Huánuco departments, and an extension of the San Martín environmental management project with Dutch government funding.

There is less sign of follow-up funding for the wetter and less fertile project areas, including the Pichis and Palcazu valleys compared to the considerable interest in the Central Huallaga, Upper Mayo and Jaén-Bagua areas which have in common fertile soils, seasonal moisture deficits and a reliable river as source of irrigation water. Also, irrigation projects are more attractive to offshore financial institutions as they imply an easily calculated incremental benefit, involve straightforward infrastructure investments and offer a reasonable measure of control over land use. It is regrettable that one of the most promising initiatives in the wet tropical zone of the High Selva - the COFYAL strip-cutting natural forest management activity in the Palcazu valley - has not been able to attract takers, despite AID's enthusiastic involvement in its early stages.

LOW SELVA DEVELOPMENT ACTIVITIES

Public investments in the Low Selva which have had an impact on renewable natural resources have been practically limited to those in highway construction, in particular the road link between Pucallpa and the coast which brought many spontaneous settlers and, in their wake, large-scale deforestation and soil degradation, as the price for integrating this area in the nation's economy. Other penetration roads, such as those between Cuzco and Puerto Maldonado and from Corral Quemado to the Marañón river in the north, have failed to establish themselves as commercial links. Some inter-city roads, like that joining Iquitos to Nauta, have brought chaotic and environmentally harmful spontaneous settlement. In the 1970's frontier settlements were undertaken in areas close to the frontiers with Brazil and Ecuador, but they have had little impact.

The road link to Pucallpa made possible the creation of a large timber-processing industry in that city which, together with the Iquitos complex, has an estimated capital value of US\$ 500 millions and, in 1991, handled 376,931 m³(r), corresponding to less than 40% of installed capacity. Private investments in non-renewable resource extraction include those in petroleum and alluvial gold. In this connexion there are regulations which protect biodiversity: the Regulations for Environmental Protection in Petroleum Exploration and Exploitation Operations of the Ministry of Energy and Mines require the preparation of an environmental impact study as a prerequisite for the signing of new contracts and an environmental upgrading and management program for existing contracts. Such safeguards are needed in view of damage resulting from oil spills and unnecessary deforestation. In getting alluvial gold, operators frequently use front-loaders and other heavy equipment which damage river banks, particularly in Madre de Dios department, where this activity is centered. There appears to be no official way of controlling this practice.

By no means all interventions in the Low Selva are deleterious. Among the technologies studied and/or developed for sustainable natural resource management in Amazonia, the following deserve mention:

1. forest plantation techniques with different levels of luminosity according to the needs of the species; including reforestation by under-planting, reforestation in strips of variable width and reforestation after clear-cutting.
2. Natural regeneration techniques with economically important species such as tornillo, ishpingo and bolaina blanca.
3. Management of natural regeneration and pilot-scale exploitation of tropical forests associated with industrial units with direct participation of native populations in the Selva.
4. Establishment and management of grasses and legumes adapted to Amazonia, alone or in association, also in agroforestry. Species include several from the genera *Brachiaria*, *Desmodium*, and *Centrosema*, in association with tree crops-notably oil-palm-. Grazing intensities as high as 3-4 AU/ha. have been achieved with *Brachiaria dictyoneura*, an East African species.
5. Rehabilitation of degraded pastures known as "torourco", composed of grasses of the genera *Axonopus*, *Paspalum* and *Homolepis* and of some legumes of the genera *Mimosa* and *Desmodium*. This complex is associated with compacted soils, acidity and low fertility, and recovery has been achieved with cowpea as pioneer crop together with *B. decumbens*, *B. dictyoneura*, and *Stylosanthes sp.*, with liming and fertilizer, leading to the establishment of agroforestry with rice, pasture and bolaina.
6. Cultivation of pijuayo (*Bactris gasipaes*) on acid, infertile soils which are deep and well-drained. This species produces fruit and heart of palm, and its productivity is improved with leguminous ground-cover.
7. Improved secondary - forest fallow, with weed control and restoration of fertility of acid soils using herbaceous, shrub and leguminous tree species, in order to reduce the rest period of this ecosystem and increase its productivity.

SIERRA AND COASTAL DEVELOPMENT ACTIVITIES

In recent years the greater part of public investment in the agriculture sector has been concentrated in the Costa, principally in large-scale irrigation projects: Majes, Chira-Piura, Tinajones in particular. INADE, since it assumed responsibility for these projects ten years ago, has channeled US\$ 765 millions to coastal hydraulic projects, of which 16% went to the Chao-Virú-Moche-Chicama project.

Between 1965 and 1989 several entities have carried out studies and projects related to irrigation in Peru, notably those related to soil salinity and drainage (PLAN REHATIC and PRONADREI). The results of these programs were not reflected in any noticeable downswing in the rate of salinization or in the number of hectares affected, in spite of much effort by competent professionals, owing mainly to the persistence of the causative factors (See Chapter Eight) and to the high cost of reclamation.

The institutions which have contributed most to the expansion of the agricultural area have been those devoted to the development of small and medium sized irrigation schemes.

In the Sierra, where irrigation is supplemental, the irrigation projects are generally small and simple in design.

CAUSAL FACTORS IN DEFORESTATION

ECONOMIC, SOCIAL AND CULTURAL FACTORS

The principal cause of deforestation in the Selva is agriculture as conducted by settlers, rarely by natives. The growth of this settler population has been due to migration, mainly from the Sierra to the Selva Alta and from the latter to the Selva Baja (Aramburu, 1982; Rodriguez, 1991).

Migration to the Selva has always had economic and social motivations, in which there have been expulsion factors in the place of origin and attraction factors in the place of destination. In the case of the Sierra, the expulsion factors are related to conditions which do not satisfy the aspirations of the inhabitants, especially the younger generation: low levels of productivity and income, shortage of available farmland, lack of job alternatives, etc. Attraction factors at the potential destination consist mainly of work opportunities and availability of land. Expansion of the agricultural frontier in the Selva Alta has created a vast market for casual labor which has attracted seasonal migrants who come from adjacent or nearby areas of the Sierra, setting up a process of pendular migration which leads eventually to permanent settlement by these migrant workers. The building of penetration highways by the State has been another attraction factor for migrants from the Sierra.

Although the best lands have usually been occupied by companies or people with more economic resources and/or political influence, the image in the mind of the migrant is that there will always be the chance to obtain land, either by purchase or transfer of "mejoras" or by occupying "free-disposal" land over which nobody is exercising rights. The pressure on this last category of lands, which generally are the farthest away from roads and are of poorer quality, can be observed in all the areas of colonization and expansion of the agricultural frontier.

The form of social organization and of land use in the peasant communities in the Sierra has to a certain extent influenced the process of settlement of the migrant population. Relations of communication and support between relatives and/or members of the same community make it easier for them to find temporary employment and available land, including the simultaneous exploitation of lands in the Sierra and the Selva during the initial stages of the settlement process.

Contact of native populations with settlers and with the commercial world introduces profound changes in their socio-economic patterns. There often are upsets and conflicts over use of the land and over the amount of time to be devoted to agriculture and to traditional activities carried on for subsistence purposes, such as hunting, fishing & collecting. There usually is an increase in areas deforested for agriculture - for example rice in Aguaruna communities in Alto Mayo and coffee in the Ashaninka communities in Satipo. All such changes affect land use patterns and may give rise to accelerated deforestation.

The expansion of the growing of coca, which has a purely economic motivation, has been and continues to be one of the gravest factors in deforestation and soil degradation in the Selva Alta, as has already been remarked.

POLITICS AND OFFICIAL POLICIES

The State has played a leading role in the promotion of development in the Selva during the last few decades; the effects of the policies and strategies applied have always led to an increase in land occupation and in deforestation for agricultural production.

Although the motivations have been different, State policies have been oriented toward promoting occupation of territory, linking the region by roads and also economically and politically with the rest of the country and encouraging economic activities, among which agriculture has always occupied a predominant place.

One expression of these policies in every period has been the building of highways. In some cases this has been done for geopolitical reasons in order to occupy territories near to national frontiers as in the case of the Olmos-Marañón access road and of highways built toward the frontier with Brazil, in others in order to provide a safety-valve for social pressures and conflicts in the Sierra and to achieve a better distribution of the population within the country. Explicitly or implicitly, the extension of the agricultural frontier has always been one of the principal reasons for, and consequences of, road-building in the Selva. Examples are the Huánuco-Tingo María-Pucallpa road and the Marginal Highway, the latter built during the two Belaunde administrations.

Government policies oriented toward the promotion of certain crops such as rice and corn, through promotional credit, guaranteed markets and prices, research and extension, have also stimulated expansion of the crop area and consequently caused deforestation.

Indirectly, policies which give priority to investments in development in the Costa and Selva, ignoring the Sierra, have contributed to migration and consequently to pressure on the renewable natural resources in the reception areas.

Official policies aimed at promoting the occupation of territory and the extension of the agricultural frontier - especially those of Arq. F. Belaúnde in his two periods as president, were influential not only for the investments and works realized. The political promotion of colonization and development projects, and of the image of the Selva as a land of promise waiting to be exploited aroused the hopes of potential migrants, accentuating the processes of spontaneous migration and of deforestation.

In the last few years, governmental policies applied in relation to the Selva have not played a decisive role in terms of impact on natural resources through deforestation as happened in previous administrations. Since the suspension of external funding for the Special Projects in the Selva around 1988, the scanty internal funds available have not been used for road building, nor for territorial occupation or the extension of the agricultural frontier.

During the last two years, some resources have been devoted to repairing and maintaining stretches of the highway system in the region in order to help move agricultural produce.

Although official policies since the promulgation in 1975 of the Law on Native Communities and Agricultural Development in the Selva and of the Forestry Law have propounded the principle of correct use of natural resources, these policies have not borne fruit in practice and deforestation and resource depletion have continued, aggravated in fact by investments in highways, as has been indicated above. The problem is the lack of strategies and of viable operative mechanisms for enforcing the law through existing institutional capabilities, in face of the pressures of settled and/or migrant populations.

Certain macroregional objectives in the National Medium Term Development Plan 1991-95 (INP, 1991) could have considerable impact on natural resources through deforestation due to spontaneous settlement and the expansion of the agricultural frontier if they are implemented. The scarcity of fiscal resources and the priority assigned to social investments throw some doubt on the likelihood that these policies will be put into effect during the period covered by the Plan; however, their potential impact is real. A case in point is the inter-ocean highway project in the southern macro-region, in which Brazil has a permanent interest. Its potential area of influence contains several protected areas and many native communities.

These objectives are the following:

- Completion of the transverse road link from the ports of Etén and Bayóvar on the Pacific coast to Olmos, Jaén, Bagua, Sarameriza, Iquitos and Caballacocha on the frontier with Brazil, involving:
Improvement of the Chiriaco-Nazareth-Sarameriza road and upgrading of the Marginal Highway from Corral Quemado to Tarapoto and Yurimaguas (in execution);
Completion of the Napo-Putumayo road (started but suspended) and the road from Jenaro Herrera to Angamos.

In the southern macroregion:

- Consolidation of the inter-oceanic axis linking Ilo and Matarani with San Gabán and Iñapari on the Brazilian frontier, including upgrading and improvement of the stretches Iberia-San Lorenzo and Urcos-Quincemil and construction of the San Gabán-Otorongo section.
- Improvement of the complementary axis San Juan del Oro-Juliaca, upgrading the town of San Juan del Oro.

INAPPROPRIATE TECHNOLOGIES

The techniques used for agricultural production in the Selva are varied, as are their effects in terms of deforestation and soil degradation.

At one extreme are the rotational systems involving small farms or "chacras", with periods of rest or fallow, employed by members of native communities with sufficient areas of land and whose contacts with the rest of the local population have not yet substantively affected their resource use patterns. Also in this category are the varied kinds of mixed-cropping systems with rotation and rest periods practiced by riverine farmers in the Selva Baja and small farmers with agroforestry crops in the Selva Alta. Although these low-intensity systems do involve some deforestation, it is usually limited to land with agricultural capability.

Under these conditions, with low population density, and with sufficient land to permit a sustainable rotation with sufficient rest periods, the impact on the ecosystem is acceptable.

In a native community with sufficient land, agriculture is complemented by hunting, fishing and gathering of wild plants, which serves to maintain a balanced and usually adequate diet, without damage to areas classed as forest land. When population pressure on land increases, community members may find themselves in the same situation as some "colonos" or settlers who are obliged to adopt destructive cut-and-burn methods involving increasing rates of deforestation with encroachment on to land with forestry or protection capability. Even before this situation is reached, agriculture passes through a stage of increasing poverty, with production barely sufficient for subsistence, which some authors describe as permanent poverty (Sánchez *et al*, 1982 and Nicholaides *et al*, cited by Szott, T. y E. Castilla, 1983, Sánchez, 1990). Finally, as population pressure continues to increase, rest periods get shorter, yields decline, new land-often no longer climax forest - is cleared, but the decline goes on, until the system becomes unstable and the site is abandoned, leaving the soil degraded, often eroded, and scrub growth that will need many years to recover a semblance of forest cover.

At the same time, there are areas in the Selva, for example in San Martín, Pasco and Junín departments, where agriculture is conducted on suitable land, using appropriate technologies involving use of inputs. These systems - rice growing in the Alto Mayo, coffee and cacao production in Upper Huallaga, coffee in Villa Rica and Oxapampa, or oil-palm in the Huallaga valley with leguminous ground cover feeding high-grade cattle, are sustainable systems that exist in the Selva, involving appropriate technologies that are applicable insofar as markets allow. Mention should be made of systems developed by the Tropical Soils Research Program at Yurimaguas, some of which could help to reduce the pressure on forest land for conversion to agriculture. (Sánchez, 1990).

Despite the existence of suitable technologies, the situation that predominates in the Selva, particularly in the areas destined for extension of the agricultural frontier, is one in which mainly inappropriate techniques are employed, for example:

- Continuous monoculture of corn on steeply-sloping land classed as suitable for grazing, forestry or protection;
- Continuous rainfed annual crops without a cereal-legume rotation or fertilizers;
- Pastures on land only suitable for production forestry or protection, often accompanied by over-grazing;
- Coca planted in downhill rows on land classed as suitable only for forestry or protection.

An ever-present factor, and frequently a direct cause of the use of inappropriate techniques, is the shortage of land suitable for agriculture in face of the increasing demand of land hungry migrants who have no alternative but to occupy the land they can find, whatever its major use capability. In these conditions, the practice of slash-and-burn agriculture with unsuitable soil and insufficient land to permit rotation and rest periods is one of the most serious causes of deforestation and soil degradation.

Finally, it should be noted that agricultural research and extension up to now have not addressed the problems of critical areas subjected to incorrect use of natural resources with unsuitable technologies, and scattered throughout the zones of extension of the agricultural frontier. In this connexion, it is strongly recommended that practical trials be initiated in several parts of the Selva Alta to explore the viability of applying results obtained in the Tropical Soils Research Program in Yurimaguas, in order to relieve pressure on land not suitable for agriculture.

LESSONS LEARNT FROM AID-FUNDED PROJECTS

THE CENTRAL SELVA RESOURCE MANAGEMENT PROJECT (CSRM)

- a) Although initially conceived as a conventional road-based rural development project, CSRM was fortunate in having the services of a team of environmentally-conscious international specialists - firstly through the study phase (JRB Associates) and later in the field - who, together with Peruvian and AID project management, were quick to see that climate (up to 6 meters of rain a year) plus rugged topography and weak soils made the Palcazu environment far from favorable for the project as at first envisioned. This understanding brought a change in project concept and the adoption of an experimental approach more in keeping with the conditions, which has permitted the carrying out of research into resource management methods aimed at sustainable development. This experience in itself constitutes the most important lesson learnt from this project.
- b) Another important lesson is that of the need to spend time and resources in finding out as much as possible about the resource base and about the socio-cultural characteristics of the local population before project initiation.
- c) Even with the best available information at start-up, the initial stage of a project of this nature should have enough flexibility to react to experience and to effect needed course alterations.
- d) CSRM was fortunate in being cut off from the rest of the country not only by its location but also by delays in completing the road into the area. In the event, this delay saved the project from being overrun by uncontrolled migration at a time when it was not ready to even consider new settlements. This situation will change if the northern entry to the area is opened, even to the point of risking the loss of achievements obtained with much hard work under difficult working conditions.
- e) The centralization of activities and responsibilities in the project office, although beneficial in several ways, gave rise to a top-heavy bureaucracy at local level. This can be overcome with wise leadership; in any case this alternative is preferable to that of leaving sector programs in the hands of the ministries.
- f) A suitable solution may be to create a small special projects office in the regional headquarters and assign execution to NGO's or consultants working under the coordination of the local authority.

- g) In the area of technical assistance, there was some loss of effectiveness due to what appears to have been excessive individualism among specialists. This problem could have been avoided by the appointment of an on-site chief of party.
- h) The strip-cutting method of natural forest management has received widespread publicity and undoubtedly shows promise, but years of careful study and analysis are needed before it can be proclaimed as a success.
- i) Two parallel achievements merit more attention: the development of low-input, semi-subsistence farming systems suitable for the local conditions and the creation of a communal reserve adjoining the Yanachaga-Chemillen national park, as an area in which members of the Yanasha native communities can carry on their traditional activities based on sustainable management of the forest, with legal protection against intrusion.
- j) It is by no means certain that the cooperative is the best form of organization for native communities; it is foreign to their customs and traditions and, in the case of the Yaneshas, has given rise to considerable friction. Apparently, the community structure would lend itself to the creation of an organism more in harmony with traditional forms.

THE UPPER HUALLAGA AREA DEVELOPMENT PROJECT (UHADP) 1981-1993

This project was conceived as part of a strategy to drastically reduce coca-growing in the Upper Huallaga valley by offering legitimate crop production alternatives to farmers whose coca plantations had been eradicated by CORAH, the INM-funded coca eradication project. In this way it would also help ease the social tensions caused by the eradication program (ECONSULT, 1986).

It was originally intended that the project, known as PEAH (Proyecto Especial Alto Huallaga) would reinforce public sector agriculture support services, and develop and test different agricultural technologies in the Upper Huallaga (Project Agreement, 1981). Subsequent amendments emphasized community development activities and, finally, revised objectives and goals were established which reflected the evolution of the project and the lessons learnt during its execution. The project area was extended to include all of San Martín department and there were substantial modifications in the main components of the project, as well as in the strategy for its execution. (Project Agreement, Amendment N° 10, February 1993).

These changes were a response to radical changes in social, economic and political conditions in the project area, in consequence of the expansion of coca growing and the intensification of terrorist- and drug - related violence. The analysis of these factors is outside the scope of this study; however, due to its effects on natural resources and the environment, it is necessary to refer to the expansion of coca growing in the original project area and subsequently farther afield. The greater part of the new coca plantations are on land classed as suitable only for forestry or protection because of steep topography and poor soils. This has caused massive deforestation and soil erosion, as well as pollution, particularly of watercourses, due to chemicals used in processing coca leaves for making "pasta básica". Although versions differ as to the area under coca in the Upper Huallaga and in the remainder of San Martín department, usually reliable sources speak of figures in excess of 150,000 hectares.

In the initial implementation of the project prior to 1986, there was no component specifically related to conservation of natural resources, particularly soils and forests, although the idea of conservation and rational use of natural resources was no doubt implicit in the farm technological packages generated by the project.

In the last stage of the project, since 1991, the project concept has changed to an integral approach with activities concentrated in watersheds. Three main components are:

- a) Democratic Community Development (DCD), aimed at restoring the population's confidence in the government and at promoting the democratic process through popular participation in the selection and execution of small-scale community development projects.
- b) Integrated Watershed Development (IWD) with the main purpose of reducing the area under coca through the provision of social and physical infrastructure, and the promotion of legitimate crops which offer a life quality equal to or better than that offered by coca.
- c) Provision of primary and secondary roads in order to give access to markets.

Also, in the research, extension and information component, it is intended to establish throughout the Huallaga valley, a network of applied research plots, which will include reforestation and soil conservation activities, coupled with an information campaign related to ecology and drug abuse. (Project Agreement, Amendment N° 10, February, 1993).

