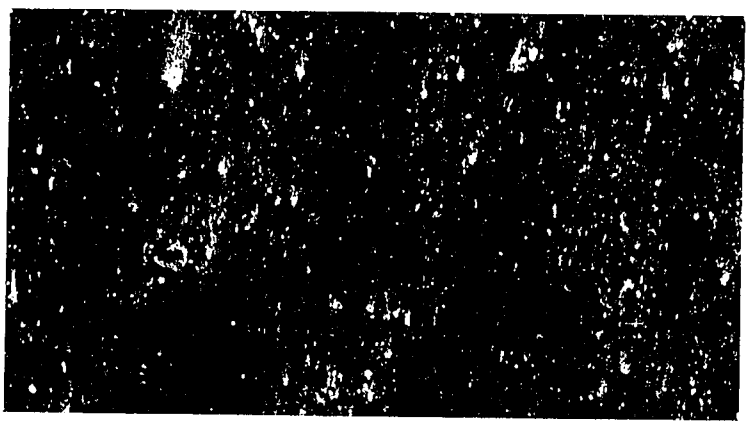
COOPERATIVE AGREEMENT ON HUMAN SETTLEMENTS AND NATURAL RESOURCE SYSTEMS ANALYSIS



Clark University
International Development Program
950 Main Street
Worcester, MA 01610

Institute for Development Anthropology
99 Collier Street
Suite 302, P.O. Box 2207
Binghamton, NY 13902

FRAGILE LANDS IN PERU

REPORT TO THE S&T - LAC
FRAGILE LANDS WORKING GROUP

by

Fragile Lands Rapid Assessment Team

Michael Painter, Team Leader
Institute for Development Anthropology

Thomas Carroll
George Washington University

Howard Clark
LAC/SAM Regional Environmental Office

Edward G. Farnworth
USAID/P - APODESA

Luis A. Manrique
University of Hawaii

Catherine McIntyre
S&T-LAC Fragile Lands Working Group

Douglas Pool
International Institute for
Environment and Development

March - April 1985

Table of Contents

		Page
	Glossary of Acronyms	ii
0.0	Preface	1
1.0	GENERAL DISCUSSION OF FRAGILE LANDS ISSUES	2
1.1	Key Concepts of Fragility and Fragile Lands . . .	2
1.2	Operative Definition of Fragile Lands	6
1.3	Geographic Focus of DESFIL	6
1.4	Conceptual Approach	8
2.0	SIERRA AND SELVA ALTA REGIONS	8
2.1	Reasons for Focusing on the Sierra and Selva Alta	8
2.2	Problems of Integration in Selva and Sierra Projects	9
2.3	Shifting Priorities and Development Experience . .	9
2.4	Natural Resource Use Issues	10
2.5	Sierra-Selva Alta Linkages	14
3.0	EXPERIENCE IN SELVA AND SIERRA	15
3.1	Settlement	16
3.2	Land Use	16
3.3	Political Pressures	16
3.4	Technology Transfer	17
3.5	Vulnerability of Fragile Lands	18
3.6	Off-site Impact	18
3.7	Existing Production Systems	18
4.0	INSTITUTIONAL/POLICY CONSTRAINTS AND OPPORTUNITIES	19
4.1	Low Degree of Consciousness/Awareness	19
4.2	Weak Institutional Base for Sustained Natural Resource Planning	19
4.3	Incentives and Private/Public Interests	21
4.4	Land Tenure and Settlement Policies	22
4.5	Other Policies	23
5.0	CONCLUSIONS AND RECOMMENDATIONS	24
5.1	Purpose of Visit to USAID/P	24
5.2	Shared Concerns	25
Annex 1	People Interviewed by Fragile Lands Team	
Annex 2	Soil Erosion and Management of Sierra and Selva Lands	
Annex 3	Summary of Team Recommendations	

Glossary of Acronyms

ADO	Agricultural Development Officer
AID	Agency for International Development
AID/W	AID in Washington, D.C.
APODESA	Apoyo a la Política de Desarrollo de la Selva Alta
CORDE	Corporación Regional de Desarrollo
DESFIL	Development Strategies for Fragile Lands Project
FLAWG	Joint S&T/LAC Fragile Lands Working Group
GOP	Government of Peru
INP	Instituto Nacional de Planificacion
LAC	Bureau for Latin America and The Caribbean (of AID)
NCSU	North Carolina State University
OARD	Office of Agriculture and Rural Development
OAS	Organization of American States
ONERN	Oficina Nacional de Evalucion de Recursos Naturales
PID	Project Identification Document
S&T	Bureau for Science and Technology (of AID)
UNEP	United Nations Environmental Programme
USAID/P	U.S. Agency for International Development in Peru (also known as "The Mission")

0.0. PREFACE

The Fragile Lands Rapid Assessment Team was dispatched by the joint S&T-LAC Fragile Lands Working Group in March-April 1985 to USAID/Peru (USAID/P) in order to accomplish the following tasks:

- Collect practical, realistic and timely data to integrate into the Project Paper for the Development Strategies for Fragile Lands (DESFIL) Project. The paper should be reviewed and approved by May 6, 1985 so that project activities can be implemented in FY85.

- Provide the Mission with some assistance in recompense for their time and efforts in helping the Fragile Lands Working Group.

As a result, this report is addressed to the FLAWG. It reflects Mission activities as presented by Mission staff. We hope that our synthesis feed back to the Mission the team's understanding of how Mission goals, increasing agricultural productivity and maintaining/expanding the land base, overlap with each other and with the fragile land initiative. The report's immediate utility to the Mission may be to help in policy dialogue and project design.

The team has interviewed Office of Agriculture and Rural Development (OARD) and related USAID/P staff and some Peruvian counterparts in order to demonstrate the broad range of specific projects and project components relevant to fragile lands problems. (Annex 1 is a list of persons interviewed.) The Mission in Peru has a unique range and number of relevant projects. The team has attempted to identify projects which could be linked through the DESFIL project to other missions in the LAC region.

Some of the team members will travel on to Bolivia, Ecuador, and Central America to identify where potential linkages would be initiated. For example, networking with Bolivia and Ecuador will provide a practical base for a "subregional," Andean strategy.

Also essential to the Project Paper is a catalogue of the Mission's anticipated information needs concerning development on fragile lands. It will suggest the range of needs which DESFIL could be asked to meet for other LAC Missions. From the catalogue of USAID/P needs, DESFIL project designers can link specific capabilities of S&T projects in agriculture, forestry/natural resources, and rural development to practical applications in the field, and to assure the right degree of both flexibility and focus in the project design.

Examples of matching mission needs to DESFIL capabilities include:

- Provide assistance to assess existing technologies for forest, water, and soil resources in terms of economic viability for beneficiaries and sustainability of production.

- Select successful components across projects and quantify them in ways that make sense to farmers, or to communities, as benefits worth investment;

- Specify what technologies exist for soil, water and forest

management for steep slopes in the Sierra and in humid tropical lowlands, and clarify the policy and institutional contexts which facilitate sharing them widely; and,

- Address the potential for institutionalizing successful fragile lands management at national and decentralized (CORDES and municipios) levels over the long term, using DESFIL's ten-year life span as a source of continuity.

Meanwhile, USAID/P awaits the Peruvian national election outcomes. The remainder of this paper gives some suggestions and a framework which we hope will be useful in building environmental, regional development, and conservation sections in the agricultural policy paper, and in the natural resources management section of the Recapitalization of the Agricultural Sector PID, both instruments for policy dialogue with the new GOP.

Section 1.0 discusses fragile lands as we have begun to define them for Peru and discusses the most important concepts of our fragile lands approach. Section 2.0 focuses on the Sierra and Selva regions, outlining their unique needs and how they overlap; in section 3.0, we illustrate these concepts and needs with examples from specific USAID/P projects. Section 4.0 highlights the institutional and policy issues presented by fragile lands in Peru as we have conceptualized them during our visit. Section 5.0 presents conclusions and recommendations.

1.0 GENERAL DISCUSSION OF FRAGILE LANDS ISSUES

1.1 Key Concepts of Fragility and Fragile Lands

1.1.1. General Concept of Fragility. Fragile is a term that is used to designate areas, goods or services that are readily subject to disturbance or change. The idea frequently is restricted to man's influence on natural or managed systems (e.g. agriculture) and the consequences suffered as a result of mismanagement. This functional definition of the concept of fragility is too restrictive and does not include the basic ecological principles and concepts that underlie the idea.

Fragility is a systems concept which includes the ability of a natural or managed system to resist disturbance and to recover from disturbance. Resistance to disturbance embodies the potential to degrade. Recovery refers to the resilience of a system. These concepts are coupled to the ideas of perturbation and subsidy and stress. Also involved is the concept that natural and managed systems are coupled to other systems and that change in one system affects other connected systems.

1.1.2. Resistance and Resilience to Perturbation. Natural perturbations (disturbances) such as earthquakes, floods, or landslides, affect natural or man-managed system differentially. Steep slopes with shallow soils, for example, will be more susceptible to the effects of earthquakes, i.e. landslides, than will be level slopes. These steep slopes have less resistance to certain kinds of disturbance than others. Areas such

as these should be considered fragile lands because if and when they are impacted or perturbed by natural causes the result is disturbed conditions that affect their productivity. For example, understanding natural perturbation is important to identifying appropriate disaster relief activities.

Perturbations to natural and managed systems through man's cultural practices, e.g. logging, slash and burn agriculture, land clearing, planting on steep slopes, removal of riverine vegetation, etc., result in changes to landscapes that differ depending upon the natural state or present condition of that system. Small clearings in forest can induce increased productivity whereas large clearings can result in the destruction of the productive capacity of that system. Fragility can be measured the resilience or recoverability of these natural or managed systems to the perturbation.

These ideas are best expressed through subsidy/stress or perturbation theory, which states that given increasing inputs or perturbations, a system will respond with favorable or non-favorable outputs and if perturbed severely, recovery may not be possible (Odum et.al. 1979; Farnworth et al. 1983) (Fig. 1)

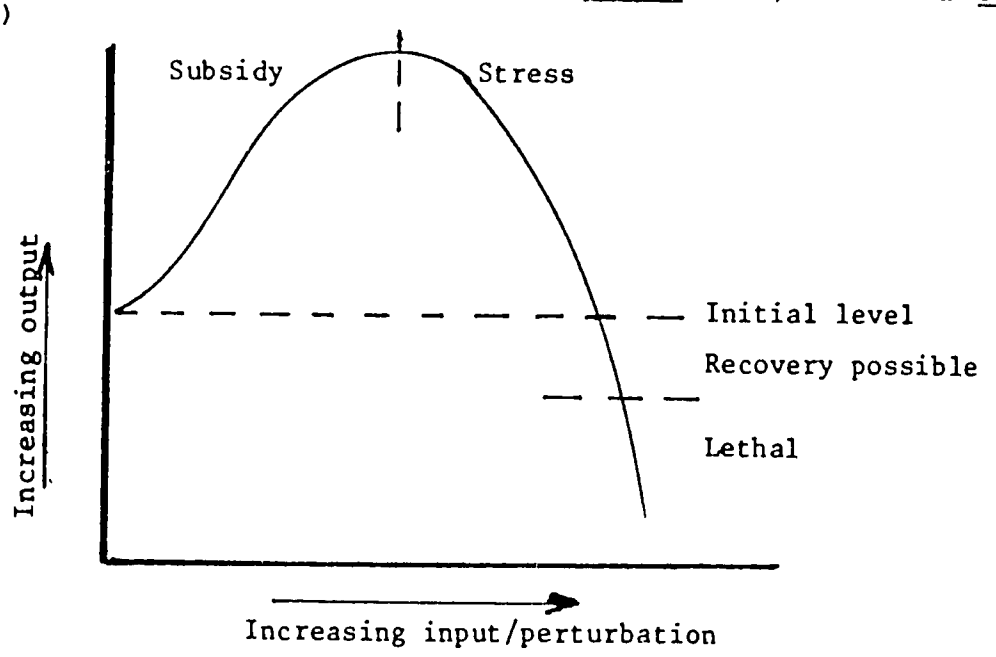


Fig. 1. Subsidy-Stress Concept

As perturbation increases, from cumulative input or as a single large event, then output increases or decreases depending upon the state of the system and its inherent potential for disturbance. Given excessive perturbation the system will be stressed and a slight or severe reduction of productivity (output) will result. The system may be capable of recovery once the perturbation is removed or reduced, or may go to a lethal state and may never recover to a state of useful productivity. The internal conditions and mechanisms of these systems are differentially subject to disturbance and respond differently to the same amount of outside input. For example, limited cutting of the Palcazu Valley forests will not damage forest productivity,

interrupt the cycling of nutrients, or limit forest recovery. Intensive cutting will damage the forest resource -- its nutrient base, soils, or regenerative ability -- and could lead to a condition in which the land will not support forestry or agriculture.

1.1.3.System Linkage. All natural and managed systems are connected to and receive inputs from adjacent systems. Every productive system has inputs and outputs, and the outputs of one are the inputs to another. Every system has inputs and outputs of energy, nutrients, goods, or services which flow within it among its components and cycle between the systems. (Farnworth and Golley 1974; OAS 1984) (Fig. 2).

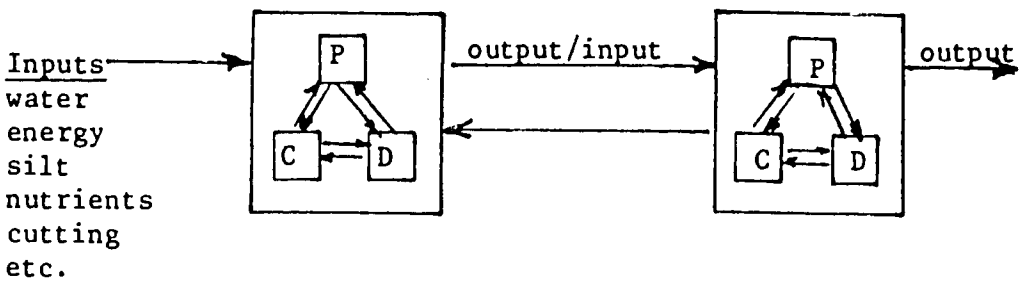


Fig. 2. Scheme of system interactions. Small boxes and arrows within the large boxes represent stocks and flows of energy and materials, eg. carbon, water, money among the producers (P), consumers (C), and decomposers (D) of a system.

The concept of watershed applies here as a functional unit with natural boundaries. The aquatic system of the watershed is connected to the terrestrial system around it, and together they contribute to a larger system, the watershed. Inputs from the land perturb the water and during flooding, for instance, the water impacts the land. Small quantities of silt bring nutrients from the land to the water and enhance aquatic productivity. Large inputs of silt stress aquatic productivity and also reduce the productive capacity of the land. (Welcomme 1979).

1.1.4. Regional Linkage and Fragility. Linkage and fragility in natural and managed systems are found in the eastern slopes of the Andes of Ecuador, Peru and Bolivia. These areas can be considered regional systems that have interactions within and between them. These large landscape systems have internal condition and mechanism that are diferentially subject to disturbance and respond differently to the same amount of outside input (Fig. 3).

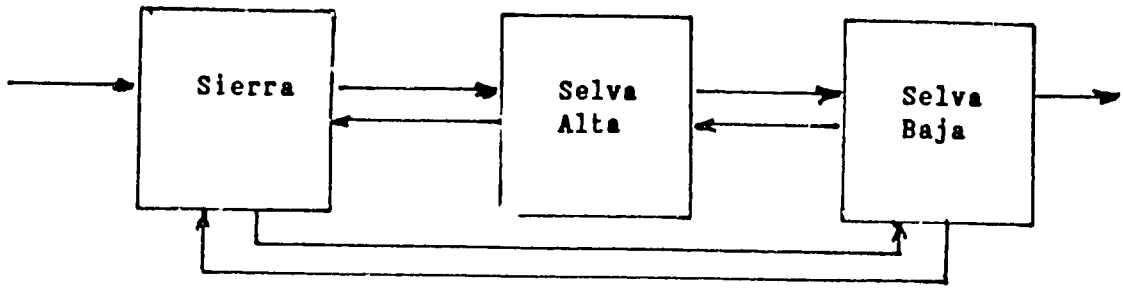


Fig. 3. Interactions Between Major Regional Systems

Some of the flows between these regions/systems are water, silt, nutrients, products, people, technology, and money. Each of the flows has various levels of intensity and different impacts depending on its place of input. The natural conditions of these regions are such that the inputs to these regions can and do stress the systems and reduce productive capacity. These natural conditions and potentially disturbed conditions are shown in Table 1.