At the present time, PE/II is executing, through contracts with institutions and independent consultants, several projects related to the protection and proper use of natural resources, e.g.:

- Reforestation for hillside protection in Tingo María;
- Establishment of a Pijuayo (Bactris gassipaes) nursery for production of palm hearts, in Tocache;
- Creation of forest tree nurseries;
- Agroforestry units, fertilized with earthworm humus;
- Planting of Lemongrass (Cymbopogon citratus) in contour rows on hillsides formerly under coca.

Also in 1993, new stipulations were written into the Proag related to natural resources and the environment, prohibiting use of AID funds for:

- Acquiring and using pesticides;
- Actions tending toward commercial timber extraction, and;
- Road building without prior environmental impact assessment.

One of the lessons learnt in this project has led to a new strategy based on a close relation with local authorities and communities, with the active participation of the population in project selection, analysis and execution.

Another positive development is the increased use of independent consultants and NGO's in the implementation of activities and projects, permitting greater administrative agility and lessening the bureaucratic load on PEAH.

The Tenth Amendment to the Proag has transformed PEAH's role significantly, with the project gradually ceding responsibility to municipal and regional governments, to private enterprise and to community leaders. Its role from now on will be to improve and refine methodologies, fund pilot programs and take part in supervision, evaluation and provision of technical assistance as required.

THE SUB-TROPICAL LANDS DEVELOPMENT (CENTRAL HUALLAGA AND LOWER MAYO) PROJECT

This was the first Special Project in the Selva, initiated in 1979 after the time of the colonization projects of the 1960's. Its purpose was to develop the agricultural potential of the Central Huallaga and Lower Mayo watersheds with a gross area of 865,000 Has. and a priority area of 280,000 Has.

The central concept of the project was the hypothesis that the main obstacle to the area's development was its isolation from the rest of Peru and the lack of internal road links. This concept was clearly reflected in the makeup of the project budget in which 58% was for the building and improvement of neighborhood or feeder roads and 4% for the maintenance of the Marginal Highway. Agricultural machinery services received 12.6% and land titling nearly 4%, while 8.5% went to project administration and 5.5% to credit.

One important innovation in the design of this project was the recognition of the negative environmental impact that was likely to ensue from the building of feeder roads, the clearing of 233,000 hectares for conversion to agricultural use and the settling of some 3,500 families in the project area. This concern gave rise to the following conditions precedent for project implementation:

- a) Presentation of an Environmental Protection Plan, to be prepared in two stages; the first stage consisted of a "Basic Plan" which ONERN prepared in three months, but the main Plan did not see the light of day until 1983 when the AID project was near to conclusion; in fact, the Plan was never implemented.
- b) The provision, in every component, of actions and measures aimed at avoiding or controlling serious deterioration of natural resources. Some of these were never put into effect while others, such as those related to road construction, were of limited effectiveness; the effect of the road as a structure was considered, but not the far greater effect it would have in permitting environmentally harmful resource use in areas previously inaccessible.

An important complement to this project, and one that helped to give it a more integral character, was the simultaneous carrying out, with help from other funding sources, of irrigation, hydroelectric and industrial projects and the provision of social infrastructure such as schools and medical posts, which formed part of the so-called Central Huallaga Integral Development Project.

Although there has been no socio-economic evaluation of this project, partial evaluations made in 1983 and 1986 (Perea, 1990), reveal an overall increase of 76% in agricultural production between 1980 and 1988, with rice (388%, maize (150%), cassava (133%) and beans (72%) occupying leading positions.

Both the achievements of the project and its most serious resource and environmental problems, are related to the expansion of the farmed area sparked off by building of feeder roads and irrigation facilities. The roads gave impulse to agriculture in the areas with fertile soils suitable for row-crops, but the other side of the coin was that they made it easier for selective logging and total deforestation for conversion to slash-and-burn agriculture in a very extensive though as yet unquantified area.

Simultaneously with dry-land agriculture, irrigation infrastructure was provided for 12,000 has. in the Sisa valley.

The environmental program was well conceived but did not come into operation in time to exert any influence on project execution. However, since 1987, an environmental management program has been in operation in the valley, with funding of US\$ 550,000 from the Dutch government and a total cost of US\$ 730,000 and with an emphasis on training and education, forestry and, recently, the execution of pilot watershed management project in the valley of the Shilcayo river near Tarapoto. It is premature to forecast results of this program, but the fact that it has been undertaken is a step in the right direction.

The land titling and machinery components provided experience which can be of use in other projects. The first-mentioned regularized the titles of thousands of occupiers, was instrumental in the granting of farm credits and provided a legal basis for rural property transfers. Unfortunately the dynamic nature of the informal land market meant that the benefits of this program were shortlived.

The machinery pool was less successful than had been expected, in part because it was in the hands of a State-run organization, SENAMA and in part because the credit component was diverted to other uses. Still, the pioneer role of SENAMA did give a lead which private firms were later to follow.

The lesson from these experiences is that projects should exert a promotional influence with funding and technical assistance and strengthening private organizations to fulfil the functions of paid services like farm machinery hire, road maintenance and so forth, avoiding direct involvement by the project.

Subsequent developments in the project area have had a strong negative impact. Firstly, the appalling state of the roads, which received practically no maintenance after project completion, has caused serious problems for transport and marketing of the main cash-crops; maize and rice, the freeing of rice marketing (including and encouraging imports) and the depressed world prices of coffee and cacao. These factors no doubt have helped to expand the area planted with illicit coca which, allied with terrorism, is causing grave damage to forest land and can adversely affect legitimate agriculture in the area. While terrorism has been greatly reduced, illicit coca growing and narcotics trafficking are still on the increase.

THE NATIONAL SOIL CONSERVATION PROGRAM (1981-1986)

This program, supported by AID under Project # 527-0220, had two main objectives: a) to disseminate conservation techniques and b) to institutionalize soil conservation. Within its self-imposed geographical limitation to the Sierra, satisfactory results have been achieved in terms of the first objective, the program having covered 11 departments, 30 provinces and 100 districts, working with peasant communities and farmers' organizations.

Regarding the second objective there has been little achieved, and soil conservation continues to be the business of different agencies acting in an uncoordinated manner. In the public sector the responsible bodies are INRENA and PRONAMACHICS, acting at national level.

The history of this program has been illuminating. It started out with what some observers described as fixed ideas about the soil conservation measures to be propounded: counter-slope bench-terraces were to be the standard measure, and the method of implementing them through what were termed "áreas de comprobación", or trial areas. As time went on, other measures acquired importance and the idea of mixed trial areas gained ground. By this change in approach, farmers were given the chance to see which of the measures best suited their needs in terms of their particular socioeconomic reality.

Several other forms of dissemination were adopted, such as the setting up of conservation committees under the leadership of the communities, use of mass media and work planning based on socioeconomic studies.

Even the concept of the counter-slope terrace, based on the technically unassailable principle that a terrace with an outward sloping platform was more likely to wash away in heavy rain, was less strictly applied than at the outset as it was found that farmers in some areas already practised the system of gradual terracing by which a low retaining wall was built, and gradually heightened as erosion filled up the area behind it, until a more or less level platform was achieved.

An important experience was the confirmation that rural promotion works best on the basis of a conscious commitment and an organized participation on the part of the beneficiaries, and not on the payment of wages or the distribution of food.

It has been said that the program was wrong in limiting its activities to the Sierra when real conservation needs exist in other regions, particularly in the Selva Alta. There was a tentative beginning in Tingo María in 1983, but it was not followed up, program officials arguing that the Sierra's needs were so urgent that they should continue to receive priority. It would seem that the time has now come to widen the geographical area of the Program.

Another lesson was the realization of the desirability of what in other latitudes has been termed the conservation farm plan; that is, the integral treatment of crop, grazing and forest land; conjointly, the diversity of micro-environments dictated by the Andean topography came to be reflected in a similar diversity of conservation measures. Likewise, the program's stock of measures and methods was enriched as it proved the viability of numerous traditional conservation practices. A similar process was followed in the adoption of dissemination methods adapted to the local culture.

In the early years there was rather a "go-it-alone" attitude in the program; time and experience taught the wisdom of coordinating with other bodies operating at farm level, such as PAIT, Cooperación Popular and, more recently, FONCODES.

As was said earlier, the Program has not achieved its second objective of institutionalizing soil conservation. This has been largely due to a failure on the part of the different ministries and line agencies to understand the need for a global conservation campaign and to the existence of the not-unusual phenomenon of professional jealousy.

It must be said that the Program's impressive achievements at grass-roots level have been hewn out in face of much bureaucratic obstruction, pointing up the desirability of an autonomous soil conservation service.

AID conducted a formal, mid-term evaluation in 1983, but did not make a Project Completion evaluation. However, it is to the lasting credit of the Program that it carried out an objective and highly professional auto-evaluation covering all aspects of its execution and the response of beneficiaries and their organizations. (Ministry of Agriculture, 1988). Although there has not been a subsequent evaluation, there are signs that a number of the evaluation's findings have been put into effect in recent operations of PRONAMACHCS, which took over the program in 1988. This agency, really a continuation of its predecessor both in content and personnel, concentrates its efforts in selected micro-watersheds, in which it sets up "treatment sectors" which, in addition to erosion control, include support activities aimed at increasing farm production, reforestation and river-defense.

Between 1981 and 1992 upland areas treated with what is termed "productive soil conservation infrastructure," reached a total of 1,800 hectares.

The following soil and water conservation measures are disseminated by the Program:

In Crop-land:

- Contour rows
- Absorption terraces
- Slow-formation terraces
- Rehabilitation of "andenes" - traditional bench-terraces
- Other practices: e.g. strip - cropping, live barriers, incorporation of organic matter.

In Forest Areas:

- Contour - ditches
- Absorption terraces
- Live barriers with tree species
- Plantations with exotic tree species

In Pasture Areas:

- Infiltration ditches on the contour
- On-site seed nurseries
- Rotational grazing and natural reseeding
- Small earth storage dams

Other Measures

Various gully-control measures, e.g. check-dams, inlets, flumes and vegetative control.

DEVELOPMENT ACTIVITIES IN COASTAL AND HIGHLAND REGIONS

The most important development activities that cause an impact on ecosystems, are farming production, mining and urban development.

IRRIGATION WORKS

The use of land for farming production on the coast has depended on the construction of irrigation works since pre-Inca times, traces of which still remain. Since the beginning of the Republican period the private sector has implemented different irrigation works, and in recent decades the State has been particularly active in this field, in order to incorporate new farmland and/or improve the irrigation of land under cultivation.

Virtually 100% of farming production on the coast relies on irrigation, compared to 20% in the highlands (246,000 to 332,000 hectares, according to different sources). Likewise, State investments in irrigation works have mainly been concentrated on the coast.

In recent decades, irrigation works accounted for most of the public investment in the farming sector, particularly between 1970 and 1990, when approximately 80% of the total investment in this sector was spent on irrigation projects, incorporating 69,295 hectares of new land and improving the irrigation of 263,159 hectares (Ministry of Agriculture, 1992).

The main negative impacts of irrigation works are the salinity of the soil and water-logging caused by poor drainage, which affected 252,000 hectares on the coast in 1986 and an estimated 300,000 hectares at present. The problem arises from a lack of precautionary measures and/or the incomplete or non-existent implementation of drainage works, as well as the wasteful use of irrigation water and flood irrigation systems such as those used in rice plantations. Techniques for solving problems arising from irrigation were not taken into consideration when drawing up irrigation projects and implementing works in the past, and it was only in the sixties that steps were taken to prevent the problems caused by salinity and water-logging. Nevertheless, the negative impact continues. The PRONADREI project has recovered about 100,000 hectares of affected areas and is in the process of recovering some 50,000 hectares more, thus curbing the expansion of areas affected by salinity and poor drainage which had previously increased at practically the same rate (255,040 hectares in 1974 and 252,464 hectares in 1986). (Ministry of Agriculture, 1992).

Irrigation in Peru mainly involves surface irrigation, with a low level of efficiency. Sprinkler irrigation and drip or trickle irrigation are used on a very small scale - approximately 17,720 hectares of which 16,000 are located on the coast.

In addition to the negative impacts caused by salinity and poor drainage, irrigation projects lack a number of factors:

- a) The lack of an overall approach at river basin level, to anticipate the measures that should be taken to ensure the proper use and preservation of the soil, water and forests of higher areas.
- b) The lack of foresight as far as drainage is concerned, and inappropriate crop schedules which cause soil degradation.
- c) The lack of promotion and training in the proper use and management of water.
- d) The lack of water rates that reflect the real cost of this resource and encourage a more efficient use of water as well as providing funds for the maintenance of irrigation systems.

Irrigation problems in the highlands are mainly caused by water erosion.

MINING

Mining, which is one of the most important development activities in the highlands, produces negative impacts mainly because of the pollution of highland rivers and lakes by tailings containing copper, lead, zinc, iron and silver.

This type of water pollution affects the hydro-biological resources and even causes the extinction of certain species.

Farming production is also affected in areas irrigated with polluted water, causing negative effects on the soil and reducing the infiltration rate, the oxygenation of the top soil and the pH. In some areas, natural pastures are also affected by rainwater that runs off tailing deposits.

The most affected rivers (% of the volume of tailings discharged compared to the volume of run-off water) are the Rimac (1.80%), Cañete (1.52%), Acari (2.98%) and the Moche (0.69%). The Mantaro river, on the other hand, receives tailings from mines located in its basin and the Metallurgical Complex of La Oroya, which increase the concentration of polluting elements way beyond the limits established by Law (ONERN, 1986).

URBAN DEVELOPMENT

The urban development process on farmland is a phenomenon that has particularly affected the city of Lima in recent decades, owing to migration and the fact that the majority of the population is concentrated in the capital city. To a lesser extent, the urban development process is also affecting capital cities of different departments, particularly Piura, Chiclayo, Trujillo, Tacna, Huancayo and Cuzco.

In Lima, the expansion of middle to upper class urbanization on farmland and an explosive occupation of barren land by low-income sectors have occurred at the same time. Several laws were issued during the sixties to protect farmland from urban growth. Some farmland was even declared intangible for urban expansion and development purposes by the Ministry of Agriculture (D.L. 21419 dated February 1976). Nevertheless, due to the demand and the extremely high value placed on urban land compared to the value of farmland, the legislation was amended and urbanization increased.

Between 1964 and 1984, the farmland in Lima irrigated by the Rimac river was reduced from 27,725 hectares to 7,525 hectares, whilst urban areas increased from 4,958 hectares to 24,708 (ONERN, 1986).

Table 4.1
INTERCENSAL POPULATION GROWTH IN SOME PROVINCES
IN HIGH AND LOW SELVA

Provinces	Intercensal Population Growth					
	1940-1961		1961-1972		1972-1981	
	Total	Rural	Total	Rural	Total	Rural
Selva Alta						
Bagua	7.36	7.29	8.21	8.13	4.72	4.73
Jaén	5.49	7.99	5.29	4.77	3.19	2.60
San Ignacio	4.42	4.16	7.51	7.50	4.21	4.06
Leoncio Prado	7.68	7.61	7.07	6.01	4.16	2.96
Moyobamba	1.29	0.10	2.44	4.57	6.05	10.89
Rioja	1.59	5.70	4.05	9.84	13.63	16.92
Selva Baja						
Coronel Portillo	1.95	6.74	5.55	3.83	3.31	0.94

Source: Rodríguez, M. 1991. Anexo II-4

Table 4.2

**SPECIAL PROJECTS IN THE SELVA: FUNDING BY INVESTMENT CATEGORIES
(U.S.\$,000)**

Investment Categories	Rural Development Projects (1)		Projects to Extend Agricultural Frontier (2)	
	Amount	%	Amount	%
Roads	116.165	35.22	58.187	49.83
Economic Infrastructure	(3)33.132	10.04	--	--
Social infrastructure	10.636	3.22	1.429	1.22
Agricultural Development	103.963	31.53	12.777	10.96
Forestry Development	16.629	5.04	13.454	11.54
Natural Resource and Environmental Studies	2.639	0.80	650	0.56
Cadastral and Titling	13.876	4.21	2.471	2.11
Others	16.064	4.87	22.221	19.04
Administration	16.733	5.07	5.533	4.74
Total	329.837	100.00	116.700	100.00

Source: Resumen de los Proyectos Especiales en Selva. INADE, 1984.

- (1) Comprises: Huallaga Central - Bajo Mayo, Alto Mayo, Jaén - San Ignacio - Bagua, Alto Huallaga, Chanchamayo - Satipo, Oxapampa
- (2) Comprises: Pichis, Palcazu
- (3) Includes irrigation works in Jaén-San Ignacio - Bagua y Alto Mayo projects. Does not include the Sisa irrigation scheme in Central Huallaga or the Gera hydroelectric in Alto Mayo financed separately.

Table 4.3
SPECIAL PROJECTS IN THE SELVA: 1993 BUDGETS
(US\$,000)

INVESTMENT CATEGORIES	PROJECTS									TOTAL
	HCBM	ALTO MAYO		ALTO HUALLAGA		JSIB		PEPP (2)	M.D.	
	INT.	INT.	EXT.	INT.	EXT.	INT.	EXT (1)	INT.	INT.	
Economic Infrastructure	2450	1076		1467	3000	2600		2344	1500	14437
Social Infrastructure	600	750	2378	498	1195	362	1235	1250	920	3363
Production Support		420		506	2200			75	509	9460
Resource Studies	147		250			115	1461	340		75
Environmental Protection		280		1106				250	125	2313
Communal Development	600	600	28	524	605	494	131	250	500	1761
Others										3732
Directions & Administration										
TOTALS SOURCES	3797	3126	2656	4101	7000	5571	2827	4509	3554	35141
TOTALS PROJECTS	3797	5782		11101		6398		4509	3554	35141

Source: INADE, 1993

Notes :

(1) IDB balance pending. Budgeted but awaiting approval of modified agreement.

(2) Consists of Pichis, Palcazu, Chanchamayo-Satipo, Oxapampa.

JSIB: Jaén - San Ignacio - Bagua Special Project

HCBM: Huallaga Central y Bajo Mayo Special Project

MD : Madre de Dios Special Project

CHAPTER FIVE

ENDANGERED SPECIES

INTRODUCTION

Although much has been learnt about Peruvian ecology, our knowledge is still far from complete, and this makes it difficult to assess the extent of species extinction and numbers of species in danger of extinction. However, serious efforts have been made to prepare lists of species under different degrees of risk. These lists and sporadic, partial studies have been the means for forming at least a preliminary evaluation of the problem.

In this chapter a summary analysis will be presented of the principal menaces to plant and animal species. The latter will be biased toward vertebrates, on which we are better informed than in respect of other classes of animals.

ENDANGERED PLANT SPECIES

Owing to the wide distribution of plant species, the complex flora of most ecosystems and the relatively scanty floristic information, it is difficult to be certain about the disappearance of a plant species in Peru. Nevertheless, at least five plant species have been formally recognized as extinct during the last 30 years: Chloraea venosa, Mathieau galanthoides, Weberbauerella bronquiartioides, Weberbauerella raimondiana and Solanum cajamarcense.

Although not documented, the disappearance of species is known to be a characteristic of a continuous process which has been going on since Man first inhabited this continent some 200 centuries ago. This process speeded up with the introduction of exotic livestock species by the Spaniards (Dourojeanni, 1986). In recent times, the massive occupation of certain sections of the High Selva has caused serious depletion of a number of species.

Some pioneer studies in this field, for example those of Ferreyra (1977), speak of at least 234 plant species in danger, in the Sierra and Costa.

At the present time it is believed that, since 1950, at least 163 plant species are in extreme danger of extinction, 176 are under moderate risk with serious reduction in numbers, and 195 are considered vulnerable (WCMC, 1991).

Uncontrolled deforestation for conversion of forest to other uses is one of the chief causes of genetic erosion. Some conspicuous and well-known victims of this process are Puya raimondii, Cinchona officinalis, Aniba roseadora, Haplorus peruviana, Podocarpus spp., and Polylepis spp.

In general, it appears that the High Andean steppes and scrublands, the dry forests, the coastal lomas and the forests of the High Selva are places where species extinction is most serious.

The typical ecosystems of the Andean steppes have suffered pressure from overgrazing and by livestock unsuitable for the conditions, as a result of which much of the lower altitude scrub or matorral areas and of the high Andean pastures are degraded, with extremely low productivity and elimination of desirable species such as Festuca sp. Although range burning in order to stimulate growth does bring tender shoots, these are of coarse species and their tenderness is short-lived. There is no accurate information on the number of species lost in this way, but some writers put it in the hundreds. The forests of "quinual", (Polylepis sp.) which once covered extensive areas situated mainly on the hillsides of the Andean Cordillera between 3,400 and 4,500 m.a.s.l. have been reduced to tiny patches of relic forest due to cutting for firewood and construction materials. This process continues, especially in areas near to mining camps, and is accompanied by changes in microclimate and in the habitat for other plant and animal species which once formed this ecosystem, habitat loss being a powerful factor in species loss.

The coastal "lomas", a unique phenomenon in a desert region, owe their existence to the mists which form on the sea-facing slopes of the Cordillera. They have been subjected to systematic depredation through seasonal overgrazing with goats and cattle which has caused at least the near disappearance of many herbaceous and shrub species.

Another ecosystem subjected to over-exploitation is the dry deciduous forest of the northern Coastal region, characterized - if one can still employ the term - by timber species such as hualtaco (Loxopteriqium huasango).

Indiscriminate cutting for charcoal, parquet, local woodworking and firewood, combined with seasonal, uncontrolled grazing of the open range areas has reduced populations of typical species to relic proportions.

The mangrove ecosystem in the extreme northern coastal area has lost more than 1,500 hectares either totally destroyed or irreversibly damaged during the last 20 years by the construction of ponds for shrimp-breeding, causing severe tension in the ecosystem which comprises numerous species associated with the mangrove. The most serious consequence is the destruction of the habitat of numerous communities of marine and land species, including molluscs, crustaceans and reptiles, some of them in process of extinction as, for example, the "lagarto de Tumbes" and the "nutria del noroeste".

The region where probably the heaviest impact has been suffered in the last few decades is the Selva, particularly the Selva Alta and Ceja de Selva. According to Dourojeanni (1990), the total area deforested in the Selva by 1990 was approximately 7.5 million has., with an annual increment of more than 250,000 has., which means a 1993 total of at least 8 million has. Deforestation in this region and conversion of the climax mixed tropical forest for slash-and-burn agriculture imposes stress which, if rest periods are much curtailed, results in permanent impoverishment of the flora, which has already permanently lost many species, particularly of herbaceous plants. In the Central Huallaga valley there are reports of several extinct species, including Aphlandra mucronata, Sanchezia aurea, S. klugii, Bomarea ferreyrae & Manilkara bidentata.

Although not yet on the danger-list, Peru's only native conifer, Podocarpus glomeratus, once found in large, almost homogeneous stands, has been reduced to relatively small areas and could be in danger of extinction soon if the process continues.

Selective cutting of valuable timber species such as mahogany and cedro during the last 400 years has made these species scarce, although they cannot yet be said to be in danger of extinction.

ENDANGERED ANIMAL SPECIES

WILDLIFE

The richness and diversity of Peru's ecosystems finds expression in the abundance and variety of the fauna. The estimated number of mammal, bird, amphibious and reptile species is 2,960, or 12% of the world total, with a growing number of identified endemisms. (UNEP-ONERN, 1992 and Brack, 1986).

Animal species recognized as being in danger of extinction in Peru are now put at 25, of which 13 are mammals, 11 birds and 1 reptile species. (WCMC, 1991).

Most studies of this subject have tended to be biased toward the larger species, whether mammals, birds or reptiles, which are relatively easy to detect; also, the larger the size of individuals in a species, the smaller the number and, usually, the more conspicuous they are, apart from their possible attraction as game, pets, or animals for medical research. Less is known about the threats to smaller, less conspicuous animals but, considering the rate of ecosystem destruction through deforestation in the tropical forests of the Selva, it is more than likely that a number of inconspicuous or even unknown species have disappeared or are in danger of doing so.

As stated by Gow *et al* (1988), the major causes of species extinction and rapid decline 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 vicuña (Vicugna vicugna), marine turtles (Tretmocheles, Dermochelys, Caretta, Chelonia and Lepidochelys spp.), river turtles (Podocnemeis spp.), the Junín frog (Batrachophrynus spp.) and the paiche (Arapaima gigas).

Some species, such as the spectacled bear (Tremarctos ornatus) suffer primarily because they are considered good hunting trophies.

Others because they are perceived to be pests or competitors for human food sources. The South American sea lion (Otaria flavescens) and the Andean condor (Vultur gryphus) are in this category.

CAUSES OF ALTERATIONS IN FAUNAL DIVERSITY

It appears to be a rule of ecology that, in general, the higher up the zoological scale from invertebrates to mammals, the less numerous are the members of a given species, although this also depends on the size and richness of the habitat. For this reason one finds in nature species comprising few individuals, not because they have suffered depredation but because their populations were small in the first place. Thus it is not always easy to determine whether a species is rare for what may be called endogenous or exogenous reasons.

ONERN (1986) gives a list of the 105 species of fauna which are in different degrees of danger of extinction. They comprise:
14 species in process of extinction;

60 species considered to be vulnerable;

18 rare species;

13 indeterminate species.

The list presented in Table 5.1 details the 14 species in process of extinction, as listed by ONERN. (cf. WCMC, 1991).

MARINE RESOURCE SPECIES

The Ministry of Fisheries regulates the conservation and exploitation of hidrobiological resources in accordance with technical standards and reports of the Instituto de Mar Peruano - IMARPE.

IMARPE carries out periodical inventories and biological studies on such topics as reproductive cycles and growth rates of economically important species, and analyzes the environmental factors that influence population dynamics. Taking into account all these aspects, the Ministry establishes the open and close seasons for the capture of the different species.

For example, the ministry has established for 1993 two close seasons for pelagic resources, in February-March and in August-October in order to permit reproduction and growth, leaving around 70% of the year for fishing.

Capture of the river shrimp (Cryphiops caementarius) is currently allowed during 2/3 of the year, with a minimum size of 7 cms. and only down to 5 kms. from the river mouth.

Seals (Artocephalus australis and Otaria byronia = O. flavescens) are valued for their skins, oil, meat and by-products. Their population has been reduced from 500,000 in 1925 to 49,000 in 1984 due to over-exploitation. Since 1976, when the ministry prohibited hunting of juveniles, the seal population had recovered to 103,000 by 1993.

Apart from these control measures for specific resources, aimed at sustainable exploitation of the marine bioma, the Paracas National Reserve and the Mangrove Sanctuary in Tumbes, which form part of the National System of Natural Protected Areas - SINANPE - include both land and sea areas.

The Sociedad Pachamama, a respected environmental NGO, has proposed the creation of two marine reserves, in some ways analogous to the continental reserves, in the localities of Máncora (297,000 has.) and Illescas - Islas Lobos (607,300 has.). Both are situated in the northern section of Peru's territorial waters where the wide variations in the meteorological and oceanographical phenomena give rise to a wide biodiversity which requires to be protected in both national and international interests. The proposal includes the preparation of management plans and programs of environmental education, evaluation aspects of the protection and management of these resources on a sustainable basis.

Continental waters are regulated in a similar manner. Close seasons have been established for various lakes and rivers, and for certain species, such as the paiche Arapaima gigas, gamitana Colossoma macropomum; paco Piaractus brachypomus, dorado, Brachyplatystoma filamentosum; and corvina Plagioscyon auratus, among others.

In the Sierra, close seasons are fixed for various fish species, including trout, an introduced species, and several Lake Titicaca species.

ENDEMISM AMONG MARINE SPECIES

The main public sector effort in biodiversity conservation has been directed to terrestrial flora, fauna and ecosystems. In this connexion, Peru has 170 land fauna species in danger of extinction and 25 Conservation Unit (protected areas). In contrast, there are no legal dispositions for the protection, in a global manner, of endemic or endangered marine species or marine ecosystems, except for the two composite protected areas mentioned above.

The Paracas National Reserve, with an area of 335,000 has. of which 65% is ocean, exists for the purpose of conserving one of the most diverse marine ecosystems comprising a wealth of fish, mollusc, crustacean, bird and mammal species, as well as to protect the cultural and historical heritage of the area and to develop techniques for the rational utilization of the seal population.

The National Mangrove Sanctuary in Tumbes department has as its main objective the protection of the last vestiges of the mangrove forest and of a score of aquatic invertebrates which are endemic to the area.

As part of a preliminary study of the endemic fauna of Peru, A. Brack lists 34 fish species and 19 crustaceans which are endemic to the northern tropical ocean and two endemic fish species found off the bay of Paracas. That author also refers to several endemic fish species which inhabit the Tumbes river, 14 fish species of the genus *Orestias* in Lake Titicaca and many others in rivers, pools and lakes in the Selva, but he considers it premature to attempt to establish a global list of endemic species for lack of catalogues and distribution lists (Brack, 1986).

Ministerial Resolution # 1802-90-AG and the Red Book of Peruvian Wildlife (V. Pulido 1991) establish as endemic the following marine aquatic species: Species in process of extinction:

1. The "gato marino", *Lutra felina* which inhabits the cool waters of the Peruvian Current off Ica, Arequipa, Moquegua and Tacna. The only protected populations of the species which are included in Appendix I of CITES, are in the Paracas Reserve.
2. The Humboldt Penguin, *Spheniscus humboldtii*, an endemic species of the cool waters of the Peruvian Current, distributed between Cabo Blanco in Peru and Coral in Chile - This species, which is included in Appendix I of CITES, is in association with the guano birds or in caves and beaches inhabited by seals. The only protected populations are in the Paracas Reserve.
3. The Tumbes crocodile, *Crocodylus acutus*, distributed from southern Florida to Tumbes, also included in Appendix I of CITES, is under total hunting prohibition since 1950. It is found in the Tumbes National Forest, the Amotape National Park and in the National Mangrove Sanctuary in Tumbes.

VULNERABLE SPECIES

1. The green turtle, Chelonia mydas, distributed in the cool waters of the Peruvian Current and in the northern tropical sea. It is included in CITES Appendix II. It can be found protected in the Paracas Reserve.
2. The Carey turtle, Eretmochelis imbricata, mainly inhabits the tropical ocean and occasionally the cool waters of the Humboldt Current. It is in Appendix I of CITES.
3. The little sea turtle, Lepidochelys olivacea, found in the cool waters of the Peruvian Current. Included in Appendix I of CITES.
4. The leather-backed turtle, Dermochelis coriacea, found in both cool and tropical waters. Included in Appendix I of CITES. Hunting prohibited since 1976.

The relevant ministerial resolution also considers the two seal species to be vulnerable. Juveniles of this species are under hunting prohibition since 1976. Other endangered species are the blue whale, Balaenoptera musculus, B. brydei and the cachalot, Physeter catodon.

Table 5.1
PARTIAL LIST OF ANIMAL SPECIES
IN PROCESS OF EXTINCTION

Common Name	Scientific Name	Family
Choro de cola amarilla	<i>Lagothrix flavicauda</i>	Cebidae
Huapo colorado	<i>Cacajao rubicundus</i>	Cebidae
Mono coto de Tumbes	<i>Alouatta palliata</i>	Cebidae
Chinchilla real	<i>Chinchilla brevicaudata</i>	Chinchillidae
Gato marino	<i>Lutra felina</i>	Mustelidae
Nutria del Noroeste	<i>Lutra annectens</i>	Mustelidae
Lobo de río	<i>Pteronura brasiliensis</i>	Mustelidae
Pinchaque	<i>Tapirus pinchaque</i>	Tapiridae
Guanaco	<i>Lama guanicoe</i>	Camelidae
Flamenco jamesi	<i>Phoenicopterus jamesi</i>	Phoenicopteridae
Flamenco andino	<i>Phoenicopterus andinus</i>	Phoenicopteridae
Suri	<i>Pteroenemia pennata</i>	Rheidae
Cocodrilo de Tumbes	<i>Crocodylus acutus</i>	Crocodylidae
Pava aliblanca	<i>Penelope albipennis</i>	Cracidae

Source: ONERN, 1986.

CHAPTER SIX

CONSERVATION OF ECONOMICALLY IMPORTANT SPECIES AND GERMPLASM

ECONOMICALLY IMPORTANT PLANTS

The main center of genetic diversity of the potato is located in the Andes, in the vicinity of Lake Titicaca, where there is the greatest variability of cultivated forms anywhere in the world. It is the only place where eight cultivated species can be found growing side-by-side, viz.: Solanum tuberosum, S. andigena, S. stenotomum, S. phureja, S. ajanhuiri, S. juzepczukii, S. chaucha and S. curtilobum, apart from some 120 wild species out of a total of 230 discovered to date in the Western Hemisphere.

Because of this genetic wealth the Peruvian Andes have been a favored destination for collecting expeditions, as a result of which there are now more than 30 germplasm banks in different parts of the world which have become important centers for genetic improvement of this species, one of them being the International Potato Center (CIP), headquarters in Lima, which possesses what is probably the most complete germplasm collection, with more than 4,000 accessions. In the universities of Puno and Cuzco, germplasm of bitter potato (papa amarga) is being collected.

It has been proposed that "seed fairs" similar to the traditional rural fairs of the Sierra, be extended in order to stimulate the conservation in situ and distribution of desirable varieties, with the active participation of women, who have a traditional role in conserving and selecting planting material. This idea has been applied in Cajamarca and Puno for some years. At the 1993 Cajamarca fair 1,600 accessions belonging to 12 native Andean crops were handled. We know of farmers who are able to identify as many as 56 varieties of papa amarga, of which they plant up to 6 varieties, as well as 28 varieties of oca.

Peru has two native cotton species, Gossypium barbadense, known as "algodón del país" which was ancestor to the now-famous Egyptian and Pima varieties; and G. raimondii, or "algodoncillo". Peru is the center of origin of G. barbadense (var. peruviana) of which it possesses the most complete collection comprising 180 accessions, half of which come from Peru and the rest from other Latin American and Caribbean countries. It is a valuable genetic resource for high-quality textiles.

Brack has established a list of 292 native species used in agroforestry in different parts of Peru. It includes tree, shrub and herbaceous species which are planted in mixed cropping, strip cropping, silvo-pastoral and other systems - some of these species have as many as ten uses, for example, maguey: Agave americana, molle: Schinus molle, tuna: Opuntia sp. and pijuayo: Bactris sp. Brack's list comprises 62 monocotyledons, including 51 palm species, 226 dicotyledon species, notably the mimosaceae, and 4 gymnosperms.

ECONOMICALLY IMPORTANT TIMBER TREES

Between 1981 and 1990, the then National Forestry Institute (INFOR) and INAA conducted a joint study on forest regeneration in the Selva with Japanese government support. Among its results were the following:

- 1) Establishment of seeding stands, phenological studies, collection and conservation of germplasm and nursery trials of more than 50 species including aguano masha: Huberodendron swietenoides; azúcar huayo: Hymenaea oblongifolia, boláina blanca: Guazuma crinita, caoba: Swietenia officinalis, estoraque: Myroxylon balsamum, huimba negra: Ceiba samauma, ishpingo: Amburana cearensis, pashaca quillosa: Schizolobium sp., and tornillo Cedrelinga catanaeformis.
- 2) Sylvicultural performance of tornillo, indicating its adaptation to acid soils, especially to acrisols and, to judge from its distribution in the Iquitos area and in Brazil, its probable adaptation to ferralsols, though perhaps with less vigor. The increment in diameter and height was promising and its timber is suitable for heavy structural members.
- 3) Sylvicultural performance of bolaina blanca, a species which is expected to do well on gleisols and possibly also on cambisol soils. Its light requirement and recommended system of planting were studied, also its increment in diameter and height. It is suitable for various uses, including door- and window-frames, roof trusses, electric light posts and light structural members.

The Jenaro Herrera Research and Development Center, belonging to IIAP has carried out important new work in the silviculture of tropical species during the last twenty years, and has reached the following conclusions:

For the timber industry tornillo and marupá: Simarouba amara, pashaco curtidor: Parkia multijuga, huayruro de altura: Ormosia sp., tangarana de altura: Sclerolobium aff. tinctorium, canela moena: Ocotea aciphylla, almendro: Caryocar glabrum, cumula colorada: Iryanthera elliptica, quinilla colorada: Manilkara bidentata, aguano cumala: Virola albidiflora and andiroba: Carapa sp. show considerable promise, with diameter increments between 1.5 cm. and 0.5 cm. annually.

For rural constructions carahuasca: Guatteria spp., and pumaqui: Aspidosperma sp. are outstanding, with diameter increments from 1 cm. to 1.5 cm.

Under an arrangement with ITTO and the Camara National Forestal, fifty Peruvian tree species, including some of the foregoing, have undergone satisfactory trials in Japan.

DOMESTICATED PLANT SPECIES

Given the multiplicity of domesticated species from which to choose, this section will indicate only a few of those which are of economic and nutritional importance.

Quinoa (Chenopodium sp.) is a crop with recognized nutritive value and rusticity which has survived four centuries of neglect and even active opposition. It forms part of the diet of Andean peoples; it contains 13.8% protein and three times the

amount of minerals contained by beef. Because of this it has attracted the interest of researchers in the United States and several European countries and even Nepal and East Africa. Several varieties are known.

With regard to Andean crops in general, the National Council for Science and Technology (CONCYTEC), INIA and the La Molina Agrarian University have formed a Committee for the Promotion of the National Program of Andean Crops in order to intensify inter-institutional efforts aimed at encouraging the participation of universities, NGO's and the private sector in general in experimental and promotion with respect to Andean crops.

The committee has given priority in the medium term to the establishment of networks of research on varieties of quinoa, tarwi and olluco, phytosanitary treatment of these species, post-harvest problems of arracacha and specific studies of the Andean fruit species: sachá tomate, aguaymanto and granadilla. In the case of quinoa, 25 ecotypes and varieties are being studied in 17 locations, in cooperation among the INIA experiment stations, the universities, NGO's and peasant communities.

INIA is participating in the interamerican trial of kiwicha, which consists of variety evaluations in Mexico, Guatemala, Ecuador, Peru and Bolivia. Work in Peru will be carried out in Cuzco, Puno, Ayacucho and Cajamarca.

GERMPLASM BANKS FOR NATIVE SPECIES

The International Potato Center (CIP) has 3,993 collections of camote (sweet potato, *Ipomaea batata*), for use in genetic improvement of this species. 65% of this material is from Peru and more than 90% from South American countries. (See Table 6.1)

In INIA's experiment stations, the universities and other research institutions there is a varied collection of Andean crops which constitutes a valuable genetic storehouse, with a total of 8,659 accessions of germplasm which are under evaluation, description and determination of the most appropriate application:

Quinoa	2,800 entries
Kiwicha	1,800
Tarwi	1,500
Cañihua	480
Oca	800
Olluco	450
Mashua	340
Arracacha	120
Yacón	35
Chagos	21
Maca	13
Native fruits	300

NATIVE GRASS SPECIES

According to ONERN (1986) natural pastures in Peru cover an area of approximately 27.6 million hectares, of which 15.9% are temporary and 84.1% permanent. 89% of the total is located in the Sierra, the principal center of livestock raising.

Pastures in the Costa, where they exist, are temporary, consisting of annual grasses and legumes which germinate when occasional rainfall occurs, and in some places with moisture from mists, as in the "lomas" formations.

In the Sierra, natural pastures extend from 3,000 m.a.s.l. upwards to more than 4,500 m.a.s.l., ending almost at the snowline. They cover about 24.6 million has., over 90% permanent. They comprise mainly grasses of the genera Festuca, Calamagrostis and Stipa. Tiller (1982) describes 12 Andean grass species of the genera Bromus, Poa, Calamagrostis, Muhlenbergia, Acicne, Stipa and Paspalum.

The National Soil Conservation Program has established what are termed "in situ nurseries" (semilleros in situ). These are areas within a pasture which are fenced off and protected from grazing animals in order, not only to allow regeneration of the pasture, but also to serve as a germplasm bank for grass and forage species which otherwise would be in danger of disappearing. They have been successfully established and maintained in Huancayo and at San Mateo, in the Rimac valley.