Table I. The natural and disturbed conditions in the Sierra, Selva Alta, and Selva Baja that constitute fragile conditions.

	Natural Condition	Disturbed Condition
Sierra	steep slopes shallow soils	erosion--soil loss nutrient loss loss of agric. product. drought susceptibility
Selva Alta	steep to moderate slopes shallow acid soils moderate/high rainfall limited nutrients	erosion-soil loss nutrient loss reduced agric. product. flooding
Selva Baja	moderate to level slopes shallow acid soils (general) high rainfall limited nutrients	nutrient loss reduced agric. product.

The natural condition of the regions is one of relatively high fragility and the Selva Alta is probably the most fragile area of the three. It's high fragility has been shown through the experiences of settlement, road building, logging, land clearing, etc. Traditional agricultural and forestry technology of the Sierra when used in the Selva Alta results in more rapid degradation of land than it does in the Sierra. Development technology in the Selva Alta and the Selva Baja generally does not utilize the concepts of perturbation effects and linkages of ecosystems. The concept of "use land - use it up - move on" forces people to move to fragile lands and to employ agricultural and forestry practices that are not suitable or sustainable for these areas. (OAS 1984).

1.1.5. Long-Term, Sustained Yield Management. There is a need for a long-term view, one that incorporates an understanding of the limitations of these natural and managed resource systems, and is focused on sustained yield of products without the destruction of the productive base. The ecological constraints of the area must be considered. Agricultural productivity must be based on appropriate utilization of resources and on the realities of land fragility. An understanding that natural systems provide goods and services for man and that they have economic value must be engendered. Soil, water, nutrients, etc. are resources that must be used wisely if the values from these fragile lands are to be realized for many years by man. (Farnworth et al. 1981; Smathers et al. 1983).

1.2 An Operative Definition of Fragile Lands

The notion of "fragile lands", as it has been adopted by the Fragile Lands Working Group in the DESFIL project, refers to lands that have proven to be "highly subject to deterioration under common agricultural, silvicultural, and pastoral use system and management practices..." (Bremmer et al. 1984). Indicators of deterioration include declines in production over the short term; reductions in the long-term potential productivity of the resource base; negative off-site impacts resulting from environmental destruction within a designated area; and slow recovery of water, soil, plant, and animal resources after being subjected to stress (Ibid.).

1.3 Geographic Focus of DESFIL

A wide range of ecological life zones in Latin America and the Caribbean could rightfully be regarded as fragile. However, DESFIL has indicated its principal area of concern, are the humid tropical lowlands and the steep slopes of the region (DESFIL/PID 1985).

In Peru, the steep humid slopes of the eastern Andes and the highland (Sierra) region of the country have received considerable attention from USAID and other international donors. Table 2 indicates USAID/P projects with implications for fragile lands management in which improving productivity and production is a major goal. Figure 4 shows the GOP Special Projects for development and their relationship to Peru's fragile lands in the Sierra and Selva Alta.

Table 2. USAID/P Projects with Fragile Lands Components.

PROJECT	STARTING DATE	DURATION (yrs)	FRAGILE LANDS COMPONENT
Central Selva Resource Management	1982	5	Agroforestry, natural forest management, agro-pastural, farming system, Native Community adaptation
Huallaga Central	1979-1984	5	Increased production of annual crops
Upper Huallaga Area Development	1981	6	Research, extension of appropriate humid tropical agriculture
Research, Extension and Education	1980	6	Agricultural productivity nationwide
Integrated Rural development	1979	7	Decentralization, markets, irrigation in Sierra
Plan MERIS	1977	7	Small & medium irrigation in sierra
Land Use Inventory and Environment	1980	5	Geographic information system to integrate environmental and economic data for long-term planning nationwide
Soil Conservation	1980	5	Conservation practices in sierra
Tropical Soils CRSP	1970	continuing	Soil management techniques for humid tropical agriculture
Small Ruminants CRSP	1978-87	11	Range management, pasture improvement in Sierra
Disaster Relief and Rehabililation	1983	2	Recuperation of agriculture on flood and drought damaged Land
P.L. 480, Title II PRAA	-	-	Small-scale reforestation efforts

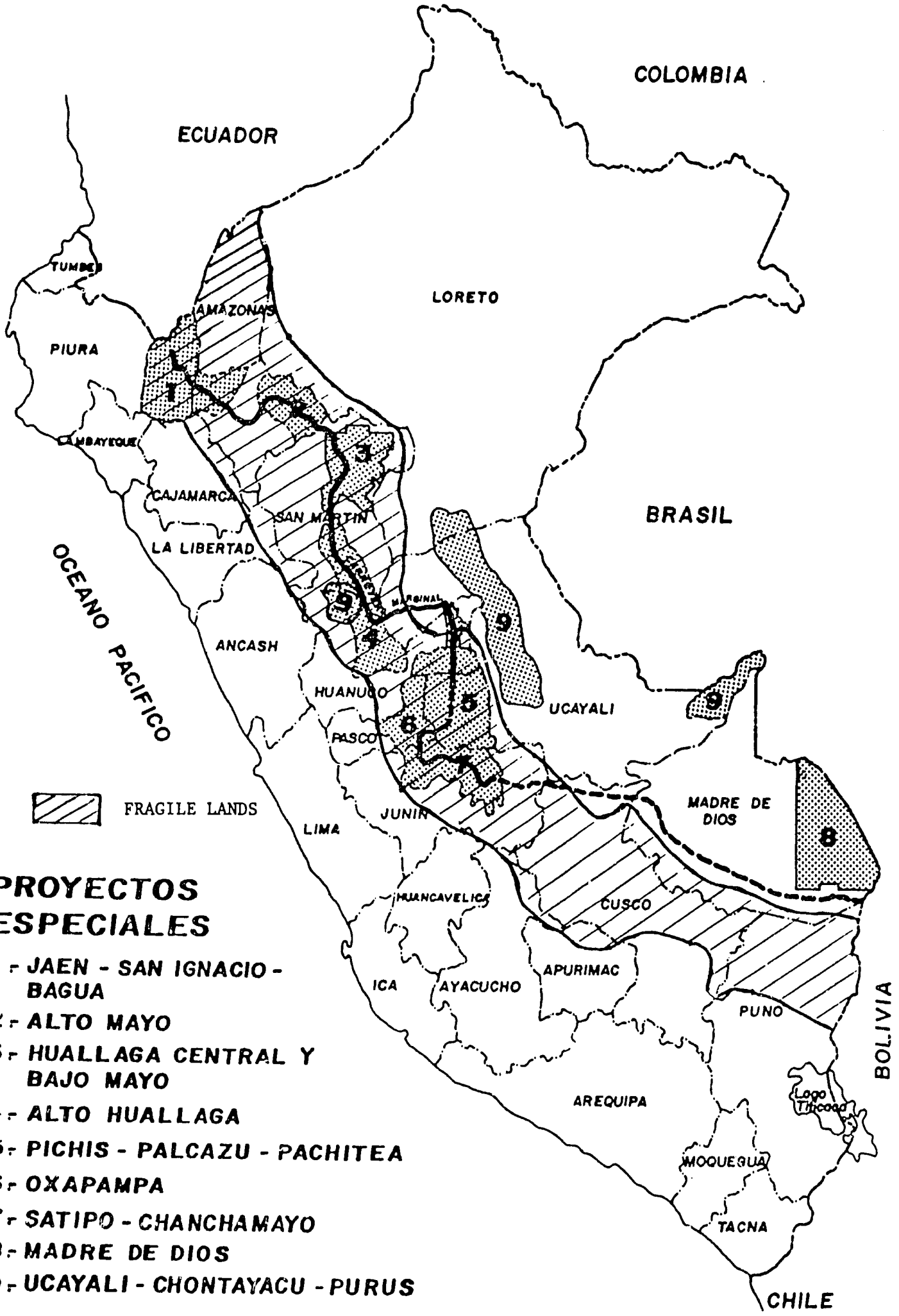


Fig. 4. Fragile lands of the eastern slopes of Peru and the special development projects

Based upon mission attention to the humid tropics and the steep slopes of the eastern Andes and Sierra, we have given these areas our greatest attention. DESFIL would address resource management problems on the steep slopes in coastal areas of Peru as well. Some of the same processes that give rise to fragile lands problems in the Sierra and Selva are also at work on the coast. However, greater attention to the coast would come in future responses to Mission and GOP interest.