Pastures throughout the Sierra suffer from lack of rational management. In the case of the High Andean pastures, extending to over 19 million hectares, the introduction of sheep by the Spanish settlers subjected the range to selective grazing which eliminates the more tender species such as Festuca, encouraging coarser and less nutritive species. Replacement of sheep with camelids is the logical solution as the latter are adapted to these pastures.

In the Selva there is a relatively small area of natural pastures occurring in scattered fashion in several departments. There is, however, disagreement as to how much of this grassland is truly natural. Grassland ecosystems like those of Pampas de Heath in Madre de Dios, and the Gran Pajonal (Obenteni) in Junín department are probably anthropic in origin. Certainly they and the grasslands in parts of the Ceja de Selva, have experienced the effects of deliberate burning to stimulate growth.

Most cattle raising in the Selva is extensive in nature, with very low stocking rates, reflecting the prevailing low soil fertility. The pastures are established on deforested land, often after it has been retired from agricultural use. Because of the low soil fertility, pastures decline in carrying capacity and have to be expanded by clearing more forest. In the Palcazu, where land suitable for pastures is extremely scarce, pasture can now be seen on steep hillsides suitable only for protection. The future of livestock raising in the Selva should be in sylvo-pastoral or intensive stabling systems.

WILDLIFE

In view of the social and economic importance of wildlife management as a source of food and for products demanded in national and foreign markets, a preliminary list has been prepared of mammal species of economic importance and their location in the national system of protected areas (SINANPE). This list is shown in Table 6.2.

Apart from the intrinsic and economic value of a given species, the existence of wild species in their habitat can help in much the same way as native plant species when it comes to crosses between species like the successful one carried out between the vicuña and the alpaca, known as the "paca-vicuña".

An indication of the most important wildlife species has been given in Chapters Two and Three. More complete information can be readily obtained from the literature, including ONERN-AID (1986); anthropic impact is described by several authors, including Dourojeanni (1985), Gaviria (1981) and Rios *et al* (1973).

That more economically-important species are not in imminent danger of extinction is no doubt due to the nature and extent of their habitats. As Dourojeanni (1990) remarks: "Hunting for food does not appear to have caused any extinctions. Relatively large animals such as the sajino (*Tayassu tacaiu*), huangana (*T. pecarij*), deer (*Mazama americana*), the tapir or sachavaca (*Tapiris terrestris*), ronsoco (*Hydrochoerus hydrochoeris*) or the smaller ones like the majás (*Cuniculus paca*), añuje (*Dasyprocta*) or armadillo (*Dasypus*), which are those that are consumed most, do not face the risk of extinction although some of them are now rare in more hunted-over areas..." In areas of heavy human population density, as in the vicinity of Iquitos, Pucallpa and other cities and in areas such as the Gran Pajonal where there is a relatively dense Campa population accustomed to eat wildlife meat, local extinctions have taken place (Denevan, 1971).

AQUATIC SPECIES

The cool ocean currents of the world - the Benguela Current off south-western Africa, the Canary Current and the cool currents of the Peruvian Pacific are recognized as important fishery waters. The great hydrobiological wealth of Peru's territorial waters, which occupy an area of 325,000 sq. miles, is due to the combined action of the Humboldt, Cromwell, El Niño, Peruvian Oceanic, Peruvian Sub-Tropical and Sub-Antarctic Temperate Currents, as well as to the effect of changes in the direction and force of the trade winds and the proximity of the Andes, all of which combine to create favorable conditions for growth of the microorganisms which are an essential link in the nutritional chain.

Biological diversity in the Peruvian ocean comprises 2,148 species identified to date, consisting of 736 fish species, 872 molluscs and 540 crustaceans. The total biomass is estimated at 25 to 30 million tons. Studies carried out by IMARPE (Instituto del Mar del Perú) in 1990 recorded a pelagic biomass in about 50% of Peru's territorial waters of 17.3 million tons of anchoveta, "sardine" (pilchard), jurel and caballa. (By constitution, Peru's territorial waters extend to 200 miles).

In 1990, Peru occupied fourth place in the world list of fishing nations with 7.9% of the total catch. Unlike its main competitors, Japan and Russia, which carry on deep-sea fishing, Peru fishes only in its territorial waters, mainly in the neritic zone between 10 and 70 miles from shore. About 100 species figure in the national catch, 4.9% of the species identified.

Fish and seafoods play an important role in the protein supply.

In 1985-90 fish represented 38% of total meat consumption with 14 kgs. per capita.

Foreign exchange earnings from fish and fish product exports in 1990 were US\$ 419.6 million comprising 75.9% fishmeal, 13.9% frozen and 9.8% canned fish and seafood.

In the chain of marketing between operator and consumer, fish passes through several hands, often doubling in price between fish-quay and table, the lion's share being taken by the wholesaler.

The information on fish and hidrobiological resources contained in AID's "Peru: Natural Resources Assessment" 1990 (p.46-55) is still valid, requiring only numerical updating. The situation regarding the resource base, exploitation levels and conservation requirements has not changed materially since 1990.

Table 6.1
ORIGINS OF SWEET POTATO MATERIAL IN CIP
1988

Country/Region	Donation	Collection	Total	%
Peru	1,435	157	2,592	64.9
Colombia	4	322	326	8.2
Ecuador	1	230	231	5.8
Bolivia	1	158	159	4.0
Brazil	7	122	129	3.2
Rest S. America	67	91	158	5.8
C. America	47	-	47	1.2
Caribbean	119	110	229	5.7
N. America	90	9	99	2.5
Others	23	-	23	0.6
TOTAL	1,794	2,199	3,993	100.0

Source: CIP, 1988

Table 6.2

ECONOMICALLY IMPORTANT WILD MAMMAL SPECIES AND THEIR
CONFIRMED LOCATION IN SINANPE

SPECIES	LOCATION IN PROTECTED NATURAL AREAS
01 <i>Dasyprocta fuliginosa</i> "Aguti"	Yanachaga-Chemillen
02 <i>Cuniculus paca</i> "Majás"	Pacaya-Samiria y Manu
03 <i>Dinomys branickii</i> "Falsa paca"	Manu
04 <i>Myoprocta pratti</i> "Punchana"	Pacaya-Samiria
05 <i>Hydrochoerus hydrochaeris</i> "Ronsoco"	Manu, Pacaya-Samiria, Tingo María y Yanachaga-Chemillen
06 <i>Vicugna vicugna</i> "Vicuña"	Pampa Galeras, Huascarán y Salinas y Aguada Blanca
07 <i>Tapirus terrestris</i> "Sachavaca", "Tapir"	Pacaya-Samiria y Manu
08 <i>Tayassu tajacu</i> "Huangana"	Pacaya-Samiria y Manu
09 <i>Tayassu pecari</i> "Sajino"	Pacaya-Samiria y Manu
10 <i>Mazama americana</i> "venado rojo"	Pacaya-Samiria y Manu
11 <i>Odocoileus virginianus</i> "Venado gris"	Cerro Amotape, Lachay y Coto de Caza El Angolo
12 <i>Hippocamelus antisensis</i> "Taruca"	Huascarán

Prepared from: Dourojeanni, Marc 1968

CHAPTER SEVEN

THE LEGISLATIVE AND INSTITUTIONAL CONTEXT FOR CONSERVATION

A. LEGISLATION

INTRODUCTION

Much of the content of the 1988 Biological Diversity Assessment is equally valid in 1993. Some important changes have taken place, however, and these will be highlighted in this chapter.

Legislation related to Natural Resources and the Environment

This topic will be dealt with in hierarchical order, commencing with international treaties and conventions, which rank first in order of importance followed by the constitution(s), laws and other instruments.

INTERNATIONAL TREATIES AND CONVENTIONS

Peru's participation in international policy-making concerning the environment and natural resources has been gaining ground since 1989 when international discussions helped in shaping the Environmental Code and, later, the holding of the United Nations Conference on Environment and Development at Rio de Janeiro in June, 1992. The Brasilia Declaration signed in March, 1989, by ministers of the countries taking part in the Sixth ministerial meeting on the Environment in Latin America and the Caribbean acknowledged that priority should be given to the pressing need to establish a balance between socio-economic development and the protection and conservation of the environment.

Subsequently, ministers of foreign affairs of some American countries signed the Declaration of San Francisco de Quito, signed in March, 1989, acknowledging increased concern for the conservation of the environment in the Amazon region and recognizing the need for sustainable development in that region.

The Manaus Declaration stressed the need for policies to combine development and environmental protection in order to achieve balanced resource use. Peru is signatory to the following international instruments:

- The UNESCO Convention on Protection of the World's Cultural and Natural Heritage, 1972;
- The American Countries' Wildlife and Landscapes Convention, 1940;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington 1973, ratified 1975; as modified to include the vicuña; Most wildlife trading procedures in Peru are governed by this convention.

- Convention on Conservation and Management of the Vicuña, 1979, ratified 1980;
- The Amazon Cooperation Treaty, Brasilia 1978, ratified 1979. The rotating secretariat of this convention will be housed in Lima 1994-96;
- Wildlife Conservation Agreement for the Amazon territories of Peru and Brazil, Lima 1979;
- International Convention for Regulating Whaling Practices, Washington, 1946, ratified by Peru in 1978;
- International Tropical Timber Agreement, 1983, ratified 1985;
- Latin American Forestry Institute Convention, 1960;
- Decision 89 of the Andean Pact, covering Andean technological development projects involving tropical forestry resources, ratified 1975;
- Conference on Management and Conservation of Marine Resources in the South Pacific, ratified 1952;
- Convention for the Protection of the Ozone Layer, Vienna 1985, ratified 1988;
- Convention of International Wetlands Especially as Waterfowl Habitat, 1991;
- Convention on Biological Diversity, Rio, June 1992, ratified by Peru 1993;
- Decision 345, of the Andean Pact, Bogotá, 1993, on Plant Breeders' Rights. It does not protect rights related to traditional knowledge.
- Convention 169 of the International Labor Conference. Convention Concerning Indigenous Rights and Tribal Peoples in Independent Countries, approved by the Peruvian Congress in December 1993.
- Decision 344, of the Andean Pact, Bogotá 1993, opens the way for patenting of modified microorganisms, plants and biotechnological processes and products not occurring naturally.

THE POLITICAL CONSTITUTION OF PERU

The 1979 Constitution, superseded in December, 1993, by the new Constitution approved by referendum, is mentioned briefly for purposes of comparison. It prescribes the conservation and rational management of Peru's natural resources, specifically covered in Articles 118-123, which state that these resources belong to the State which is responsible for their protection, conservation and evaluation.

The 1993 Constitution does not differ greatly from the previous one as far as natural resources and conservation are concerned. One important change relates to the citizen's rights to the environment. Article 2, para. 22 of the 1993 Constitution acknowledges the individual's right to enjoy and live in a balanced environment, adequate for development but leaves out the word "healthy" as well as the obligation to prevent environmental deterioration contained in the 1979 charter. Article 67,

which says the State must establish an environmental policy, should lead to the creation of an environmental authority as a necessary instrument for this purpose. A new feature is the State's obligation to promote the conservation of biodiversity. The last article on environment and natural resources deals with development of the Amazon region, stipulating that management of this region must be sustainable. Hopefully, this provision will help to prevent irrational colonization policies in the future.

There is some concern as to the possible consequences of the provision in Chapter VI which changes the status under which community lands are held. These are no longer inalienable and can be disposed of and can be mortgaged or taken in lien for a debt; as it stands, this provision, although it represents a sincere effort to bring all land into the market economy and so to facilitate investment and credit in agriculture, threatens the territorial basis on which some of the most stable and sustainable resource management systems in Peru are founded: those of the indigenous peoples.

LEGISLATION CONCERNING NATURAL RESOURCES AND THE ENVIRONMENT

The Environment and Natural Resources Code (1990)

The Code is the most important piece of national environmental legislation, which focuses on environmental matters from a holistic point of view. It does, however, contain some technical inaccuracies that must be clarified in later regulations. The Code provides for citizen participation in setting environmental policies and establishes the obligation of the contaminator to meet the cost of the environmental damage arising from his activities.

These provisions were considered too stringent by many critics. It was argued that the Code was issued without sufficient prior debate, and that it is so strict that it will drive investors to other countries. Several parliamentary efforts were made to have it suspended.

Finally, in November, 1991, the Code was amended by the Executive on the grounds that changes were necessary to promote new investments.

Agrarian Sector Investment Promotion Law, Legislative Decree 653 (D.L. 653) - (8-1-91)

Article 71 of the Environmental Code which banned mining and petroleum activities in protected areas was revoked by D.L. 653. A further decree issued the same year subjects the granting of permission for such activities to the prior execution of an environmental impact assessment.

Private Sector Investment Promotion Law, Legislative Decree 757 (D.L. 757) - (11-13-91)

An article of this Legislative Decree annuls any legal provisions that interfere with the productive process except those that govern hygiene, industrial safety, environmental conservation and health.

Article 8 of the Code which specified activities for which an Environmental Impact Assessment was required, was also modified leaving it to the relevant sectoral authorities to rule on this point. During the two years since this decree was issued, only the Ministry of Energy and Mines has specified the activities for which such assessments must be made. Under the same decree, Protected Areas may only be created by the Central Government by Supreme Decree. Local and regional governments may be delegated powers for the administration of such areas.

One of the merits of D.L. 757 is that it creates the possibility for the granting of land to private individuals for the purposes of eco-tourism, but the manner in which this may be done has not yet been regulated.

The annulment by this decree of Chapter XXII of the Environmental Code, which created the possibility of organizing a National Environmental Authority, has aroused opposition in several quarters.

One of the greatest limitations of this decree is that it has delegated to the different national sectoral authorities the establishment of environmental policies according to the activity concerned and the determination of the necessity to present environmental impact assessments. Also, it bars any regulation of pollution until it exceeds limits set by Law. In Peru, only the Water Law has set such limits.

Mining Sector Investment Promotion Law - Legislative Decree 708 (11-14-91)

This decree amends Chapter XXII of the Environmental Code in the parts that refer to mining and establishes conditions regarding waste disposal, treatment of waste water, etc.

An attempt was made to adopt the requisite implementing regulations required by the Environmental Code, and a committee formed for this purpose drew up a draft regulation which was submitted to public debate in June, 1991, but it appears that the political will to see it through was lacking although some of the provisions in the draft regulation have been adopted by certain sectors.

Forestry and Wildlife Law - Law Decree 21147 (05-13-75)

This is the major piece of legislation on the conservation of flora and fauna. Initially, its main focus was on forestry and forest utilization; it rules that lands classified as suitable for forestry should remain in that use.

Authority for forestry matters resides in the Ministry of Agriculture, which exercised such authority at that time through the Direccion General Forestal y de Fauna (DGFF). At present the Forestry Authority is still the Ministry of Agriculture but authority is now exercised by the Direccion General Forestal of the National Institute for Natural Resources (INRENA). This law establishes that forest and wildlife resources are public property and that no rights to them can be acquired. The State's role is to regulate, control and preserve forest and wildlife resources. Law Decree 21147 declares that reforestation is a matter of public interest, authorizing the Ministry to establish reforestation areas for protection purposes. Later sections establish conservation units, management of protected areas and penalties for violations.

This law established forestry contract conditions, including requirements for studies in respect of areas of 1,000 has. or more, a provision which has been evaded by combining a number of concessions of less than 1,000 has. each into an industrial sized concession.

Regulation Governing Flora and Wildlife Conservation - Supreme Decree 158-77-AG (6-4-1977)

This decree establishes specific regulations for the conservation of flora and fauna. It establishes five categories of species in descending order of endangerment:

- a) Endangered species
- b) Vulnerable species
- c) Rare species
- d) Species in unspecified situations, and
- e) Species not in danger of extinction

This decree provides for close seasons, hunting reserves and communal reserves, of which the Yanasha reserve in Palcazu is the only example to date; it also establishes wildlife breeding centers.

Regulation on Forest Classification and Management Supreme Decree 159-77-AG (6-4-1977)

This decree establishes the classification of land by major use capability and seeks to establish the technical, administrative and economic conditions for the conservation and use of land with forestry capability, and related matters.

Supreme Decree 160-77-AG (4-7-1977) Regulation Concerning Flora and Wildlife Conservation Units

This provision regulates Chapter II, Title II of the Forestry Law, providing for the establishment, regulation and management of the various kinds of conservation units including: protection forests, national parks, national reserves, national sanctuaries and historical sanctuaries. It establishes conditions for use of these units for scientific research, tourism and recreation. This regulation has been one of the most effective conservation tools in Peru and has led to the establishment of 24 protected areas.

Supreme Decree 161-77-AG (4-7-77): Regulation for Forest Products Extraction and Processing

This disposition regulates the Forestry Law in respect of the utilization, processing and marketing of forest products. It stipulates that logging for industrial and/or commercial purposes must take place in free-access forests under exploration and exploitation contracts, and sets out the conditions for granting such contracts.

Creation of the National System of Natural Areas Protected by the State - SINANPE (Supreme Decree 010-90-AG, 03-24-90)

This decree creates a National Program of Parks and other Natural Areas protected by the State known as SINANPE, which became the decentralized public entity of the then DGFF. It incorporates the National System of Conservation Units (SINUC), as

well as other categories established by the Agrarian Sector. This has since been changed with the creation of INRENA.

Supreme Decree 051-92-AG (Dec. 1992)

This decree suspended, indefinitely, all applications for forest exploration and exploitation contracts. It was considered the easiest solution to numerous problems that had affected forestry administration, given the expectations generated by the impending enactment of a new Forestry Law and the abuses which had occurred under the existing one. However, it was not necessarily the most advisable or appropriate and has had negative repercussions on certain sectors.

Law 26258 of December 12, 1993.

This Law prohibits for a period of 15 years, the felling of trees of the natural forests of Tumbes, Piura, Lambayeque and La Libertad, in the north of Peru. It also prohibits the production, transportation and commercialization of wood and charcoal from these trees.

Draft Forestry Law

Various drafts of a new forestry law are circulating among interested groups. One of these, prepared jointly by the SPIDA and FPCN, following an extensive cross-sectoral consultative process was submitted to the Congress in July, 1992, but as yet no new law is forthcoming.

The draft just referred to was the basis for a Draft Forestry Law drawn up by the National Institute for Natural Resources (INRENA). This draft sets out a new classification of forest areas and provides for the design and implementation of Forestry Management Plans, the allotment of forest exploitation rights by public auction, an environmental impact study of the management system proposed and an annual financial guarantee to secure the faithful fulfillment of the management plan. Another draft forestry law has been prepared by the National Forestry Chamber, but it seems probable that the INRENA draft will be accepted, though no doubt with modifications. The important thing is to have a reasonably workable law, not to wait indefinitely for a perfect one while ensuring adequate protection for the interests of small holders, campesino communities and indigenous peoples in particular. Hopefully, the law finally issued will provide a basis for long-term forest management, which is lacking in the present law.

D.L. 17752-69-AG General Water Law

This law replaced the 1902 Código de Aguas. It declared that waters are property of the State and must be used in a rational manner in harmony with national interests. To this end, it formulates general policy for the utilization, development and conservation of water, empowering the Executive to reserve water resources, manage watersheds and other areas, declare protected areas and states of emergency and emit the dispositions it considers necessary for the control of water use. The law makes it compulsory to hold a permit for the use of water, except for satisfying basic needs.

Special emphasis is given to water conservation, watershed management and the development and operation of Water Users' Boards, Irrigation Districts and an inter-sectoral Water Council. It also establishes the principle of volumetric rationing of

irrigation water according to cropping plans approved at local level, but it does not consider the charging of realistic water fees, believed by many to be the best mechanism for ensuring economical water use and the avoidance of over-irrigation, the cause of much of the soil salinity prevalent in the Costa. A new draft law is in preparation, which it is hoped will embody this principle.

Legislative Decree 653, of August 1991, makes use of water for agricultural purposes conditional upon the available quantities of this resource. The administrative provisions of this regulation establishes water authorities, declaring that the Technical Administrator is the authority with regard to watershed management, the ambit of each watershed being established by the Ministry of Agriculture based upon their actual hydrological characteristic. At the same time this regulation allows for the creation of autonomous authorities for watershed management where intensive and multisectoral use of water resources exists. Such autonomous authorities have as their objectives the formulation of management plans for their water resources and coordination with the relevant authorities for adjacent watersheds where appropriate or necessary.