1.4 Conceptual Approach.

DESFIL reinforces AID attempts to address resource management problems in fragile lands in a more comprehensive fashion than is normally possible. Its scope manifests itself in greater integration in the design and implementation of project components, and in heightened awareness of the ways in which resource management problems in different regions are interrelated. Such breadth would offer the mission several important advantages. First, it would reinforce the complementarity of agricultural sector goals (increasing productivity and expanding the land base) as they overlap the LAC Fragile Lands initiative of managing fragile lands for sustained production, and would help build all three into the design and implementation of individual projects. Secondly, in so doing, it could permit greater project impacts by increasing the degree to which they are mutually reinforcing and cumulative in their accomplishments. Finally, it would aid the mission in responding positively to shifts in GOP funding priorities without sacrificing long-term goals.

DESFIL would provide support in achieving greater integration of the technical institutional, and policy questions that are part of each project. This will be discussed in detail in Section 4.0.

DESFIL also seeks to emphasize the relationships that exist between natural resource management problems in different geographic regions. In Peru, many of the natural resource management problems encountered in the humid tropical areas on the eastern Andean slopes (Selva Alta) have their origins in the Sierra. For example, the uncontrolled movement of large numbers of people into the Selva Alta and the problems of deforestation and erosion that accompany it are in large measure a function of population pressure, low productivity and limited income and employment opportunities in the Sierra, as people move into the tropical region in search of greater opportunities.

2.0 THE SIERRA AND SELVA ALTA REGIONS

2.1 Reasons for Focusing on the Sierra and Selva Alta Regions

As previously mentioned DESFIL anticipates that the humid tropics and steep slope regions of Latin America and the Carribbean will be where the project will have greatest impact. In Peru, the steep slopes of the Sierra and high jungle (Selva Alta) of the eastern Andes are where the activities of the Mission and the focus of the DESFIL project coincide. The bulk of the Mission's agricultural and rural development activities have been targeted to

the sierra and selva alta regions in recent years and this trend appears likely to continue. Evaluation reports and interviews with Mission project officer suggest that the considerable experience of USAID/P and Peruvian counterpart agencies may contribute to future development efforts in the sierra and selva alta.

2.2 Problems of Integration in Selva and Sierra Projects

In planning future agricultural and rural development activities, USAID/P could take important factors into consideration. Projects might be planned and executed in an integrated manner, with the coordination necessary for them to mutually reinforce one another to achieve desired impacts. In Selva Alta activities, for example, such as the Central Selva resource management project, project components include lumbering, road building, agricultural research and extension, natural resource management and other activities (APODESA 1984:91-93). Officials of APODESA (Apoyo a la Politica de Desarrollo de la Selva Alta), who are charged with program and policy coordination in Peru's special projects in Selva Alta development, report that one of the biggest problems they face is the inability of field personnel responsible for managing project components to coordinate their activities around a common goal.

In Plan MERIS, designs of the irrigation systems did not consider how the systems might be affected by upstream water users, or what effect the Plan MERIS systems might have on downstream users. The potential consequence could be serious in several instances, particularly during a year of below average rainfall (Gustavo Sobrino; personal communication). In both Plan MERIS and the Soil Conservation project, project officials have indicated an interest in learning more about issues such as the opportunity cost of the labor of beneficiary families, and its relevance to levels of beneficiary response.

2.3 Shifting Funding Priorities and Development Experience

Another factor that USAID/P could consider is how to apply the experience it has gained over the past years, while responding positively to changes in rural GOP development funding priorities. These are likely to accompany changes in the government following the upcoming elections. It appears probable that a new government may increase the amount of resources dedicated to agricultural development in the Sierra while decreasing development activities in the Selva Alta environment and the native communities residing there; such a shift will pose major challenges.

While a shift in emphasis to sierra agricultural development will reduce destructive pressures on the selva alta, it will not eliminate them. Many of the destructive processes at work in the Selva Alta are a function of social, economic, and resource management problems in the Sierra which stimulate large numbers of people to move to the Selva Alta. This means that, as support for resource management activities in the Selva Alta decrease, it will become increasingly important to understand specific relationships between conditions in the two regions. This will facilitate development assistance to the Sierra being directed at those conditions that are most directly related to Selva

Alta environmental degradation. It also means that since no amount of development aid will completely stem the flow of people from the Sierra. Selva Alta areas most subject to destruction by a further in-migration need to be identified and targeted for continuing assistance despite changing funding priorities.

Much of the knowledge to be gained from current USAID/P activities in the Selva Alta has development policy implications that extend far beyond Peru. For example, the design and implemention of a natural forest management regimen under the auspicies of the Central Selva project will provide information on the feasibility of establishing sustainable and economical tropical forest production systems. The Central Selva experience will be a basis for formulating development policies for many regions in the humid tropics. It is extremely important that the natural forest regimen and other Selva Alta activities with similar far-reaching implications be identified and that their significance be clearly communicated to any new government. While shifting funding priorities may slow or accelerate the rate at which humid tropical areas are brought under exploitation, the expansion of human populations into these areas will continue. Acquiring the knowledge upon which to base a rational land use policy for the humid tropics is essential for Peru and the Latin American region as a whole.

Changing GOP priorities raises the question of how the knowledge and experience that have been gained recent years may be preserved in order to be drawn upon again in the future. It is important to improve institutional memory both for USAID/P and the GOP so that the lessons currently being learned are digested and systematically made available in the future. The lessons learned from donor experience should be made available to Peruvians, particularly in light of the institutional instability of the GOP. Thus, an important contribution would be to support publication in Spanish on areas of concern to both USAID and Peruvians. For example, a published volume reviewing and assessing Peru's settlement experience in the Selva Alta would be an extremely useful document for Mission personnel and Peruvians likely to be involved in decision-making regarding Selva Alta development for many years to come. It would also communicate the depth and breadth of settlement experience of Peru to other countries.

2.4 Natural Resource Use Issues

The Sierra and Selva Alta are regions with differing climatic, biological, geological and geomorphological properties. Although different in these respects, the two regions are linked through flows of materials, goods, and people. Use of the natural resources in the Sierra affects the resources in the Selva Alta.

The natural resource base, the soil and forest, is being lost because of misuse and ignorance of the value of the base. On site alterations not only affect resources on-site, but resources off-site also are disturbed and degraded. The following treatment of erosion, soil degradation, deforestation and change in natural species mix is presented to show the major natural resource use issues in the Sierra and Selva Alta.

2.4.1 Erosion. Erosion is a naturally occuring phenomenon in all ecosystems and only becomes a problem when rates are accelerated by natural events or human intervention. Although all forms of erosion, (rill, interrill, gully and tunnel) occur in both Sierra and Selva regions, the relative distribution of different forms has not been documented, and soil losses or crop yield declines have not been quantitatively measured. (Low 1967). The degree of soil losses, however, is believed to vary widely, as a product of the interaction between the prevailing climate, soils, landscape and land use management. In general, most soils of the Sierra highlands are deep, well drained, fertile and less subject to physical or chemical constraints than soils of the Selva region. Soils of the Selva are generally highly weathered, acid, and deficient in available nutrients for sustained plant growth. Less weathered and relatively shallow soils occupy the eastern slopes of the Andean mountains.