With respect to users the law establishes the organization of commissions of users for each sector or subsector of the watershed, and of the Council of Users for each watershed. These Councils and commissions have responsibility for promoting participation of their members in the operation, maintenance, development and rational use of water and soil resources.

Water Code Project

A project for the establishment of a new Water Code is under discussion within the Ministry of Agriculture, and its prompt approval is almost certain. Its most important change to existing legislation is with regard to the concession of specific rights for the use of terrestrial waters, which in turn permits the use of waters exclusively and for any purpose. The Project recognizes the right to transfer legal rights over waters, separately from any land property rights or activity to which these waters are destined, coming furthermore under the scope of the Civil Code provisions. This transfer will be registered in the Register for Water Rights.

It recognizes as management organizations for the use of waters, basin (watershed) bureaus with jurisdiction over their basin, and channel commissions with jurisdiction over channels and other hydraulic constructions. It also mentions underground water commissions and drainage commissions.

The Project recognizes watershed management as management of the whole basin, requiring, therefore, authorization of the Watershed Director for the construction or modification of any structure on the river's course.

This Project contains only a couple of provisions referring to quality of waters, specifically stating that it is prohibited to alter water quality when it affects human health, flora, fauna or third parties.

General Fishery Law - Legislative Decree 25977 (12-22-92)

The main purpose of this law is to promote the sustainable management of fishing activities as a source of food, employment and income, in keeping with conservation of the environment and of biodiversity. It declares that the State is responsible for protecting and preserving the environment within the framework of fishery activities.

Article 67 provides for coordination between the Ministry of Fisheries and other Ministries concerning prevention and control of pollution caused by fishery-related activities. The law expressly forbids disposal of noxious wastes on beaches or in other public areas or actions which may upset the balance of coastal ecosystems, especially mangrove swamps and estuaries.

NORMS ON CONTAMINATION

The Environmental Code received strong criticism upon its enactment as it contained no specific chapter on contamination.

Nevertheless, the Code includes provisions on prevention, control of the contaminating source, and the polluter pays principle, as means to effectively combat contamination. With the modifications introduced by Legislative Decree 757, it was stated that any reference to contamination must be related to permissible standards and limits established by each sector which, at present, are non-existent. The Energy and Mining sector, in the EMTAL project, financed by the World Bank, has established certain norms related to contamination control in the mining and oil areas.

Regulation for Environmental Protection in Mining/Metallurgical Activities-Supreme Decree 016-93-EM (1-5-93)

This regulation seeks to establish adequate control mechanisms in order to balance mining/metallurgical activities and development, with environmental protection. To this end, it provides that persons carrying out mining activities at the date of its promulgation are obliged to elaborate Environmental Adequation and Management Programs so as to, in a period of 10 years, adequate their activities to environmental provisions governing this activity. On the other hand, if activities are begun after the date of promulgation an Environmental Impact Assessment study is required in accordance with Annex II of this same norm. Persons are also obliged to present a report on emissions and/or vertiments of residues of mining/metallurgical activities.

One of the biggest problems with this Regulation results from the fact that it did not determine the criteria under which the mining environmental authority should consider the establishment of future maximum emission levels.

For this reason Supreme Decree 059-93-EM, (13-12-93), specifies that the mining authority will publish a special manual for the implementation of programs for water, air monitoring, elaboration of EIA and Environmental Adequation and Management Programs.

Another problem is that the General Direction of the Environment of the Ministry of Energy and Mining, considers itself the only entity with specific competence in environmental concerns, without considering the intersectoral impacts such activities generate.

Regulation for Environmental Protection in Hidrocarb on Activities Supreme Decree 046-93-EM (12-11-93)

The structure of the relevant legislation is similar to that previously referred to with regard to mining activities, though it corrects certain errors. It recognizes the public interest in EIA studies, as well as the general right to opinion of people interested in these matters. Nevertheless, it does not enshrine an effective right of participation of indigenous populations upon whose territories these activities are to be done. This is a right which will have to be recognized in following recent approval by the peruvian Congress of Convention 169 of the International Labour Organization.

The pertinent Supreme Decree specifies conditions for programs on emissions and liquid discharges, establishing a maximum concentration standard for contaminants in the air. However, air quality standards should be established by the health authority, otherwise in the future we may see each sector deciding upon different standards for their own specific activities.

B. INSTITUTIONAL FRAMEWORK

THE PUBLIC SECTOR

The institutional framework for conservation in Peru has changed considerably since 1988. As mentioned before, the intention of Chapter XXII of the Environmental Code, regarding the National Environmental System, was to establish the Peruvian Environmental Authority. However, this chapter was annulled in November 1991 and the sectors were made responsible for the environment within their spheres of competence. Different projects have been drawn up since then to create a National Environmental Authority, but so far there appears to be a lack of political will to do so.

The latest amendments to the organic laws governing Ministries, which virtually eliminate Regional Governments and reduce the State structure, have given rise to a less effective environmental management than in the past. For example, the National Natural Resources Evaluation Bureau has disappeared, the future of the Peruvian Amazon Research Institute is uncertain and the National Planning Institute has been dismantled.

The following is the organic structure governing conservation in Peru:

Ministry of Agriculture

This Ministry's organic law is Law No. 25902 dated November 29th 1992. The Regulation governing the Organization and Role of the Ministry of Agriculture and its Decentralized Organizations, was issued by means of Supreme Decree No. 053-92-AG dated January 3rd 1993.

Within the Ministry of Agriculture's organic structure, the responsibilities of its General Bureaus have been transferred to the Decentralized Public Organizations created by this law. Regional Agrarian Bureaus were also created as decentralized bodies responsible for the Ministry of Agriculture's regional activities and to promote all agriculturally related production activities. Furthermore, Agrarian

Agencies and Agrarian Districts were created, and finally the Special Land Title and Rural Land Registry Project. The National Vicuña Council's role as a consultative body was eliminated, as was the coordinating role of the National Agrarian Coordination Council.

The Ministry of Agriculture's Public Decentralized Bodies

These are autonomous organizations in technical, administrative, economic and financial terms.

- a) The National Agricultural Research Institute, INIA, has replaced the previous National Agricultural and Agro-industrial Research Institute (INIAA). INIA's objective is to help introduce technology into the farming sector under competitive conditions. This entity is responsible for research, promotion and the transfer of technology in the farming sector, placing priority on highland and jungle areas and complementing farming activities on the coast. It is also responsible for the conservation, preservation and management of the country's germplasm resources.
- b) National Agrarian Sanitation Service: responsible for encouraging the private sector to participate in the implementation of plans and programs for the prevention, control and eradication of plagues and diseases affecting farming activities.
- c) National Council of South American Camelids: responsible for promoting, supervising and providing advice on the development, conservation, management, improvement and utilization of all species of South American camelids throughout the country.
- d) National Institute of Natural Resources (INRENA): Created to promote the rational and integrated management and utilization of renewable natural resources in order to achieve sustained development. INRENA was based on the role originally played by the National Natural Resources Evaluation Bureau (ONERN) and the General Bureaus pertaining to the Ministry of Agriculture. Undoubtedly because ONERN was dismantled and INRENA created, the agricultural sector has acquired a sectoral point of view as far as the conservation of natural resources is concerned. Moreover, Peru's National Parks Programme and National Forestry Programme have been transferred to INRENA.

INRENA's authority is established in the Organization and Responsibilities Regulation approved by Supreme Decree No. 055-92-AG and the Organization and Responsibilities Handbook drawn up by the Institute itself in March 1993. Details of INRENA's organization and its five General Bureaus appear on the attached Organization Chart).

An Executive Council was established within INRENA's organization scheme, responsible for setting and evaluating policies, plans and strategies. However, this Executive Council has failed to meet so far, therefore conservation plans and policies cannot be expected yet.

The General Forestry Bureau's role is to propose policies, plans and standards for the sustained use of forestry resources, and to ensure that these are fulfilled.

The General Protected Natural Areas and Wildlife Bureau is responsible for proposing policies, plans and standards for the management of the Units comprising the National System of Protected Natural Areas, as well as for the sustained management of wildlife. This entity is important because it is directly responsible for managing SINANPE.

The General Rural Environment Bureau, is the entity responsible for evaluating the environmental impact of activities, programs and projects within the agrarian sector.

INRENA also comprises other units which are not structured, such as the Seed Bank and the Forestry Nursery, as well as operational units of the General Protected Natural Areas and Wildlife Bureau, which are in fact Conservation Units.

The reorganization of INRENA is currently under debate due, among other things, to the assumption by it of the authority hitherto exercised by the Regional Agrarian Bureaus.

Proyecto Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos (PRONAMACHCS)

This is a decentralized organ of the Ministry of Agriculture, charged with designing, promoting and executing strategies and technical - administrative action for the integral management of watersheds through soil conservation reforestation and development of rural infrastructure in order to ensure sustainable use of renewable natural resources.

Comisión Nacional de Plaguicidas

Is the organ responsible for preparing the Ministry of Agriculture's policy and strategies with regard to pesticides and similar substances throughout the territory. It is in charge of proposing actions related to plant and animal sanitary measures, public health and the environment.

Regional Governments

The Regionalization Guidelines Law established the sphere of competence of certain Regional Governments as far as the conservation of resources was concerned, to which end Regional Secretariats for Extractive & Productive Affairs were formed in each region. In this way, regions regulated, implemented and promoted the preservation and conservation of forestry and wildlife resources and forestation and reforestation programs, assuming the role previously played by agrarian regions.

These Regional Secretariats were responsible for all matters concerning farming, forestry and fauna, fishing, mining, hydrocarbons, natural resources and the environment.

Nevertheless, this entire regional organization became inoperative when its sphere of competence was reassumed by the Central Government. For example, the Ministry of Agriculture took over the role of the Agrarian Sector, creating Regional Agrarian Units as decentralized bodies of the Ministry of Agriculture itself which no longer depend on the Regional Government. A similar situation occurred with

Regional Mining Bureaus which were taken over by the Ministry of Energy and Mines, which is now responsible for matters concerning Mining Concessions through the Public Mining Registry.

There were many arguments explaining why Regional Governments were dismantled, including the lack of consistent policies, bureaucracy in Regional Governments, discrepancies with national policies, among others. Nevertheless, activities are now more centralized than ever, although Peru's 1993 Political Constitution has rather apprehensively implied the possibility of a new regionalization process.

When Congress was dissolved on April 5th 1992, provisional Regional Government Presidents were appointed, Regional Assemblies and Regional Councils throughout the country were dissolved and Transitory Regional Administration Councils created. However, no specific offices were established to cover regional environmental matters.

PROFONANPE (Law Decree 26154. 30-12-1992)

This Law Decree created the National Fund for State Protected Natural Areas - FONANPE, which is an intangible Trustee Fund for the conservation, protection and management of State Protected Natural Areas. FONANPE is to be financed with an initial fund contributed by the Global Environmental Facility, managed by the World Bank. This Decree Law also created PROFONANPE, a non-profit private institution responsible for the administration of FONANPE and the channelling of other funds for financing projects or programs.

PROFONANPE's Executive Council consists of three representatives of INRENA, three representatives of the Peruvian Environmental Network and one representative of an International Cooperation Agency.

PROFONANPE was formed as a mechanism for channelling resources for the conservation and management of Protected Natural Areas and spheres of influence; it finances plans or programs, but does not implement projects. Since its incorporation, it has channelled financing for the Canadian Cooperation institution's facilities and for a German Cooperation project through GTZ, involving finance for projects in four Protected Natural Areas.

The channelling of funds is governed by the Law Decree, the regulatory Supreme Decree, Supreme Decree No. 024-93-AG dated July 16th 1993, PROFONANPE's Bye-Laws and the Agreement to be signed with the donor, which could include the establishment of an Administration Board for evaluating and controlling funds, if necessary.

Draft Law Creating the National Environmental Council

This was submitted to the Senate in 1992. This Council was scheduled to become the National Environmental Authority responsible for national environmental policies. The project was approved by the Senate and subsequently submitted to the Chamber of Deputies for approval, however it was left in abeyance when Congress was closed on April 5th 1992. Since then, four draft laws pertaining to the creation of the same Council have been submitted to the Democratic Constituent Congress and another four have been drawn up at the initiative of different sectors of the Executive Power.

Despite the number of projects available, legislation creating an Environmental Authority has not been issued due to an apparent lack of political goodwill, although each sector has acknowledged the need for an entity responsible for issuing national environmental policies.

International Cooperation in this field should be aimed at designing the structure of a National Environmental Authority and drawing up a medium term Environmental Plan, given the chaotic situation caused by the sectoral nature of environmental spheres of competence and the lack of environmental planning policies.

PERUVIAN NON-GOVERNMENTAL ORGANIZATIONS

There is an ever-increasing number of NGOs involved in issues relating to natural resources and the environment in Peru, many of them new organizations formed by old members of different Public entities who have thus continued exercising their activities in this field. The Rio de Janeiro Conference and the greater dissemination of information on the environment and natural resources, further increased the number of NGOs.

Despite the fact that the tendency is for the majority of NGOs to be centralized in Lima, it is also true that new institutions are constantly being incorporated in other parts of the country, although these often lack information and adequate access to State organizations in order to effectively exercise their activities. As a result, many regional NGOs have to be coordinated by NGOs in the capital city. One of the most important aspects of the work performed by NGOs in Peru, is related to the Public Sector's willingness to provide information to them and accept their proposals. Likewise, many NGOs form part of Government committees responsible for designing sectoral policies for the conservation of resources. NGOs, for example, played an active and important participatory role in the Reviewing Committee for the Draft Code. NGOs also work with the Environment and Amazon Region Committee established by the Peruvian Congress, and have organized several joint events with the Public sector and legislative branch.

NGOs are not always in agreement with the public sector, however, and conflicts often occur. For example, several NGOs openly opposed the Government's intention to sign an oil drilling contract in the Pacaya Samiria National Reserve, and the oil company involved subsequently refused to operate in this area.

As a result of the vast number of NGOs in Peru, there is a pressing need for coordination, to which end the following different networks have been established, the purpose of which is to coordinate work and adopt joint strategies, if relevant.

Non-Governmental Organization Networks

Peruvian Environmental Network

- Currently comprising 31 organizations, its purpose is to help achieve a stable relationship between society and its natural surroundings, integrating conservation and development in order to improve standards of living.
- Peruvian IUCN Committee: Formed by all Peruvian NGOs belonging to the IUCN. Its purpose is to establish reciprocal coordination mechanisms in order to simplify and improve members' actions.

- National Andean Forestry Development Network - REDFOR, involving NGOs devoted to forestry management in search of coordination.
- Ecological Farming Network (RAE) - an inter-institutional effort to improve research methodologies related to ecological farming, in order to acquire sufficient knowledge to design an economically viable sustained development alternative.
- Action Network for Agrochemical Alternatives (RAAA): joins institutions and individuals identified with the farming sector's environmental problems, with a view to implementing environmental protection activities, particularly against the indiscriminate use of agrochemicals in agriculture.
- Editorial Consortium of the Magazine Medio Ambiente: Formed by NGOs involved in the conservation of resources, to design and publish a monthly magazine to disseminate the activities of the different NGOs and to include articles concerning environmental problems affecting natural resources.
- APECO-RED: A network formed by 18 organizations throughout the country working together with the Peruvian Nature Conservation Association (APECO) on topics concerning the conservation of Biological Diversity.
- National Watershed Management Network.

According to a study of 16 NGOs made by Seguimiento, Análisis y Evaluación S.A. (SASE) at the request of The Nature Conservancy (TNC), there is a low level of diversification as far as sources of financing are concerned, whereas NGOs tend to work in more than one thematic area. This study recommended the need for national NGOs and financial aid entities to join efforts to prevent duplication in financing and evaluation of impacts of each project.

The NGO "PROTERRA" has drawn up a Peruvian Environmental Directory, describing the activities of most NGOs involved in environment and development matters. The following are the most prominent NGOs included in the list:

- AGUA Instituto para el Desarrollo - AGUA (AGUA Development Institute)
- Asociación Amazonia (Amazon Association)
- Asociación Civil Labor ('Labor' Civil Association)
- Asociación de Conservación para la Selva Sur - ACSS (Southern Jungle Conservation Association)
- Asociación Conservacionista de los Recursos Naturales del Amazonas - Acorena (Conservationist Association for Amazon Natural Resources)
- Asociación Derecho Ambiental de la Región Inca - ADARI (Environmental law Association, Inca-Region) based in Cuzco.
- Asociación del Medio Ambiente y del Consumidor - GEA (Environment and Consumer Association) based in Loreto.
- Asociación de Ecología y Conservación - ECCO (Ecology and Conservation Association).
- Asociación para la Conservación del Patrimonio de Cutivireni - ACPC (Cutivireni Heritage Conservation Association).
- Asociación para la Investigación y Desarrollo Rural - AIDER (Research and Rural Development Association)
- Asociación Peruana para la Conservación de la Naturaleza -APECO (Peruvian Nature Conservation Association)

- Centro Amazónico de Antropología y Aplicación Práctica -CAAAP (Amazon Anthropology and Practical Application Centre)
- Centro de Estudios para el Ecodesarrollo de la Reserva de la Biosfera del Manu - BIOMANU (Manu Biosphere Reserve Eco-development Study Centre)
- Centro de Estudios y Prevención de Desastres - PREDES. (Disaster Prevention Study Centre).
- Centro de Estudios y Promoción del Desarrollo - DESCO. (Development Promotion and Study Centre).
- Centro de Investigación, Documentación y Desarrollo - CIED. (Research, Documentation and Development Centre).
- Centro de Investigaciones y Proyectos Urbanos y Regionales - CIPUR. (Research and Urban and Regional Projects Centre).
- Centro para el Desarrollo Regional Raíz - CDR. (Raiz Regional Development Centre).
- Centro Peruano de Estudio para el Ecodesarrollo Marino -ECODEMAR. (Peruvian Marine Eco-development Study Centre).
- Consejo Andino de Manejo Ecológico - CAME. (Andean Ecological Management Council).
- Environmental Law Alliance Worldwide - ELAW PERU.
- Frente Ecológico Peruano (Peruvian Ecological Front).
- Fundación Peruana para la Conservación de la Naturaleza -FPCN (Peruvian Nature Conservation Foundation)
- Instituto de Conservación y Medio Ambiente - IDMA. (Conservation and Environment Institute)
- Instituto de Estudios de Factibilidad Ecológica - IDEFE (Ecological Feasibility Studies Institute)
- Instituto para la Conservación del Medio Ambiente (INCOMA). (Environment Conservation Institute).
- Vida Instituto para la Conservación del Medio Ambiente (Vida Environment Conservation Institute).
- Instituto Saber ('Saber' Institute).
- Naturaleza, Ciencia y Tecnología Local para el Servicio Social - NCTL. (Local Nature, Science and Technology for Social Services).
- Oficina de Asesoría y Consultoría Ambiental - OACA (Environmental Advisory and Consultancy Office)
- Programa de Conservación y Desarrollo Sostenido de Humedales Perú. (Programme for the Conservation and Sustained Development of Peru's Damp Areas).
- PROTERRA.
- Seguimiento, Análisis y Evaluación para el Desarrollo -SASE (Follow-up, Analysis and Evaluation for Development).
- Seminario Permanente de Investigación Agraria - SEPIA. (Permanent Agrarian Research Seminar).
- Sociedad Pachamama. ('Pachamama' Association).
- Sociedad Peruana de Derecho Ambiental - SPDA (Peruvian Environmental Law Association).

Besides the NGO Community in general there exists a number of local, regional and national organizations representing the interests of indigenous peoples. While many NGO's carry on work with indigenous peoples it is extremely important that their own voice be represented in the national debate. This is of particular relevance with regard to development policies affecting their traditional territories. At the national level AIDSESP (Asociación Interétnica de Desarrollo de la Selva Peruana) and CONAP (Confederación de Nacionalidades Amazónicas del Perú), are the

most active, while FADEMAD in the Madre de Dios region is a good example of the benefits of regional organization. With regard to individual nations the Consejo Aguaruna y Huambisa has proved very effective in articulating the concerns of these peoples at the national and international level.