Annual rainfall is several times greater in the Selva Alta than in the Sierra region, but whether the erosivity affect of rainfall is greater in Sierra than in high Selva is unknown. In the high Selva and Sierra regions, rainfall is concentrated in the few months of the rainy season, with dry periods and rainstorms of short duration but of high intensity. Presently, no studies are available that analyze existing climatic data to assess the impact of rainfall intensity on soil erosion in both Sierra and Selva. Mission personnel have indicated a particular need for these kinds of data for project planning in the high Selva.

Soil erosion losses in Sierra highlands appear to depend on soil moisture and temperature regimes. Soils with low temperatures appear to be less suseptible to erosion than warmer soils. Unless overgrazed, soils located at high altitudes (where production is limited to pasture and livestock production) have high organic matter content, are permanently covered, and have greater stability against soil particle detachment and transport. Warmer soils are located at altitudes where most of the Andean food crops are grown. Hence, if cultivated, they are prone to losses as the soil moisture regime increases.

Dry soils are generally likely to erode during the rainy season and during windy periods. With the proliferation of irrigation projects in the Sierra region, irrigation runnoffs from these soils are likely to allow soil erosion for longer periods.

Erosion of high Selva soils in their natural state is minimal, although some accelerated erosion occurs in areas where shifting cultivation is practiced. However, erosion is becoming a serious problem where shifting cultivation is gradually being replaced by continuous cultivation. Lumbering and land clearing operations, in addition to poor management of steep lands under cultivation, threaten to convert vast agricultural lands of the high Selva into shallow and highly impoverished lands. The downstream effects of siltation and sedementation have serious impacts on fisheries, hydro-power generation, navigation, and wetland agriculture.

2.4.2 Declining Soil Quality. A wide variety of soils is found in the Sierra and Selva Alta. Entisols, mollisols, inceptisols and alfisols generally predominate the Sierra highlands, whereas inceptisols, alfisols, and mollisols dominate the Selva Alta (Table 3).

Table 3 Predominant soil orders (U.S. Soil Taxonomy) in the Sierra, Selva Alta and Selva Baja. Cited by INIPA (1984).

Soil Order	Sierra	Selva Alta	Selva Baja
Entisols	X	X	
Mollisols	X	X	X
Inceptisols	X	X	X
Alfisols	X	X	X
Ultisols		X	X
Vertisols			X
Spodosols			X

Agriculture creates stress on soils by removing nutrients in the form of crops or forage, and by affecting soil chemistry and subjecting soil structure to compaction. This stress may not be reflected in lost productivity if the soils initial fertility is high, since lost nutrients can be replaced by fertilizers and the soil structure can be maintained or allowed to recover during fallow periods. (Bremmer et al. 1984).

These stresses are less manageable under humid tropical conditions because most tropical soils have lower initial nutrient levels. Under natural humid tropical conditions, the majority of nutrients are held in the vegetation. Once the natural vegetation cover is removed, the soil may support cropping for one or two cycles before nutrient leaching and the demands of the crop deplete nutrients to levels where crop yields are uneconomical.

Decline in productivity of steep lands in both Sierra and high Selva is mainly the result of erosion, whereas declines in flat lowlands are most often loss of nutients by leaching. Due to erosion, part or all the fertile top layer of the soil profile is removed, hence exposing either bedrock or subsoil which most of the time act as a physical or chemical impedence for plant growth. The extent to which a soil loses its ability to sustain plant growth and yield, however, varies between regions and among soils within a given region. Entisols and inceptisols of the steep landscapes of the high Selva, for example, if subjected to severe erosion, would experience irreversible loss of soil quality beyond a point that even high application of agricultural ammendments would not be enough to restore past productivity. The same soils located in the Sierra regions and under pasture exploitation may suffer erosion but would recover some of their lost productivity with appropriate soil management.

The exposure of subsoils as a result of erosion may also expose other hidden physical or chemical constraints which need to be addressed differently as soils and land use change. For example, subsoils of severely eroded ultisols of high rainfall areas would provide a harsh environment for plant growth and would need inordinate amounts of soil amendments for crop production. In lower rainfall areas, subsoils of similar eroded ultisols would be less stressful to plant growth and would require less soil amendment for crop production.

2.4.4 Deforestation. Tropical forests which are the major natural vegetative cover of the humid tropics, are themselves a resource that, once destroyed, cannot be replaced quickly or easily, if at all. As a self-regenerating system that produces wood and other minor forest products (latex, fibers, dyes, medicines), that is the natural habitat of animals and plants not found elsewhere, and as a critical element in the water cycle, fragile land forest constitute a unique and productive resource.

In the Selva Alta, shifting cultivation has been a sustained production system. However, under present conditions of population growth with shortened fallow cycles and burning in previously unoccupied slopes, it is the major source of deforestation. The wood resources are lost by burning when the land is cleared for agriculture. Deforestation in the eastern Andean slopes is believed to be accelerating, but the rate of increase is not established (Hecht 1982). Degradation following deforestation is manifested by declining soil quality, land use changes resulting from the conversion of forest to pasture, and the regulatory importance of forests in waterflow and in minimizing erosion. (Dourojeanni 1981).

Rangeland mismanagement in the Sierra has similar environmental and economic impacts, however forest regeneration is slow and active reforestation and pasture improvement is necessary to mitigate long-term deterioration.

2.4.4 Change in Species Mix. Overuse or inappropriate use of fragile lands may set in motion the progressive replacement of productive economic species with plants that are less useful to humans. Overgrazed pastures degenerate as inedible species and species of low nutritional value replace desirable grasses and legumes, due to preferential grazing by most livestock. Native hardwood forest with great diversity of species and economically high-quality wood are transformed to low grade secondary forest with low species diversity and rapid-growth light wood of limited commercial value. Agricultural lands become increasingly invaded by weed species that are adapted to the new conditions created by forest clearing (e.g. bracken-type farm colonization of acid soils in the Huallaga Central (GOP/UNEP/INP 1984). These changes in species mix may be as damaging as erosion in converting a land resource into one that cannot be used for production. In some cases these changes in fragile land ecosystems are irreversible, cannot be repaired, and will require decades or longer to recuperate their original productivity, even if left undisturbed.

The loss of species of presently unknown economic value is a major and permanent loss of the national resource base for any country. If these losses include native species adapted to survival in fragile lands, then some possible solutions to future productivity problems are lost. Particularly in humid tropical lowlands, the present serious lack of knowledge of existing species and their possible economic usefullness represents an under-utilized source for national planning. For example, of the estimated 2000 species of trees in the Palcazu valley, less than 5% are presently utilized in the peruvian lumber industry. The identity and wood properties of the remaining 95% are slightly characterized or completely unknown.

2.5 Sierra-Selva Alta Linkages

The Sierra and Selva Alta are closely related regions, with people and goods moving back and forth between the two. This has been the case historically and, although the nature of the relationships binding the two regions has varied over time, it remains the case today (Collin 1984; Martínez 1969). In such a context, the social, economic, and environmental factors that shape conditions in one area directly influence conditions found in the other.

While these linkages have been observed and their general importance understood for some time, little attention has been given to the specific mechanisms through which they manifest themselves. Development planners have tended to regard the relationships between the Sierra and high Selva as interesting, but with limited practical significance. Close examination, however, shows that the issues raised for development planning are quite concrete.

Through an examination of seasonal migration in Puno department, between highland Huancane province and the Tambopata Valley of the Selva Alta, for example, Collins (1981) has shown that, under current conditions, sustaining highland agriculture depends upon the inflow of resources generated by coffee production in Tambopata. Farmers do not control enough resources in either the highlands or the valley to maintain themselves permanently in either place. As a result, serious resource management problems occur in both areas. The need to go to the Tambopata Valley immediately after the highland harvest makes it difficult to dedicate the labor necessary to maintain terraces and irrigation systems. Once in Tambopata, the need to return to the highlands and begin a new agricultural cycle there prevents producers from practicing appropriate conservation measures on the steep slopes. The result is a moving coffee frontier where productivity is low, and which constantly penetrates farther into the valley, leaving in its wake denuded hillsides that may never recover (Collins 1984; Painter 1983). The constant movement has frustrated development efforts in the highlands and Tambopata alike, as farmers have not been able to dedicate resources to projects that do not yield an immediate financial return.

While more obvious in the case of seasonal movements, the relationships between the Sierra and Selva Alta may also be perceived in permanent movements of populations between the two regions. Stearman (1973) has noted that in

areas of permanent settlement in the eastern lowlands of Bolivia, many farmers maintain their lands in the highland and valley regions, and that people and goods move back and forth regularly. In Huancayo, a large but undetermined number of farmers in communities such as Sincos, Mito, and Orcotuna, which are beneficiaries of the Plan MERIS project, migrate seasonally to work in the coffee groves of Satipo and Chanchamayo. Others have acquired lands in the region and reside there most of the year, renting out their lands in the Mantaro Valley. Whether this has adversely affected beneficiary response to the irrigation systems provided under Plan MERIS is not known. However, the large-scale movement of people into Chanchamayo and Satipo has proved to be a major obstacle to the development of sustainable production systems there, and farmer response to the provision of irrigation has been lower than expected. A better understanding of the relationship between the Mantaro Valley and the Chanchamayo-Satipo area would benefit the planning and implementation of projects in both regions.

Some researchers have argued that the failure to consider such relationships in the planning and implementation of development activities has been a major reason for Peru's lack of success in achieving integrated development in the agricultural sector. At all levels, from planning and implementing of individual projects to the institutional arrangements through which these projects are organized and administered, to the formulation of national agricultural policy, Peru's humid tropics, highlands, and coast have been regarded as discrete regions with their own peculiar sets of problems and opportunities (Grillo 1980).

USAID/P has an opportunity to bring a new perspective to efforts to develop the two regions. Such a perspective would focus upon understanding relationships between the Sierra and Selva Alta, and seek to promote resource management practices that improve production and productivity over the long term in both. The elaboration of an integrated approach to the Sierra and Selva Alta would have an impact that extends beyond Peru, informing agricultural development strategies in neighboring countries which also have large Sierra and Selva Alta areas.

3.0 EXPERIENCE IN SIERRA AND SELVA

Unfortunately, there is no single factor or simple "key" to developing the potential productivity of the Andean Fragile Lands. Productive management of these areas will require significant, well focused and sustained expenditures of resources, appropriate policy and institutional commitments, expanded scientific and applied study, and time. The benefits from wisely managing the development of the area's resources can be of enormous economic and political significance to the Andean countries and subregion. Conversely, unwise use of the resource base will result in a tremendous waste of human effort and financial resources plus a rapid deterioration of the countries' long-term productive and economic prospects. The new PID on Recapitalization of the Agricultural Sector will attempt to incorporate this issue into the overall project design.

In order to better understand the experiences gained from previous or on-going projects, it is important to understand the interaction of the many social, economic, and ecological processes that characterize projects located on fragile lands. The following is a short summary of these processes. It is important to recognize that the list is not all inclusive and that much detail has been eliminated. As the FLAWG and the LAC missions continue to develop a coherent strategy, it is hoped that this list will be expanded and better documented.

3.1 Settlement

Human settlements in the fragile lands are the result of Sierra populations actively seeking new lands in order to improve their quality of life. Evaluation of past colonization efforts in fragile lands shows how inadequate settlement planning and program implementation result in over-exploitation of resources, poor return on investment, and undesirable environmental impacts on the region which are difficult to overcome (Nelson 1973; Martinez 1969; OAS 1983; USAID/P 1981). Wise plans would include: proper selection of cropping, livestock, and agroforestry systems based on land capability, cultural acceptability, availability of labor, ecological constraints, profitability, and a marketing infrastructure appropriate to the new environment.

Contrary to what migrants were frequently led to expect the fragile lands of the eastern Andes cannot realistically be expected to be the "breadbasket" of Peru due to the limited availability of fertile soils, extremely wet climate, and sharply dissected topography. In many areas the best soils are already occupied by colonists or native communities and the potential for additional colonization is limited.

3.2 Land Use

Unequal access to land promotes land use patterns in which relative use intensity is disproportionate to land quality (i.e., good lands are used less intensively than poor lands). Since fragile lands do not produce sustainable yields under current management practices, incomes are reduced to subsistence levels or lower. As a result, lands are abandoned and colonists move on to repeat the cycle on new, unfarmed fragile lands. In Peru, and in the Andean subregion in general, there are large land areas unoccupied and so water and forest resources continue to be mismanaged with alarming long-term consequences. Intensifying production on relatively level lands with fertile sols may relieve some of the pressure being exerted on fragile areas.

3.3 Political pressures

Politicians and decision-makers seeking immediate solutions to growing social problems (unemployment, housing shortages, crime, social unrest) in Lima and other urban centers, look to empty or sparsely populated lands of the eastern Andes. They see such lands as expanding the agricultural frontier without adequately understanding the limited potential for agricultural use there. When a policy of settlement on areas not previously incorporated into

the national production system is used as a substitute for addressing inequitable resource distribution and concomitant problems such as overpopulation, low productivity, and a lack of economic opportunity in other areas of the country, the problems which gave rise to the policy in the first place are simply reproduced. Furthermore, when the areas designated for settlement and incorporation are fragile, as are the steep slopes of the eastern Andes, rapid environmental deterioration may cause the problems duplicated in the newly settled areas to become even more acute than in the original areas of the country, and in a relatively short time (de Janvry 1981; Scudder 1981, 1984).

3.4 Technology Transfer.

Under continuous cultivation, soil remains uncovered and exposed to erosion for longer period of time than soil under shifting cultivation. The question that arises is whether continuous cultivation can be extrapolated to more vulnerable ecosystems such as the steep lands of the High Selva. Adaptive research probably will be needed to modify their technology to Selva Alta conditions, with careful considerations of limiting site-specific characteristics (i.e., soils, rainfall, topography, and other environment conditions). The lack of resources and expertise in the prevailing subsistence agriculture in these regions limits present research efforts. These should aim to alleviate soil and nutrient losses, with their concomitant degradation of cultivated sites and decline of productivity so as to develop feasible and affordable alternative cropping systems yielding sustainable productivity. The choosing of cropping systems, including continuous forestry production, with tolerance not only to prevailing natural environmental stresses but with a proven ability to persist and produce acceptable yields is of critical importance in the development of suitable technologies applicable to both steep lands and humid lowlands.

Research on cropping patterns should include intercropping, relay cropping and crop rotation studies combining the use of grasses and forage legumes with short-cycle and/or perennial crops. Research emphasis should be place on both wild and cultivated species presently growing in these fragile lands. Native species prove their adaptations to conditions of fragile lands by living there.

The National Program of Soil Conservation in Perú has developed a technological package in both soil conservation practices and mechanical methods designed to counteract rill and gully erosion losses in the Sierra highlands. Terracing, contouring, mulching and special gully control measures have been successfully tested in a network of research and extension-type plots in several places. Effective information dissemination has been used to create awareness among small farmers on soil erosion problems and control. Whereas technology on erosion control for the Sierra region is readily available, research on soil conservation practice and mechanical control methods in the high Selva is far from being completed. Lumbering and land clearing operations are clearly the most important causes for accelerated

erosion in the high Selva. Research is critically needed to assess the impact of lumbering and land clearing operations on erosion. Simple control measures such as concentrating lumbering and land clearing operations during the dry season can be implemented to counter current erosion in the high Selva region.

The North Carolina State University (NCSU) group is developing agricultural technology designed for the tropical lowland of the Amazon basin. The research conducted at the Yurimaguas agricultural experiment station has been investigating whether long-term, continuous crop production is feasible in humid tropical soils with the applications of agricultural inputs. The main limitation of the NCSU technology for widespread acceptance in the region is its input-oriented approach.