INTERNATIONAL SUPPORT

SUPPORT FROM PRIVATE INTERNATIONAL INSTITUTIONS

Conservation International (CI).

Conservation International is an organization which has been supporting projects since 1987, having increased this support since 1991. Its central object is the protection of ecosystems and the sustainable use of natural resources, having as an area of primary interest the department of Madre de Dios.

Amongst the projects which are being carried out at present by CI, there is the study of socio-economic impact for the Reserved Zone Tambopata Candamo, a project which is being executed by the EORI Center. With the support of INRENA and the participation of local communities it has also supported a preliminary feasibility study for this reserved area. CI is also supporting the Peruvian government to obtain a donation from the Interamerican Development Bank for a feasibility study in the Reserved Zone of Tambopata Candamo and to implement in the future the National Park of Tambopata. CI has also supported NGO Candela Peru so that this organization may develop a project for seeking alternative markets for natural resources.

Finally, Conservation International is under process of inscribing its original Statutes in the Public Registers of Lima, so that in the future it can seek its recognition as a private entity for International Technical Cooperation in Peru.

Wetlands for the Americas

This institution of recent origin resulting from the broadening of the objectives of the Western Hemisphere Shorebird Reserves Network is currently supporting certain projects relating to Wetlands in Peru, a country which is being prioritized.

Within the projects which are being executed there is the Apoyo al Comité Peruano de Conservación y Uso Sostenido de Humedales; furthermore together with Ramsar it is also supporting the elaboration of the Plan Maestro de la Reserva Nacional de Paracas as well as certain economic and technical support for the National Sanctuary lagunas de Mejía. This institution obtains parts of its funds from the Wildlife Services of the United States and Canada.

On the other hand this institution is also looking for financing for the preparation of a project which has as an objective the definition of environmental policies which have impact on wetlands in the region so as to define specific proposals to prevent such impacts.

The John D. and Catherine T. Mc Arthur Foundation

During the board of directors meeting which took place in June 1993, this institution approved a series of projects for its program Tropical Andes, which is directed to support the conservation of biodiversity and projects with communities.

As part of the projects which have been approved in the Program Tropical Andes, there is the Non Timber Forest Product Network, with institutions from Ecuador, Colombia and the NGO Candela of Peru, which seeks the establishment of a regional network for the development of alternative economic possibilities against deforestation. It has also approved the program for integral conservation of Tambopata Candamo which seeks to promote the sustainable development of the Reserved Zone of Tambopata Candamo in the south east of Peru.

The Mc Arthur Foundation has also approved a project with Asociación de Ecología y Conservación ECCO, to conduct a biological research survey and for a program of environmental education in the national forest of Tumbes in the northwest of Peru. On the other hand, within its financing for institutional capacity building it has financed the Sociedad Peruana de Derecho Ambiental, for the development of activities on environmental policies and consultancy services.

Interamerican Foundation (IAF)

Within the projects which this institution has been supporting there is one which has as an objective technical assistance and economical assistance for production so as to improve quality and quantity of potato seeds in the Valle del Colca, department of Arequipa. They also support the program of capacitation, comercialization and promotion of agroindustrial products and services for small peasants in the provinces of Junin and Piura. Aid has also been given to the program of technical assistance and capacitation to one thousand five hundred peasants in the Valley of Tambo in Arequipa; Finally IAF has helped in financing a project of environmental law courses to be given by the Sociedad Peruana de Derecho Ambiental (SPDA) in four regions of the country.

World Resources Institute

Although this institution is not currently executing projects in Peru, it is in the process of planning a regional initiative in the Amazonian region which has as an objective the identification of policies and institutional reforms necessary to promote alternative or traditional uses for land, which seek sustainable use of forestal resources.

W. Alton Jones Foundation

This organization supported in 1992, Sociedad Peruana de Derecho Ambiental in the development of a program to secure an effective compliance with environmental regulations in Peru. This project has as an objective the creation of an area for public interest defense within the SPDA.

Alton Jones has also approved a project to be carried out by the NGO APECO for a program of conservation of forests which seeks to promote the elaboration of a land-use plan in the department of San Martin; elaborate a study on agroecological experiences and agroforestry in the jungle and elaborate a study of socio-economic impacts and benefits to the human population within the limits of the Río Abiseo National Park.

The Nature Conservancy

This institution is currently executing the program "Parks in Peril" having identified in Peru 13 areas of possible support. Up to date support has been given to National Park Yanachaga Chemillen, to the National Sanctuary Pampas del Heath, to the National Sanctuary Tabaconas Namballe and to the National Reserve Pacaya Samiria which in total adds up to over five million dollars for a four year span.

The Parks in Peril program, has as a general objective the need to ensure the effective management of national protected areas.

In the case of Pacaya Samiria, financing is for a program of natural resource management with local communities so as to obtain sustainability in the use of these resources.

This institution is also supporting the Sociedad Peruana de Derecho Ambiental in a program for the generation of environmentally sound national development policies and also executes certain training projects.

World Wildlife Fund (WWF-USA)

This institution has a Latinamerican program in which there is a team which evaluates and is in charge of projects in Peru, in which other institutions which are members of the World Wildlife for Nature are part. At present it is supporting projects in the Reserva de Biósfera del Manu, in the Reserva de Biósfera del Noroeste, in the National Reserve Pacaya Samiria and in the National Reserve of Paracas. This project has as an objective the integral development of these areas including the management of the natural protected area, the management of the buffer zone, development practices, capacitation and the formation of social conscience, etc. It is also executing some projects in National Park Rio Abiseo and the Sanctuary of Ampay.

On the other hand, WWF executes projects referred to education, the program for forests which gave support to the Cooperativa Forestal Yanesha in Palcazu, as well as supporting the formulation of a project on a forestry law.

Finally, WWF has been supporting a project for the creation of a social conscience for conservation with the Fundación Peruana para la Conservación de la Naturaleza as a result of which the first part of the National Strategy for Conservation was made possible.

International Union for the Conservation of Nature (IUCN)

IUCN basically provides supports by way of technical assistance, having done this during the formulation of the National Strategy for Conservation. It also supports through funds for the formulation of proposals and recently supported with technical assistance the strategic planification of PROFONANPE.

Smithsonian Institute

This organization executes the project Biolat (Biological Diversity in Latinamerica) which in the case of Perú is being executed in Madre de Dios since 1987 and in Loreto since 1993. This projects has as an objective to support investigation on topics of interest related to biological diversity. These projects are under scrutiny by

Peruvian environmentalists and other interested sectors concerned that its activities will not lead to the diminishment of rights of the nation and its population, in particular indigenous peoples to share in the benefits derived from the exploitation of national biological resources.

INTERNATIONAL AGENCIES

The operation of international agencies in Peru has been hampered by the previous administration's policy over foreign debt payments, by insecurity due to terrorism, and to some extent by the suspension of Congress.

Multilateral agencies

The most important multilateral agencies in Peru are the following:

The United Nations Development Program - UNDP.

UNDP's 1990 disbursements in the area of natural resources, sectoral policy and planning, amounted to US\$ 32,885,000. In 1991 the amount dropped to US\$ 26,717,000 and in 1992 to US\$ 13,599,000. This agency assisted the Peruvian government in the preparation of its brief for the Rio conference in June 1992 and is offering to help in bringing together political and local authorities and NGO's.

The World Bank

This agency has several projects underway in the area of environmental support, including a US\$ 150,000,000 project with the Ministry of Agriculture, in the irrigation sub-sector, with the object of helping to develop a system of water rights, rehabilitation of irrigation systems and institutional development of water users' organizations. In another project, the Bank is assisting the Ministry of Energy and Mines in strengthening its Office of Environmental Affairs. Also, funds are available for an electricity privatization program and for policy and institutional reforms in that sector.

The European Community Commission

This body is assisting the government in preparing the Contamination Surveillance Project (VICON), covering air and water pollution and refuse disposal in Lima. It has sent evaluation missions to evaluate possibilities for renewing cooperation and is interested in projects related to tropical forest management and support for native populations. The Commission looks with favor on PROFONANPE as an agency for channeling funds for the management of protected areas.

The European Community is currently negotiating a project with the Ministry of Industry which will seek to determine the impact of international norms on Peruvian exportation.

Interamerican Development Bank (IDB)

This institution is developing two important projects the first of which is called "Program for Reform and Strengthening of Agricultural Services" the budget for which is in excess of 200 million dollars, composed of 139'300,000 dollars provided by way of credit from the IDB and a counterpart national sum of 60.7 million dollars.

The project has a series of components, among which may be mentioned the restructuring of the Ministry of Agriculture, the creation of an agricultural information system, the creation of a registration and land titling service, the strengthening of agricultural environmental management, technological development by way of restructuring of the National Agricultural Research Institute (INIA), the development of the National Agrarian Sanitation Service. Among the components of this project are also found various components relating to the reform of agricultural policies and the restructuring of the Agrarian Public Sector.

Within that part of the project related to strengthening of agriculture environmental management has been designed what is called "The INRENA Action Plan" which is to be carried out over a period of 4 years at a cost of 14.921 million dollars of which 7.272 million dollars are provided by the credit of IDB and the amount of 7.640 million dollars from national funds. The project has for its objective contribution to the consolidation and operational improvement as well as the institutional management of INRENA in order to achieve sustainable development of natural resources and the rural environment of Peru. INRENA's Action Plan contains three components:

- Institutional strengthening for forestry administration.
- Institutional strengthening for rural environmental management.
- Institutional strengthening for the design and implementation of a system of information related to natural resources.

The first step contains among other components those related to natural protected areas, which have as their objectives:

- The physical delimitation of the protected areas, acting upon the information provided by cartographers, satellite pictures and other appropriate means.
- The solution of legal problems related to natural protected areas including those related to land tenure.
- Drafting of a law for natural protected areas which will begin in the first quarter of 1995.

On the other hand, the IDB has designed a project named "Strengthening of Environmental Institutions" with a budget of 2.0 million dollars, which has as its objectives to aid in the design and implementation of a national environmental authority which would coordinate the formulation of policies and laws for the protection of the environment and the promotion of sustainable development and establish the institutional basis necessary for the control and enforcement of these policies and laws for the pertinent entities of the public sector.

Bilateral agencies

The following are the interests and priorities of some important bilateral aid agencies in the area of natural resources and conservation.

German Technical Cooperation - GTZ

Is cooperating in a project with PROFONANPE in coordination with the World Bank in the management of three protected areas: Rio Abiseo National Park, the Manu National Park and the Reserva del Noroeste, and in strengthening the Protected

Areas Office of the Ministry of Agriculture. This project in its first phase is for about 1.5 million dollars GTZ is also studying with the Finance Ministry the possibility of implementing Debt-for-Nature Swaps.

Japanese Cooperation - JICA

This agency gives aid on a government basis, not through NGO's. It has carried out research in reclamation of tropical forests in Ucayali, but has no activities in progress at this time. JICA has expressed interest in Peru's having a plan for identifying and funding projects involving international cooperation.

Canadian Cooperation - CIDA

This agency was involved in experiments related to sustainable development, mainly in the field of forest industries. After an evaluation of the situation of the timber industry, CIDA decided to close down its program in Pucallpa. At present it has a support office for pilot projects related to the environment, for instance mist-interception in the Lomas de Lachay, which is being transferred to PROFONANPE. CIDA is awaiting the normalization of the political situation before resuming its full aid program.

CIDA incorporates the environmental component in all rural development projects which it supports and is aware of the importance of having a national plan which gives priority to these activities.

Netherlands Government Cooperation

This bilateral agency is developing several projects related to the environment and biodiversity, despite being aware that the Government of Peru has no plan which would permit the setting of priorities. The projects in which Netherlands Technical Cooperation is actively involved include: Algarrobo Project (Northern Dry Forest), strengthening of IMA (Water and Environment Management Institute) in Cuzco, the FAO-Holland Forestry Project in the Sierra, an environmental education program with the Peruvian Environmental Law Association (SPDA), among others.

International Technical and Financial Cooperation in Forestry

International support has played an important part in forestry development in Peru, particularly in communal plantations, training, extension, research, forest and wildlife management and in conservation and forest planning.

In mid-1991 there were nine forestry projects involving international technical cooperation via the Ministry of Agriculture with a total investment of US\$ 20.2 millions, of which US\$ 13.6 millions were from international sources; of this latter sum, 81.5% was provided by European countries (seven projects, some of which included technical assistance from FAO) and 18.5% from multinational agencies. Average total annual funding - national and international - was US\$ 4.9 millions.

The National Development Institute (INADE) during the 1980's operated, with resources of the public treasury and from agencies including the IDB, World Bank and USAID, six special projects in the Selva: Jaen-San Ignacio-Bagua, Alto Mayo, Huallaga Central & Bajo Mayo, Upper Huallaga, Pichis-Palcazu and Madre de Dios. These projects covered a wide range of components and in some cases these explicitly included forestry.

A first approximation of the annual investment in forestry projects conducted by the Ministry of Agriculture and INADE, including food aid, during 1985-90 was US\$ 9 millions. In addition there were resources for forestry projects conducted by IIAP, ONERN, the universities, NGO's and other agencies, bringing the total to around US\$ 12 millions annually.

Table 7.1 gives the breakdown of forestry projects currently underway with international technical and financial cooperation.

Table 7.2 shows the investments in the forestry and environmental components of the Special Projects in the Selva.

United States Agency for International Development (USAID)

The USAID portfolio of projects in Peru includes several projects which are directly or indirectly related to natural resources and the environment. This section contains brief references to the most significant of these; comprehensive information on these and all other Agency projects and programs in Peru is available in AID/Lima's offices (PDP).

- **Employment and Natural Resource Sustainability, Project N° 527-0341.** Implemented by The Nature Conservancy (TNC) and FPCN (Fundación Peruana para la Conservación de la Naturaleza).

Project purpose is to create in the Pacaya-Samiria National Reserve a balance between natural resource conservation and biodiversity protection, and economic use, leading to sustainable and gradually increasing productivity and income in the region.

The project was initiated in 1991 and PACD is September 30, 1995. Total amount authorized: US\$ 3.6 millions.

Anticipated results of the project include: (1) economically important species prospering; (2) effective management of the reserve; (3) expanding community awareness of the desirability and feasibility of sustained yield practices and natural resource conservation; and (4) increasing income opportunities for people living in and around the reserve.

- **Participatory Land Use Classification and Sustainable Economic Development in Human-Impacted Areas of the Tambopata Candamo Reserved Area, Project N° 598-0780.** Implemented by FADEMAD (Federación Agraria Departamental de Madre de Dios).

Project purpose is to provide support for FADEMAD to carry out a participatory land use capability classification in the above-mentioned reserved zone, leading to effective participation in planning and implementation of sustainable development and conservation activities.

The project was initiated in September 1993 and AID support is due to conclude in September 1995. US\$ 108,859 (AID) and estimated total project cost US\$ 271,027.

Integrated Pest Management for Andean Communities, Project N° 527-0372. Implemented by CARE/Peru; assisted by CIP.

Project purpose is to increase the food security and household income of 3,500 smallholder families in four Andean departments through reduction of physical and monetary crop loss due to the Andean potato weevil and potato tuber moth. Major areas of concentration are: (1) Dissemination of the integrated control practices developed by CIP; (2) Introduction of the IPM concept in communities as a framework for promoting non-chemical responses to crop pests, and (3) Community control of the propagation of biological control agents to ensure sustainability of the practices introduced.

Total project cost is US\$ 1,128,616 including an AID grant of US\$ 700,000. The project support was obligated in September 1993 and is scheduled to conclude in September 1996.

Export, Trade and Development Project, N° 527-0349. Implemented by ADEX (Exporters' Association), IESC (International Executive Service Corps) and ACDI (Agricultural Cooperative Development International). Main contractor is Louis Berger International, Inc.

The purpose of the project is to generate employment and to increase Peru's exports, particularly non-traditional exports. The project consists of the provision of technical assistance to non-traditional exporters in agriculture and industry, and the enhancement of the export promotion services of ADEX and other export-promotion organizations.

The total (amended) amount of AID grant funding is US\$ 27,500,000. Project support was obligated in September 1991 and is due to conclude in March 1997.

(This project has been included because of the close interrelation that exists between economic and ecological sustainability, particularly as export-oriented agriculture, to be competitive, must make efficient use of natural resources, in particular soil and water).

Table 7.1

**FORESTRY PROJECTS WITH INTERNATIONAL
TECHNICAL COOPERATION CURRENTLY IN EXECUTION**

Name of Project	Contributions (US\$ '000)		
	External	Natl.	Total
Support for forest plantations for fuel-wood and for community development in the Sierra (1987-92) DGFF/FAO/Netherlands.	4,635	4,715	9,350
Forestry training, extension and dissemination in Ucayali Dept. (1983-92)	2,503	500	3,003
Support for communal forestry development in the Altiplano (1988-91) DGFF/CORPUNO/Switzerland.	540	120	620
Andean participative forestry development DGFF/FAO/Netherlands (Portion corresponding to Peru) (1988-93).	296	67	363
Peruvian project in primatology "Manuel Moro Sommo" (1975-95). DGFF/OPS	2,063	142	2,205
Management of regeneration of algarrobo in the integral development of the rural populations in the northern coastal region of Peru: Stage I (1991-92) DGFF/Netherlands	255	32	285
Implementation of the National Forestry Action Plan (1991-93). DGFF/UNDP/FAO/Switzerland.	600	153	753
Utilization of new forest species in Peru -Stage I (1991-92). DGFF/ITTO/CNF.	449	380	829
Promotion of forestry-ecological education in rural schools in the Sierra (1988-92). DGFF/FAO/Switzerland	2,272	521	2,793
Total	13,613	6,630	20,243

Source: Programa de Cooperación Técnica Internacional. OPP-DGFF.

Table 7.2

INVESTMENTS IN THE FORESTRY AND ENVIRONMENTAL
COMPONENTS OF THE SPECIAL PROJECTS
IN THE SELVA

Project/Program	INVESTMENT (US\$ '000)		
	Total	Forestry Development	Environment
Jaén-San Ignacio-Bagua	40,000	3,562	746
Huallaga Central-Bajo Mayo	46,500	-	-
Alto Mayo	80,600	-	-
Alto Huallaga	39,859	-	-
Pichis	48,156	1,500	325
Palcazu	30,000	6,445	415
Satipo	67,500	4,600	-
Total	352,615	16,107	1,486

Source: Perea, José 1990 y Perez, Oscar 1991.

CHAPTER EIGHT

RESOURCE MANAGEMENT NEEDS AND CONSTRAINTS

INTRODUCTION

In previous chapters the phenomena of resource depletion and their causes have been studied from various viewpoints. In this chapter we describe some specific cases that are considered to be typical of the main ecological regions defined in Chapter Two.

In each case indications are given regarding steps that should be taken toward sustainable resource use, including actions to remedy damage due to incorrect use and the principal constraints.

In the final issue it is the people on the ground - farmers, loggers and others - who will execute the actions that will - or should - conserve the resources, but they will need support, guidance training and other kinds of help in order to achieve what we conceive to be the goal.

To the man on the ground there may be several constraints between him and his goal. We may help him to clear one of them - say, a technical one - but immediately he faces another, probably an economic one, and so on.

Constraints exist at different levels and the nature of a constraint will depend on whose actions it affects. This point is basic to the Logical Framework methodology employed by AID and described in PPC/DPRE/PE of 2/10/75: Project Design and Evaluation Methodology.

In the present chapter, eleven typical cases of resource management needs will be examined against the background of the ecological system of classification described in Chapter Two, indicating actions needed to restore and/or conserve particular ecosystems. Although by inference potential AID actions will appear, it is in Chapter Nine that they will be studied, together with their respective constraints.

RESOURCE MANAGEMENT NEEDS BY ECOLOGICAL REGIONS

PACIFIC DESERT ECO-REGION

The desert eco-region supports relatively little biological activity, except in the irrigated valleys where a major part of Peru's agricultural production is generated, and in the "lomas", which occur in areas subject to frequent mists.

Case // 1: Soil Salinity

According to ONERN (1986), by the mid '80's, some 300,000 has. of Coastal Region soils, equivalent to 40% of the total area cultivated, were suffering from differing degrees of salinity, and the affected area has undoubtedly increased since that time. It is due to one of more the following causal factors:

- soils that have poor internal drainage and/or have not been provided with adequate artificial drainage:
- over-irrigation, encouraged by excessively cheap water. Kong (1990) shows that Peruvian water tariffs are from 1% to 5% of international rates according to quoted studies. This means there is little incentive to use water sparingly. It also means there is very little income with which to maintain canals. Another cause of over-irrigation is that in many valleys water flows are erratic; consequently, users over-water in case the next ration fails or is deficient.
- use of flood-irrigation, which is wasteful of water and is particularly unsuitable for sloping or uneven terrain where brackish water tends to accumulate in low-lying areas.
- poor canal maintenance, leading to high seepage losses.
- in general, laxity on the part of the irrigation Districts, the Users' Boards and the General Water Bureau in enforcing existing regulations.
- gaps in the General Water Law, especially concerning control and pricing of irrigation water.

Actions Required

- 1) Revision of the General Water Law to provide for realistic water tariffs and stricter control of water use, with the enforcement of rules for rationing water on the basis of an approved cropping plan and consumptive use calculation.
- 2) The law should give the General Water Bureau greater powers of monitoring and control of the operation of the Irrigation Districts and Users' Boards.
- 3) Training of water administrators and education of users.
- 4) Overhaul of local irrigation infrastructures, particularly canals and drains.
- 5) More use of sprinkler and drip irrigation.

Constraints

All of the above listed actions are designed to address the principal constraints to efficient water management, which are evident from the actions described. Failure to overcome any one of them may abort the whole package.

Case # 2: Destruction of coastal "lomas"

These ecosystems, situated on the sea-facing slopes of the Andean foothills and sustained by moisture from the mists which form in the area, were described in Chapter Two. They are valuable for their varied flora and fauna and should be kept intact, principally for nature tourism and for scientific study. They are being damaged by over-grazing - especially by goats - and by indiscriminate tree-cutting.

Actions Required:

- 1) Stricter control of entry and grazing - (stock-owners).

- 2) Encouragement of the feeding of crop residues, e.g. cotton stubble, which at present is burnt for phytosanitary reasons, but which has considerable feeding value and, if fed to goats, would relieve pressure on this ecosystem. (Subject to pest-control clearance).
- 3) Allow limited controlled grazing.
- 4) Ideally, all these lomas should be declared protected areas, but this should only be undertaken when INRENA is able to cope. Meanwhile, efforts should be concentrated on managing the existing Lomas de Lachay reserve.

Constraints:

- 1) Need to persuade farmers that conserving the lomas will benefit them in the long run: They need them.
- 2) Doubts as to INRENA ability to exercise needed control.

DRY EQUATORIAL FOREST ECO-REGION

Case # 3: Destruction of mangrove ecosystem

This association, which is typical of portions of the northern coastal area in the department of Tumbes, provides primary breeding areas for many marine organisms of commercial and scientific value, and feeding grounds for juveniles of important marine species, particularly crustaceans. It is being destroyed through felling (e.g. for tannin extraction), and through hunting, fishing and the building of commercial shrimp-ponds.

Actions Required:

- 1) Stricter control and management of the National Mangrove Sanctuary by INRENA, if possible with participation of local authorities and NGO's.
- 2) Closure of "langostineras"
- 3) Step up local propaganda and education campaigns in favor of conservation

Constraint:

Economic: need to persuade users that sale of larvae is good business and is more sustainable than shrimp raising.

Case # 4: Destruction of "Algarrobales"

This dry forest ecosystem consisting of Prosopis, Capparis and Acacia spp. with associated shrub and herbaceous vegetation, which is typical of parts of Piura, Tumbes and Lambayeque departments and has been a traditional source of food, fodder, firewood, honey, constructional timber and other household requisites, is suffering from felling on an increasing scale, principally for making charcoal which is sold in cities as far afield as Lima. The cut-over areas are then often overrun by the desert, evidence suggesting that much of the Piura and Sechura deserts was once home to this ecosystem.

Actions Required:

- 1) Stricter control by INRENA of tree-cutting;
- 2) Inclusion of forestry in the programs of the Rural Development Centers;
- 3) Community-based reforestation programs: there are 34 rural communities in the area of influence of these forests, with 200,000 potential beneficiaries who are familiar with the uses and value of algarrobo as a multi-purpose species.

Constraint:

- 1) Economic: loss of short term gains but this will be offset by sustainability: The people need these forests.
- 2) Institutional: can INRENA exercise the needed control?

ANDEAN STEPPE ECO-REGION

Case # 5: Disruption of Pacific Basin Watersheds

Most of the watersheds that discharge into the Pacific Ocean are suffering from deforestation and overgrazing which cause increasing instability of river regimes, with frequent flash-floods and "huaicos", (mud and rock flows), upsetting road and rail traffic, water supplies and electricity. The case of the Rimac valley above Lima is well known; less so perhaps are those of the catchment areas of important northern reservoirs, particularly those of San Lorenzo and Pochos.

Actions Required:

- 1) Grazing control, with reduction in the goat population where necessary and the introduction of rotational grazing, with fencing in some places.
- 2) Reforestation in gullies, quebradas and eroded areas.
- 3) River training structures where necessary, at least until stabilization has been achieved.

Constraints

- 1) In the case of the Rimac valley, and in some others there are numerous peasant communities which enjoy traditional rights over parts of the area to be treated. Means must be found of securing their collaboration.
- 2) Some form of autonomous watershed authority is desirable, especially in the case of the Rimac valley where there are many interested groups and agencies. A formula will need to be found for the creation and operation of such a body, compatible with the government hierarchy.
- 3) The present Water Law stresses the desirability of watershed management with upstream-downstream cost-sharing but does not provide adequate ground-rules; these should be set out in the new law and its regulations. This will need monitoring.
- 4) Need for intensified education and extension programs related to watershed conservation and management. At present there is little conception of the watershed as a unit.

Case # 6: Erosion and degradation of Andean Agricultural soils.

Hillside soils used for agriculture in most Andean valleys are suffering from erosion and fertility loss. Erosion in some areas is so severe that gully-streaked subsoil is all that remains.

According to ONERN (1986), 6 million has. are moderately affected. Most of these sites are officially deemed unsuitable for agriculture owing to steep slopes - frequently more than 50% - but this is a counsel of perfection in areas where there is nowhere else to grow crops. The Inca solution was to change the topography - and hence the land-capability-by means of bench terraces, some of which are still in use but most are now derelict.

Actions Required

- 1) In areas where bench-terraces (andenes) exist and can be brought back into use, terrace-rehabilitation programs presently underway should be supported and extended.
- 2) The National Program of Watershed Management and Soil Conservation should extend its operations which include promotion and teaching of soil-conserving techniques, including the building of new terraces and, increasingly, rehabilitation of andenes.
- 3) Complementary tree-planting, especially in gulleys and quebradas, as has been successfully carried out in several departments in the central and southern Andes under the FAO-Holland project and in Cajamarca with Belgian technical assistance. Preference should be given to local species such as quinal (*Polylepis Sp.*). Active participation by communities and by locally-based NGO's has been a distinguishing feature of these programs, and should be encouraged.

Constraints:

The above action address the main constraint: conservatism. Also, economic viability must be assured.

THE PUNA ECO-REGION

Case # 7: Degradation of High Andean Pastures.

These natural pastures, which cover around 19 million hectares, are suffering from deterioration due to excessive and selective grazing, particularly by sheep, which graze out the more tender grasses, allowing the coarser, higher-growing species to dominate. This process began in Colonial times, when sheep were introduced from Europe. Burning may also have contributed.

Actions Required:

- 1) Reduction in the sheep population and stocking with an increasing number of camelids which are non-selective in their grazing habits, and are highly productive.
- 2) More general adoption of rotational, managed grazing as is practised by some of the more efficient livestock owning companies, such as SAIS Pachacutec.

Constraints:

Sheep-raising is meshed with an established market system and brings in good revenue. The change toward more camelids will require development of market outlets for their meat and fiber products. Studies could detect areas where sheep could be more advantageously concentrated without adversely affecting the pastures.

THE YUNGA OR SELVA ALTA ECO-REGION

Case # 8: Forest Conversion to Non-sustainable Cattle-raising

The wet tropical life-zones that characterize much of this econ-region are poorly-endowed as regards soils and offer few options to settlers. One consequence has been the preponderance, particularly in the Palcazu valley, of extensive cattle raising on land converted from forest. Because of the low soil fertility, the pastures quickly decline in productivity and in order to maintain the herd more forest is cleared. The process is repeated, each time on steeper land, finally encroaching on protection forest.

Recovery of old pastures, if it takes place at all, is slow and the system is definitely non-sustainable. In some cases it starts with slash-and-burn agriculture, which is worse as the pastures get off to a bad start.

Action Required:

- 1) Change to more intensive cattle raising, including stallfeeding with locally grown forage crops such as elephant grass (Pennisetum purpureum Schum) and various local high-yielding legumes.
- 2) As an alternative to cattle-raising, which suffers economically from distance to markets, and in areas not yet converted from forests, consideration should be given to agroforestry, sylvo-pastoral systems or sustained-yield forest management, subject to suitable prior study.

Constraints:

The principal constraints are, firstly, the long distance from markets, which limits the profitable options, secondly, the poor, acid soils which virtually rule out most kinds of agriculture and, thirdly, the conservatism of settlers whose whole life revolves around their ranching activity, making it necessary to proceed with caution in trying to bring about the needed changes.

Case # 9: High-Selva Watershed Disruption and Downstream Damage

During the last ten years or so there has been increased incidence of landslides, erosion and damaging flash-floods in rivers and streams in numerous parts of the High Selva where settler populations are concentrated, for example in the vicinity of Villa Rica, Puente Paucartambo, Rioja, Moyobamba, Soritor, Uchiza and La Merced. This phenomenon is the direct consequence of indiscriminate deforestation, particularly in steeply-sloping portions of the watersheds, often in land designated as protection forest.

Actions Required:

- 1) Stricter control over deforestation of protection land. This is difficult enough in declared protected areas, but in land classified as having capability "X"; Protection, and lying outside of a declared protected area, there is little to be achieved by attempts at control by the authorities.
- 2) The best approach, as has been shown in some parts of San Martín department, is to get the local community to set up its own watershed management authority, under suitable technical guidance (NGO's and international technical assistance can play a decisive role). Such a program would involve education - curricular and otherwise, also propaganda with full use of local media, aimed at the creation of an awareness of the watershed as a unit and of each dweller's responsibility for its conservation (cf. UNEP/Holland in San Martín).

Constraints:

- 1) As in all conservation programs, conservatism and individualism are the main obstacles, but they can be overcome by education and by showing what can be done on a pilot scale, for example in a micro-watershed.
- 2) Fear of economic disincentives common in conservation programs which involve foregoing short-term gains. Creation of a sense of belonging helps to cultivate a longer-term view. Patient persuasion must be the watchword.

Case # 10: How to reduce the rate of tropical deforestation?

Destruction of Peru's tropical forests takes place at rates estimated between 200,000 and 350,000 hectares each year. Although logging contributes to this, it does so only indirectly since less than 10 percent of the tree volume is normally extracted; it is slash-and-burn agriculture that is mainly responsible for these high rates of deforestation. It has been observed that, under this system, every hectare farmed requires from 7 to 10 hectares deforested. In this system, land left under secondary growth eventually returns to cultivation after a rest period. The longer the fertility the longer the rest period and the more deforested land is needed to sustain a given area in crops.

It has been shown in the AID/NCSU/INIAA Tropical Soils Research Program at Yurimaguas that soil fertility can be economically sustained on relatively infertile ultisols for periods several times longer than is normal under customary slash-and-burn methods. If these results were applied on farm land in different parts of the Selva, it should be possible to curb considerably the process of deforestation.

Action Required:

A program of field application of the Yurimaguas results in selected sites in the High and Low Selva, in accordance with technical specifications to be drawn up by the Tropsoils team; a start should be made in areas where climate and soils do not differ too widely from those of Yurimaguas (2,100 mm/yr. precipitation, 25 °C mean annual temp., soils mainly ultisols and inceptisols). Depending on the early indications from these trials, planned extrapolations could take place over a wider area.

This proposal is in line with the generally accepted precept of nursing weak or fragile ecosystems by making intensive (and sustainable) use of sites that are capable of withstanding it. This translates into making intensive use of terrace and low hill soils and protecting the steeper upland soils.

Constraints:

- 1) The principal constraint to be cleared is economic: any Yurimaguas package, before full-scale adoption, will require a benefit-cost analysis.
- 2) Climate and soil will be limiting factors; for instance, it is most unlikely that these techniques will work in the Palcazu where rainfall reaches 6,000 mm/yr. and soils are highly acidic.

THE AMAZON TROPICAL FOREST ECO-REGION

Case # 11: Unmanaged Tropical Forests

Forests in Peruvian Amazonia are generally selectively-logged (high-graded) and are unmanaged. Only 2 to 6 m³/ha. are extracted, the remainder is most often burnt by shifting cultivators.

Peru is committed to having its tropical forests under management by the year 2000.

Pucallpa and Iquitos have well-equipped timber processing industries, at present grossly under-employed. The leading industrialists together with environmental and commercial interests have formed the National Forestry Chamber with the intention of placing the region's forests under management.

Action Proposed:

The Forestry Chamber has prepared a large-scale integrated project in which, for the first time, industrialists will assume responsibility for extraction and management instead of buying logs from small loggers. The Chamber also has made a survey to determine the value and acceptability of numerous Peruvian timber species hitherto not exported, the sale of which would considerably increase harvest volume and profitability.

Constraints:

- 1) The main constraint is legal: the existing Forestry Law does not assign rights over forest land, only over the forest cover. This project can only be implemented if the new law, now in final draft, grants security of tenure which will justify investment in management for sustainability.
- 2) The second constraint is technical: despite promising experiments, no proven system of sustained-yield management of natural tropical forests has yet been devised. As it will require at least a substantial portion of the first rotation to obtain a reasonably firm indication of viability, the best solution would appear to be to undertake simultaneous trials of several methods, including those under trial in the Palcazu, Von Humboldt and Pachitea projects.

CHAPTER NINE

STRATEGY RECOMMENDATIONS

INTRODUCTION

The present political and economic situation in Peru offers a challenge and an opportunity for AID. The sweeping changes in the public sector, with largely unpredictable consequences, pose an urgent need for institutional strengthening and for guidance in the formulation of policies and legislation. The swing toward a market economy and the wholesale privatization - or even annulment - of functions formerly considered a prerogative and an obligation of the state leave gaps that must be filled somehow.

In this scenario, the array of international cooperation agencies grows almost daily, making it less easy than formerly for any one agency to find a niche unshared with another agency. This situation, although it makes for some difficulties, offers the chance for complementary action in a manner that makes the best use of the comparative advantage of each organization.

Over-arching AID policy elements are the four sub-objectives of LAC Bureau Objective # 1: Support the Achievement of Broadly-based Sustainable Economic Growth, " in particular sub-objective D: "Encourage Preservation and Sustainable Management of the Natural Resource Base".

The Mission Strategic Objectives, reduced from nine in 1990 to three in 1993, are:

- I. Strengthen democratic institutions that sustain individual rights and freedoms and are responsive to their constituencies.
- II. Sustainable economic growth led by the private sector.
- III. Improve health status through access to quality primary health care.

Of these three Mission Strategic Objectives, No.2 is considered to be the one under which the subject matter of this report falls.

METHODOLOGY

The five relevant program areas and the five substantive environmental issues have been related in a matrix (Program Areas -Substantive Environment Issues) which is shown diagrammatically below:

Program Areas	I	II	III	IV	V
Substantive Environmental Issues	Policy & Laws	Institutional Strengthening	Conservation & Development	Research & Technology Transfer	Training & Education
A. Sustainable agricultural production					
B. Tropical Forests					
C. Watershed Management					
D. Coastal Zone Management					
E. Biodiversity					

The program areas (I-V) are essentially those set out in the Scope of work of this study; the Substantive Environmental Issues (A-E) are taken from current AID/IAC Bureau policy guidance papers, with some changes in order but of a non-substantive nature.

The matrix has been employed as a methodological tool to focus attention on the ways in which the subject of each program area should be applied to each of the substantive environmental issues. The matrix also serves to relate program areas and substantive environmental issues to the "cases" described in Chapter Eight, each of which is zone-specific.

RECOMMENDED ACTIONS BY PROGRAM AREAS

In this section the action needs are defined in each of the 5 Program Areas.

Program Area I: Policy and Legislation

For sustainable agricultural production, the farmer needs support of policies usually expressed in laws covering such topics as land tenure, pricing, credit and, where applicable, the supply and quality of water. The existing general water law enacted in 1969 was an improvement on its predecessor in that, among other things, it recognized volumetric water rationing, but it has a number of defects which have motivated the elaboration of a new law due to appear soon. This law or its regulations must allow for the charging of water rates high enough to encourage the economical use of water and reduce risk of salinity due to over-watering.

What AID can do:

- * Provide short-term T.A. to help formulate regulations for the new water law, including the aspect of water quality.
- * Provide short-term T.A. to advise on standards for control of contamination and judicial protection for the aggrieved ("class actions").
- * Promote the development of policies and regulations on the use of pesticides in agriculture in order to drastically reduce or eliminate the use of materials that have proved to be harmful to the environment.

In regard to tropical forests the main constraint to management is the existing forest law which does not recognize property over forest land. A new law in draft will overcome this problem, the regulations of which should cover forest management needs to comply with ITTO's requirements for tropical timber exports.

What AID can do:

- * Provide short-term T.A. to help formulate regulations for the new forestry law, including measures for promoting sustainable forest management.

Watershed management is affected by several laws, especially the Water Law, to which reference has already been made. An urgent need is for the establishment of autonomous watershed authorities, for which special regulations may be needed.

What AID can do:

- * Provide T.A. to help in formulating regulations for Watershed Authorities, and in disseminating the concept of the watershed as a basic planning unit.

With more than 2,000 miles of coastline with a varied ecology, Peru's coastal zones present diverse needs for protective legislation.

What AID can do:

- * Provide short-term T.A. for the formulation of regulations for the application of the RAMSAR convention, and in the preparation of standards and rules related to discharge of untreated sewage and contaminants in rivers and sea.

Important aspects of biodiversity include the passing of laws setting conditions for access to biological resources, for the management of protected natural areas with safeguards for Native Community rights, and for recognition of intellectual property with respect to traditional knowledge. There is a need for a law on protected natural areas complementing the new forest law which is due to come into force shortly.

Additionally, there is a need for action to stimulate awareness of legislators and other decision makers regarding natural resources and the environment.

What AID can do:

- * Provide short-term T.A. in the formulation of the above legal instruments related to biodiversity including a proposed law on protected natural areas.
- * Provide advisor(s) to the Congress either directly or through NGO's, giving priority to policies and rules on biodiversity, pesticides, the Environmental Code and the Constitution; native community land rights; the need for a National Environmental Authority and for the creation of watershed management authorities.

Program Area II: Institutional Strengthening

In Peru, under recent legislation, environmental responsibility is split among government departments and sectors, and at the same time it is centralized - i.e. monopolized by the central government. Regional governments set up under the previous administration have been stripped of many of their powers while local governments have neither power nor technical capability to address serious environmental issues.

With each government department formulating its own version of the nation's environmental policy and with little or no coordination among them, there is an urgent need for the creation of a National Environmental Authority which would dictate and supervise the policies to be implemented by the environmental organs of the three levels of government - central, regional and local. This function will in many cases call for revision of existing environmental responsibilities in order to avoid overlapping or gaps.

In the present situation there is no mechanism for coordinating environmental plans and policies. The proposed authority should formulate at least a short-term environmental plan which is absolutely indispensable for the channelling of international resources. It also should set standards for Environmental Impact Assessments.

What AID can do:

- * Provide institutional, technical and financial support to MINPRE for creation of a national Environmental Authority in collaboration with selected NGO's.

Tropical forests occupy 60 percent of Peru's land area, agriculture less than 5 percent, yet forestry receives less than 5% of the ministry's budget. This is the main reason for the under-staffing and poor back-up of the field agencies of the forestry sub-sector which are a cause of their ineffectiveness. The present government has passed the seventh organic law for the agrarian sector in twenty years - a severe handicap for any government department. Among the casualties are the forestry districts which, although nominally still in being, are less and less effective. Likewise the forest police, which in any case never enjoyed much support or understanding from MAG.