3.5 Vulnerability of Fragile Lands.

The vulnerability of the fragile land resource base is not widely understood, although alarming examples of deterioration are evident. Deforestation and farming on steep slopes without appropriate management systems results in erosion and soil losses, land abandonment and unstable rural migrations. Inappropriate forest management includes uncontrolled activities of loggers who extract timber on hillsides made accesible by new roads. Slash-and-burn farmers forced to clear new lands due to diminishing yields from increasing cropping cycles, shorten their fallows, a poor management strategy on steep slopes. These are not ecologically sound agricultural/forestry production systems; they encourage the invasion of lands held by existing populations, in particular those of native communities. Penetration roads to the eastern lowlands cross many fragile land areas with limited potential for agricultural production. For example, the Selva Marginal Highway links the coast and sierra with many previously inaccessible areas which have only a limited capability to support sustained agricultural production (Pool 1981a, 1981b; OAS/UNEP/ONERN 1984).

3.6 Off-site Impact.

In addition to the decreased soil fertility and erosional losses suffered on fragile lands, there are important off-site impacts that are frequently not recognized. For example, the accelerated deforestation of the Upper Amazon watershed has increased seasonal run off which has resulted in a fluctuating hydroperiod (Gentry and Lopez-Parodi 1980). The regularity of stream flow is important to farmers of the central and lower Amazon who utilize the seasonally flooded riverbanks (barriales, varzea sigapo) for annual crop agriculture. Furthermore, regular flow is important for sustaining the existing fish populations which are often a major source of protein in local diets (Clark 1984).

3.7 Existing Production Systems

There is a general lack of information concerning existing production systems. The production systems of Native Communities, which have proven ability to sustain populations over long periods of time are not understood. There is also a need to understand why farmers, loggers and

cattlemen do the things they do in fragile lands before their practices can be improved or changed. Basing project design and implementation on clear understanding of current system might lead to more effective methods of modifying such systems for long-term resource management.

4.0 INSTITUTIONAL/POLICY CONSTRAINTS AND OPPORTUNITIES

This Section focuses on structural issues which, in the Peruvian context, constrain the resolution of the problems discussed in the earlier sections. These fall roughly into three sets of issues: (1) Those that deal with the understanding and awareness of sustained material resource use problems in Peru and a wider recognition of the "systemic" interconnection between components; (2) those which illustrate institutional weaknesses and lack of capacity, especially in public administration to deal with these problems and (3) some policy related constraints which condition the effective deployment of technical and administrative resources. Under each heading, some observations are made on hopeful trends and promising intervention opportunities which have come to our attention during our assessment in Peru.

4.1 Low Degree of Consciousness/Awareness

It is clear that in Peru, as elsewhere in Latin America, there is a prevailing lack of overall consciousness and longterm thinking of about fragile lands issues. The environmental movement here is in its initial stages. It seems customary to think of conservation and protection as a sideline rather than as a central issue and regard environmental concerns as an extra cost and as of marginal importance when compared to short-term production. Fortunately, there is a noticeable change in these attitudes, attributable in no small part to the work of AID, particularly through APODESA. The number of Peruvian professionals competent to deal with soil conservation, forestry and water management is growing. Institutions and programs within which aspects of sustained resource management are being addressed are in place. What seem to be lacking are (1) public awareness, especially at the resource user level; (2) knowledge and sensitivity of the public service cadres (agronomists, extension agents, communit level workers) whose work directly affects resource use; and (3) perception of village and local government leaders, as well as officials of regional decentralized institutions in whose territory the spatially related aspects of land, water and forest management could be meaningfully addressed on an integrated basis. In spite of these limitations, we are impressed by the recent progress made in Peru, and believe that the different programs, and projects now in place at various levels, and the accumulating literature offer a good base for further education and diffusion efforts. Short term training of agronomists and other agricultural technical personnel seems to have a very high priority.

4.2 Weak Institutional Base for Sustained Natural Resource Planning and Management

The lack of institutional capacity at all levels to address the complex resource management issues is not surprising. We think that this problem may have two dimensions: (a) the absence of a central capacity to understand and

articulate the problem of national resource management as a whole and the urgent issue of fragile lands in particular; and (b) the need to coordinate more effectively the work of various agencies, especially in the field, whose responsibilities are seriously fragmented, conflicting and overlapping.

With respect to the first point, earlier sections of this report have already referred to the fact that fragile lands management in the Peruvian context means reconciling and integrating many different actors (individuals, communities, firms, agencies) in many different locations within ecological systems (upstream, downsteam, mountains, valleys, plateaus) and taking account of different uses, agriculture, livestock, fisheries etc. These interdependencies exist at different levels, ranging from what questions confront an individual farm family about managing a small farm system (and a superimposed household labor/income system), to the broad relationships between major geographic regions (Sierra - Costa, Sierra - Selva) in Peru. There is really no institutional reflection in the country of these systematic considerations. As usual, the existing institutions are organized along sectoral or functional lines. Perhaps an exception is the recently created regional corporations and special projects; however, within them the sectoral specialization prevails.

As to fragmentation and lack of coordination , our team heard and read ample evidence of conflicting and overlapping responsibilities, especially in the realm of public administration. For example, the evaluation report of the Soil Conservation project cites numerous concrete examples of this state of affairs. Another example is the conflict between forest industry/logging interests, tied in with the Ministry of Industries as against reforestation and forest management concerns of the Ministry of Agriculture. Different agencies and projects undertake a variety of conservation-related activities and link with separate external donors. This is, of course, not necessarily bad, but there seems to be a lot of dispersion of scarce resources, lack of common criteria and methods, and we think above all, a deplorable lack of communication and sharing of knowledge.

It is not clear how these importance structural problems could be meaningfully addressed. It seems to us that it would be a mistake to suggest the creation of yet another set of public institutions to deal with the cross-cutting topics of natural resource management, although the proposal of the Soil Conservation project for the creation of a "national system of land and water conservation" may have merit. Whatever opportunities for institutional reform emerge from the election of the new government, we are inclined to stress action at the top and the bottom of the hierarchy. At the top, perhaps at the planning level, there is need for a small, central core of people who can perceive the resource management problems in their broadest dimensions and who can begin to effectively influence national policies and strategies. There are persons now working in APCDESA, ONERN, and INP who could be called upon to serve in this capacity. At the bottom, we see the opportunity to implement a massive resource management program based on small and medium sized watersheds with the active collaboration of local communities and local government units. This idea will be discussed in a later paragraph of this report.

4.3 Incentives and Private/Public Interests

At the heart of the resource management question in Peru are a set of policy-related dilemmas having to do with incentives to encourage sustained use and the incidence of costs and benefits, private and public, between different social groups. As was discussed in the section of this report dealing with conservation-oriented technologies, the real challenge here is to identify both technological packages which are economically attractive to potential adopters and policy instruments which could help to provide incentives for practices. The challenge currently confronting Peruvian policy makers is to balance the immediate need to increase agricultural production and productivity against the country's long-term capacity to sustain those increases once they have been achieved. To do so requires a detailed appreciation of the value of existing natural systems and the cost of replacing or restoring them after they have been destroyed or damaged through poor long-term management.

There is plenty of evidence that in Peru current practices conducive to resource depletion are encouraged by short-term urgent income needs and the lack of viable alternatives, as well as by inappropriate policies. For example, price and marketing supports for corn in certain humid tropic areas encourage destructive use of steep slopes. Similarly, demand for barley by beer companies may be responsible for cultivation of marginal land. In general, farm policies in Peru as elsewhere tend to stress a commodity approach, rather than a farming systems approach, and thus may have unintended negative consequences for sustained farming practices.

In spite of what appears to be an unfavorable policy environment, some progress has been made in Peru to generate and difuse conservation-oriented technologies, such as terracing, contour cultivation and protective strips between fields, as well as some experiments in agro-forestry. Most of these initiatives are based on private benefits on individual farms and involve the investment of family labor. Mission members have expressed considerable interest in testing the economic viability of these practices and how relatively restricted pilot projects could be expanded.

Less advance, both conceptual and practical, appears to have been made in practices that involve a number of different decision makers at different points of the watershed or ecological system, in situations where the incidence of costs and benefits accrue disproportionally and in different time periods to the groups affected. One of the most vivid examples of this issue is the reported disruption of the water supply in many coastal valleys associated with deforestation and loss of protection in the upper reaches of their watersheds in the Sierra. The practical solutions to this sort of problems are extremely difficult, not only because of the wide geographic separation of the interest groups who benefit and bear the costs, but also because of the different time frame, in this case the immediate survival of highland communities against the future income stream of coastal dwellers. At the very least, there ought to be a clear recognition of these linkages and operationally oriented research to identify policy options would seem be opportune.