If there is to be any tempering of the present rate of deforestation or any hope of orderly forest management, the official forestry sub-sector must be greatly strengthened, specially at field level. The alternative is free-for-all depredation by loggers interested only in getting timber on a short-term basis, by slash-and-burn farmers, and by growers of illicit crops.

What AID can do:

- * Provide support for INRENA's forestry bureau in the area of parks and reserves, and in forest administration and control through the forest districts.
- * Help form a consortium of local NGO's to foster and control eco-tourism in bio-diverse ecosystems, and to disseminate knowledge concerning them.
- * Renew support for the Yanasha Forestry Cooperative in technical, management and commercial aspects related to the strip system of natural forest management.
- * Include control of "algarrobales" in proposal for support to INRENA.

Watershed management is a key activity in natural resource management due to the physical and climatic characteristics of the country. Despite GOP efforts in recent decades, through specific programs and projects involving partial or integral management of watersheds, it has not been possible to integrate the efforts and experience of public and private institutions in a effective manner.

What AID can do:

- * Conduct a program of institutional support to upgrade INRENA's capability, particularly in supervision, control, monitoring and technical improvement of the management of irrigation and drainage in the coastal region.
- * Provide renewed support for the National Soil Conservation Program executed by PRONAMACHCS - initiated with AID technical and financial assistance in 1981. The aim should be integration of farm, range forest and mechanical protection activities, particularly with the cooperation of the forestry directorate of INRENA and if possible FAO-Holland, together with rural communities.
- * Provide funding and technical support for the expansion of existing NGO-led bench-terrace rehabilitation programs. Institutional aspects of **coastal zone** management will include strengthening and coordinating the different NGO's concerned with coastal zone ecosystems, and vigorous action by INRENA in control and surveillance of the protected natural areas of this zone.

What AID can do:

- * Support integrated plans, programs and projects in relation to coastal zone ecosystems such as wetlands, mangroves, estuaries and lagoons, including ecotourism.

Biodiversity is as broad and all-embracing as nature itself; perhaps for this reason action in its defense tends to be dispersed. There is room for an institute to centralize information and coordinate action by the numerous interested persons and organizations (either a new body or an expanded CDC).

The proposed institute should provide coordination among interested bodies with regard to the conservation, transformation, sale and registration of species and their products; and research, including bio-technology.

What AID can do:

- * Support a consortium of Peruvian NGO's in setting up, funding and managing a Biodiversity Institute to centralize and coordinate actions hitherto dispersed.

Program Area III: Conservation and Development
Program Area IV: Research & Technology Transfer

After many years of apparent contradiction, conservation & development are now increasingly seen as being compatible: unsustainable development is a contradiction in terms.

We have grouped together Program Areas III and IV on the grounds that research, followed by technology transfer (or accompanied by it), should lead to sustainable development.

Since most of the cases are non site-specific, examples are given below of some of the more relevant lines of research that can contribute to sustainable resource use i.e., to conservation and development, with suggested further action.

The National Program of Watershed Management and Soil Conservation - PRONAMACHICS - is conducting applied research in connection with the effectiveness of certain conservation measures in stabilizing soil and streamflow, but until recently proceeded independently of forest plantation and reforestation programs conducted by other agencies. Since these activities are complementary, it is recommended that watershed management activities of this kind be integrated with reforestation programs such as those of FAO-Holland and CARE.

An inventory should be made of potential RAMSAR sites in the coastal zone, with an assessment of management and protection possibilities, identification of main hazards, etc.

What AID can do:

- * Provide short-term T.A. in dissemination of improved methodologies for Environmental Impact Assessments.
- * Support research on biological resources and biotechnological applications being conducted by INIA (National Program of Andean Crops), San Marcos University, CIP, and Cuzco, Puno and Ayacucho Universities.
- * Support pilot projects based on sustainable production and on the application of results and/or experiences arising from the above activity.

Horizontal technology transfer should be encouraged among members of different native and peasant communities and independent producers, with special emphasis on sustainable, soil-conserving and biologically diverse agricultural production systems.

Support should be given to a program of communal reforestation with Prosopis sp. to be conducted through NGO's together with the rural communities concerned, with a view to full and sustainable utilization of the ecosystem, avoiding felling for sale of charcoal.

As was stated in Chapter 8, the vast potential of the High Andean pastures is being squandered through poor management. It is recommended that a joint pasture rehabilitation pilot project be executed by INIA and the National Council for South American Camelids with NGO participation. This project is vital for future high Andean pasture improvement.

In the Selva Alta, a critical area is that of **non-sustainable livestock production** (see Chapter 8). Alternatives need further research.

What AID can do:

* In conjunction with an international and a local NGO, support a continuation of the research and field trials of alternatives to extensive cattle-raising in the Palcazu valley, initiated by CSRM, and including:

- a) agroforestry
- b) hair-sheep
- c) stall-feeding of cattle with forage grown on site.
- d) Pasture rehabilitation and improvement.

As was stated in Chapter 8, **sustainable use of agricultural soils** can reduce tropical deforestation.

What AID can do:

* Promote a joint program of extrapolation of applicable results obtained in the Tropical Soils Research Program at Yurimaguas, to areas of the High Selva threatened by excessive deforestation, with the object of introducing sustainable agriculture in place of slash -and- burn farming. In collaboration with Tropsoils (INIA/NCSU) and local universities (e.g. UNAS, San Martin and Ucayali).

Program Area V: Training & Education

The need for training of professional and technical personnel of environmentally-oriented institutions - both public and private - embraces a wide range of topics and a number of institutions. A detailed survey of these needs should be carried out as a prior condition; however, in view of the sweeping changes the present administration is making in the public sector there are needs in key institutions such as INRENA which can be readily identified. Examples are in parks management, coastal zone ecology and management, water administration and control, forest administration and eco-tourism. In particular its GIS needs updating.

What AID can do:

* Provide technical assistance and training in modern irrigation practices to personnel of the irrigation districts and to selected farmers (Through NGO's).

* Help update INRENA's Geographic Information System (GIS).

In the field of **environmental education**, two areas have been selected:

Creation of an academic program in Ecology in one or more of the leading universities, e.g. Universidad Agraria La Molina, Universidad Católica, San Marcos, UNAS Tingo María, Universidad San Martín, etc. Include ecology in economics syllabi and vice-versa.

Expansion and integration of environmental curricula in rural and urban primary and secondary schools throughout Peru.

What AID can do:

- * In conjunction with a U.S. university (e.g. Georgia) support the establishment of an academic program in ecology as recommended above.
- * Support expansion of school curricula, with the aid of specialized NGO's.

DECISION FRAMEWORK FOR AID

The following extract from the 1988 document: "Peru: An Assessment of Biological Diversity" is reprinted almost verbatim, being equally valid at the present time.

The projects identified in the preceding sections 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, marking 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, 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 CSRSM Project. Three reasons why CSRSM must be kept in the forefront of discussions for interventions related to biological diversity and tropical forest management 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 and tropical forestry 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 CSRSM by consultants and other observers, it would seem imprudent to ignore opportunities outside the CSRSM 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" 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 Seven, Peru's environmental NGOs are young and numerous, and many are quite vigorous. Additionally, the reorganization within the Ministry of Agriculture will no doubt offer new opportunities for expanding conservation activities in the public sector. This is an interesting 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 large, more comprehensive package.

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ATTACHMENT 1

NEW PROJECT DESCRIPTION

GOAL (S.O. # 2) : Sustainable economic Growth led by the Private Sector

PURPOSE : To encourage broadly based sustainable growth by the rational use and conservation of renewable natural resources.

PROJECT TITLE : SUSTAINABLE ENVIRONMENTAL MANAGEMENT (SEM)

PROJECT NUMBER : 527 - 0368

PROJECT FUNDING : \$ 000 FY 1995: \$ 3,289 (DA)* Based on '94 CP level
LOP: \$ 11,000 (DA)

APPROPRIATION :

DESCRIPTORS:

Purpose Codes:
Priority Area:

A. Relationship to AID Country Strategy and Objectives

This project directly addresses the Mission's Second Strategic Objective: "Sustainable Economic Growth led by the Private Sector".

B. Relationship to Host Country and Other Donors

The present Peruvian administration is actively pursuing a policy of creating a market economy and encouraging local and foreign private investment. Although the country's commitment toward sustainable use of natural resources and the environment is as strong as it was under previous governments, the fact that economic recovery enjoys top priority may in some instances result in sacrifice of long-term conservation benefits in favor of unsustainable short-term gains. Consequently, Peru needs a strong environmental establishment and legislation, to which end a number of foreign donor governments and multilateral agencies are executing or planning programs and projects in the environmental field in Peru, notably Germany, The Netherlands, Switzerland and Japan. Fortunately Peru has a strong non-public environmentalist community including several active NGO's which are natural counterparts for such agencies.

C. Conformity with Agency and Bureau Policies

AID's strategic objectives for its assistance to Latin America and the Caribbean are to:

- * Support achievement of broadly-based, sustainable economic growth;
- * Support the evolution of stable, participatory democratic societies, and
- * Respond to specific challenges to the attainment of these objectives.

Sub-objectives of the IAC Bureau's first Strategic Objective of Broadly-based, Sustainable Economic Growth are four in number. No. 4 is: "To encourage preservation and sustainable Use of the Natural Resource Base"

The project conforms to these policies and to Mission Strategic objective No. 2: "Sustainable Economic Growth led by the Private Sector".

D. Project Description

The project will constitute a durable source of policy and technical guidance to public and private agencies devoted to activities related to the use and conservation of renewable natural resources. AID and a Peruvian counterpart body will be jointly responsible for project execution (The identity of the counterpart agency cannot be defined at this stage).

The justification for the project is twofold:

- a) AID has gained valuable experience of Peru's natural resources, through its projects in the Selva and in other regions, and should put this experience at the service of Peru.
- b) The sweeping changes wrought by the present administration, involving the dissolution of such pillar institutions as the National Planning Institute (INP) and the National Bureau of Natural Resource Evaluation (ONERN), and the virtually intestate demise of key Ministry of Agriculture agencies and the Ag Bank, have left a virtual vacuum in the area of supporting services to agriculture and forestry. In particular the disappearance of the National Planning System comprising INP and ONERN left Peru without the services provided by the System which, by its Organic Law, was the senior institution in the field of natural resources and the environment with normative powers, even though they were seldom invoked.

Recent legislation has placed responsibility for environmental matters in the environmental bureaus of the individual government departments, only one of which has started to function. This situation, coupled with a substantial watering-down of the Environmental Code, creates an urgent need for the establishment of an autonomous Environmental Authority and for the revision of the Environmental Code.

Studies are currently in progress in the Ministry of the Presidency with the aim of structuring the proposed Authority.

Meanwhile, negotiations are underway between the Interamerican Development Bank (IDB) and officials of the GOP's agriculture sector for the conclusion of a loan agreement for a wide-reaching technical and financial assistance package in which high priority will be given to support for INRENA, a normative body created from the former ONERN and the main technical agencies of the Ministry of Agriculture.

To the extent to which a) IDB is unable or unwilling to supply all of INRENA's manifold needs, and/or b) IDB prefers not to tackle the former ONERN component -i.e. natural resource evaluation-, there will be an interesting field of activity for AID in support of this aspect of INRENA's portfolio. ONERN's Geographic Information System (GIS) was set up with AID technical and funding support in the early 1980's and is now obsolete. Updating and the necessary personnel training would be appropriate activities for AID, but they would not exclude others that may be defined.

The precise structure and location of the new project require further development, but in view of the multiple calls on its services it would be preferable to opt for a quasi-independent status. This could be insured by inviting participation by one or more reputable Peruvian environmental NGO's in a Board of Governors, with a Peruvian project director and an AID co-director or vice-versa. Appropriate personal and resources could be sub-assigned to other supported agencies such as INRENA and the future Environmental Authority, without the project having to be housed in either agency. The participation of NGO's such as the SPDA and FPCN would insure national technical input of a high order.

The creation of the SEM project affords an excellent opportunity to address the economic aspects of environmental and natural resource conservation.

With a national policy oriented toward the promotion of investments, environmental protection models based on total freedom of private initiative invariably fail, as do those which depend solely on the state. For many years, environmental damage has been a hidden cost not included in business or economic accounting, and this omission has been the cause of much irreversible environmental damage.

If this is to be avoided, companies or individuals that carry on activities which affect the environment should consider the environmental cost they occasion as a private cost and transfer it to the price system, which would price out of the market those products that have too high an environmental cost. In other words, the objective should be the internalization of environmental costs so that the market's own mechanisms force us to seek sustainable development. In Peru no attempt has been made to estimate the cost of environmental damage.

One of the fundamental reasons for the inefficacy of environmental laws is ignorance of the economic cost of applying them.

There are many examples, including the controversial case of access to genetic resources: Peru does not know the potential value of these resources nor the loss that would result from their exhaustion, nor is it aware of the possibility of getting new acquisitions through genetic resources, or of patenting them. Consequently Peru is losing valuable resources.

The cost of complying with international agreements like the Vienna convention on protection of the ozone layer, the Montreal protocol, the agreement on climatic change or the ITTO agreement on managed forests has not been taken into account.

Many such agreements involve the adoption of new technologies and the internalization of a number of environmental costs.

In this connection the SEM project should

- promote policies for incorporating the economic element in environmental analyses;
 - promote studies aimed at determining the cost of complying with international commitments signed by the government.
 - incorporate the environmental variable in investment opportunity detection projects.
- promote the formation of small environmental service companies to perform tasks related to economic/environmental studies.
- promote action to bring production processes into line with international quality standards such as ISO-9000, in order to avoid boycotting of Peruvian exports.

Among the project's activities would be programs in the areas of:

- * Legal aspects of environmental problems;
- * Economic analysis of resource conservation;

- * Teaching, publicity and dissemination of environmental knowledge and of information on biological diversity;
- * Creation of public environmental sensitivity;
- * Strengthening of environmental NGO's and of their cohesiveness.

E. End -of- Project Status

- * A National Environmental Authority in place and operating.
- * A satisfactory Environmental Code officially promulgated after due discussion and consensus approval by interested groups.
- * The natural resource evaluation functions of INRENA -particularly in the Studies Directorate comprising Remote sensing, GIS and related activities, endowed with modern equipment and trained personnel.
- * Improved performance of Environmental Impact Assessments.
- * Strengthened and well-coordinated environmental NGO's.
- * Aroused public awareness of the need for environmental protection and sustainable resource use.
- * Common ground established between ecologists and economists on key environment and resource issues.
- * Anomalies in major legal dispositions related to natural resources eliminated.

ATTACHMENT II

NEIGHBORING COUNTRY LEGISLATION

The following comparative analysis of the environmental legislation of neighboring countries helps to determine the degree of legal advances produced, the building of an institutional capacity, as well as mechanisms for the financing of conservation activities and the elaboration of new legislation. Peru took a big step towards sound environmental policy through the promulgation of the Natural Resource and Environmental Code in 1991, but has since then regressed, making substantial changes to the Code which has had a negative effect with regard to the adoption of adequate environmental regulations and policy. Neighboring countries have taken significant steps in their development of environmentally sound policy and legislation enhancing their prospects for accessing international cooperation and assistance financing.

The comparative analysis will center on Colombia and Bolivia Legislation:

Evolution of Environmental Legislation in Bolivia

The Bolivian Constitution of 1967 contains no specific norms related to environmental protection or natural resources conservation. It recognises the State's property rights over non-renewable resources, waters, soils, minerals, etc. It also establishes that the State shall regulate the exploitation of natural renewable resources, controlling their conservation and increase. Bolivian environmental legislation is however evolving rapidly since the promulgation of Law 1333, of April 27 1992, General Law of the Environment.

Prior to this law, actions have been taken with the promulgation in 1977 of a law for the management of solid wastes, and in 1985 regulation of the Disposal of Industrial Wastes in Water Courses or Landfill sites.

The General law of the Environment of Bolivia is very much similar to the Peruvian Environmental Code, with a significant difference in that it succeeded in creating the National Secretariat for the Environment (SENMA) as the organ in charge of environmental management.

This Secretariat has been incorporated into the Ministry of Sustainable Development and the Environment, and even so played an important role in coordinating with the National Fund for the Environment (FONAMA).

Another relevant difference with respect to Peruvian legislation is that it established the formation of a National System of Environmental Information, which is in charge of registering, organizing, up-dating and diffusing national environmental information, and to which all documentation related to scientific or technical works on the environment must be submitted.

Apart from the Secretariat, Departmental Councils for the Environment (CODEMA) were created in each department of Bolivia, as consultancy organs at the departmental level within a national environmental policy. The Departmental Secretariats act as decentralized organisms of SENMA, in charge of implementing departmental policies established by Departmental Councils. In order to understand Bolivian environmental management, it is useful to read "Políticas Generales para un Sistema Nacional de Gestión Ambiental" a document prepared by SENMA in December 1992. The FONAMA has also played an important role planning and organizing investment directed to environmental management at national, departmental and local levels. FONAMA has received and/or administered in excess of 40 million dollars during its short existence, through specific mechanisms such as donations, debt for nature swaps, condonations amongst others.

With these financial resources, SENMA was able to prepare, in 1993, a number of Projects such as a Regulation for the Control of Water Quality, a Project for a Regulation of Disposal of Dangerous Wastes, a Project for a Regulation of Municipal Waste and finally a Project of implementing Regulations for the General Law of the Environment.

On September 17, 1993, the Ministry of Sustainable Development and the Environment was created, with mandate to review and regulate all activities related to harmonic development of the country, taking into consideration human aspects, environmental conservation and maintenance of natural resource as well as their rational economic exploitation. It also acts as central organism of the National Planning System.

The document "Políticas y Acciones para la Gestión Ambiental", elaborated by SENMA and FONAMA, recognizes as important features of environmental management territorial planning, natural resource management, biodiversity conservation and environmental quality improvement.

Evolution of Colombian Environmental Legislation

Environmental Legislation can be traced as far back as 1973. Law 23 vested in the President the power to promulgate the Code of natural Resources and Protection of the Environment. This law also establishes certain guidelines concerning contamination, improvement and conservation of the Environment.

In 1974, through Decree 2811, the National Code of Natural Renewable Resources and Environmental Protection was enacted, containing general norms concerning environmental policies and their eventual implementation. It also organizes an Environmental Information System, with data on renewable natural resources and the environment.

This Code has received further strengthening through the 1991 Colombian Constitution, which clearly states the differences between fundamental rights, social, economic, cultural, collective and environmental rights, recognizing, as does the Peruvian Constitution of 1979, the right of every person to live in a healthy environment, and further recognizes the right to participate in decision making processes which could affect the community.

This recognition of collective rights, as well as article 88 of the Constitution which establishes a sort of class action for the protection of collective rights related to security, health, patrimony and the environment, have made judicial actions in

defense of the environment especially effective in Colombia. An action for the protection of other fundamental rights as well as for ensuring effective observance of the law and administrative acts of any authority, have also been effectively utilized to this end. Comparatively, Peru has no similar action to deal with public interest, and the Constitutional Acción the Amparo (an injunctive remedy) is not the most effective mechanism to do so.

A document, "Una Política Ambiental para Colombia", of August 1991, and prepared by the National Planning Department defines Colombia's environmental policy. Institutional reorganization is considered a must for adequate implementation of such policy, and the creation of a Ministry for the Environment has, therefore, been proposed.

Environmental management in areas like ecosystem management, education, incentives and international relations is considered a primary objective.

Financing of such environmental management is achieved through creation of taxes which are budgeted towards autonomous regional corporations, as well as by negotiations with multilateral bodies, the financing of an Action Forestal Plan for Colombia through resources provided by the Fondo Ecológico Cafetero, through International Cooperation and debt for nature swaps, amongst others.

Environmental management in Colombia, in relation to natural resources, has been organized by the National Institute of Natural Resources (INDERENA), and discussions are under way to create the Ministry of the Environment and a National Public System of the Environment. This project has been approved by the Senate. This Ministry would act as the central authority in charge of environmental management and natural renewable resource use.