In smaller systems, there are some encouraging cases of success, which should be carefully evaluated and replicated. For example in Cajamarca community development using a combination of tree planting, pasture grasses and contour ditches seems to have not only stabilized eroded steep slopes but has contributed to improved retention of drinking and irrigation water on the valley floor. In another case we were told of a project in Chanchamayo where what appears to be an innovative intercropping experiment is under way, using citrus and fast growing softwoods for the production of packing crates, and slower growing high value hardwoods. Yet another case from the same region reports a promising combination of citrus and legumes. In all these cases it seems to us that more deployment of natural resource economies, especially at the micro- and watershed level, would contribute to the farming systems and soil conservation work already underway. Work on the dilemma of the public-private interactions in land use also promises a high payoff.

4.4 Land Tenure and Settlement Policies.

Inadequate and poorly enforced land tenure and land settlement policies strongly impact on the use of fragile lands in Peru. The agrarian reforms of the 1960s and early 1970s have been interrupted and left incomplete or without follow-up. This mainly affects the Sierra. In the Selva, tenure policies, while well intentioned, have been virtually impossible to implement and have given rise to a chaotic and unstable settlement pattern. Four sets of tenure problems condition fragile land development:

a. Tenure insecurity, both in turns of occupancy rights and legal titles.

b. Limited access to land, even in portions of the Selva for campesino families.

c. Poor settlement system and lack of enforcement especially in frontier areas.

d. Lack of coherent policies for communal and public land ownership and management.

In Peru, even more so than in other Andean countries, the land tenure situation is enormously complicated, especially in the wake of a partial reform process. While the instability of the current agrarian structure has a lot to do with poor land use patterns, and hence with inefficient resource management, we wish to call attention to a few elements. Lack of permanent occupancy and insecurity are universally recognized as a highly negative influence, especially in the Selva. In addition, in many areas uncontrolled land acquisition combined with limited opportunities and incentives for permanent settlement of migrants seems to have given rise to a perverse pattern of land use, in which the best valley areas are increasingly in larger units under extensive use, while the steep slopes are either growing "intensive" food crops or are part of a truncated slash-and-burn-cycle.

In some places land reform, combined with population pressure, has had negative consequences on conservation practices in farming -- forests have been cut and not replanted, upland pasture is heavily overgrazed. In a place called Suncabamba, a former large hacienda covering a whole valley was mistakenly subdivided into two reform units, one covering the upper part, the other the lower part of the valley. When the upland beneficiaries cleared the forest, the lands of the lower cooperative were damaged. But, by-and-large, the severe resource use problems in the Sierra cannot be attributed to the reform process.

In the Sierra, parallel to the overriding issue of absolute land scarcity and fragmentation, is the problem of "group systems", that is community tenures and group control over some aspects of resource management. While group systems are perceived as a problem (especially in trying to control grazing at the upper altitudes), they are also an opportunity to implement better land use practices. Properly motivated, organized communities (and some local government units of which they form a part) could serve as vehicles for an integrated local resource management program, especially at the small watershed level. While structures created by the the land reform may be mostly in decline, communal organization in some parts of the Sierra is still strong. By carefully assessing the community organization in a watershed, communities with strong group systems can be identified whose authority and jurisdiction could facilitate such a program. Less organized communities require a different approach for watershed management.

If packages of conservation/management technologies could be identified as suitable for different parts of the Sierra, it may be worthwhile to design a community-based watershed development program. Our interviews with several members of the USAID/P Mission have pointed in this direction. It was suggested that such a program, which would incorporate lessons learned from both the Soil Conservation and Plan MERIS projects, might operate through small grants-in-aid made directly to selected communities for a variety of investments within their watershed. Grants would be reinforced through technical assistance and training/demonstration components (somewhat along the lines of the DRR project). Private organizations and PVO's could be used as support systems, such as the Fundación para el Desarrollo Nacional, which is successfully implementing a community-based bee-keeping project. This may be an innovative way to reach a large number of families and favorably affect land use over large fragile areas. Further innovations suggest themselves in classifying and selecting communities and areas for this program (for example, assigning high priority to areas needing downstream protection, producing marketable surplus, and having strong community organization).

4.5 Other Policies

We wish to reiterate that, in the global or systems perspective we have tried to use to deal with the fragile land issue in Peru, there are other policy concerns which directly or indirectly affect land and water resource use decisions in areas which could be characterized as fragile.

In this sense, we confirm that policies which raise the income producing capacity of the best and most accesible areas will undoubtedly relieve pressure on more precarious and more fragile lands, especially on steep slopes. This means that most of the agricultural and rural development policy constraints identified by the AID/P Mission in preparation for their policy dialogue and an eventual agricultural sector project are also relevant to the fragile lands initiative. This is especially the case for encouraging and using essential inputs such as credit and also for more remunerative factor pricing, market access and market town development.

However, we wish to point out that under Peruvian conditions as elsewhere, there is not always a necessary coincidence between policies designed to promote agricultural production in the short-term and long-term sustained and ecologically balanced resource use. There are, for example, potential conflicts between large-scale commercial agro-industrial and lumbering initiatives and the maintenance of a stable ecosystem, especially in the humid tropics. However weak and ineffective the public sector may be, some minimal capacity for managing public lands and maintaining a degree of public interest in land, water and forest use is essential. It seems to us that under prevailing and forseeable conditions of capital scarcity and a big push for productivity, attention should be paid to the careful protection and husbanding of perishable resources. From the strategy point of view, therefore, we see a high payoff in the Mission's and GOP's ability to select those development approaches in which measures for increasing the income stream from Peru's resources is consistent with sustained management objectives.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1. Purpose of the Visit to USAID/P

As noted at the beginning of this report the principal purpose of the visit to USAID/P was to secure information and input from the Mission to be used in writing the Project Paper for DESFIL. Since DESFIL was conceived as a response to requests from Agricultural Development Officers (ADOs) throughout the LAC region for assistance in addressing resource management issues on fragile lands, FLAWG hopes to insure that the concerns expressed by ADOs continue to be addressed as DESFIL moves forward in the project cycle. Because DESFIL depends upon substantive and financial support from the LAC Missions to accomplish its objectives, it is vital that field interests be incorporated. USAID/P proved to be a good place to explore the fragile lands issues that LAC Missions face, because USAID/P has a large number of projects with resource management components, and because its staff articulated their experience of attempting to elaborate in a strategy for fragile lands development.

A secondary purpose of the visit was to provide USAID/P with a fresh perspective on opportunities for extending its experience in fragile lands development. Mission staff have said they seek creative responses to possible changes in funding priorities for rural development due to upcoming

elections. Given the brief time our team was in Peru, it does not presume to have provided the Mission with new information about individual projects. However, the team's work may be a source of new ideas on fragile lands development. Annex 3 provides a detailed list of the team's recommendations.

5.2. Shared Concerns

The team identified six areas of convergence between the objectives of the DESFIL Project and USAID/P. Some of these arose directly out of the team's conversations with project officers and other Mission personnel, while others reflect the team's interpretation from their own specialties and the documents they reviewed. These areas of shared concern were formally reviewed and discussed with Mission personnel prior to the departure of the team, and are summarized in the following sections.

5.2.1. Recognizing the relationships between Sierra and Selva Alta regions. While possessing particular properties, the Sierra and Selva Alta are joined as components of a larger system by flows of people, money, agricultural products and other goods back and forth between them. Conditions in one area affect conditions in the other in diverse ways, so that the solution to a development problem in one area may be found in the other. For development by sustainable increases in production and productivity to occur, the relationships between the two areas must be understood and utilized to the advantage of beneficiary populations.

5.2.2. An integrated approach to project design and implementation. Greater emphasis placed on action research or monitoring throughout the phases of project design and implementation, could have important pay-offs. For example, the Small Ruminants CRSP quickly discovered that it could not succeed by focusing its attention strictly upon small ruminants. Rather, small ruminants must be considered in the context of relationships between livestock and agricultural crops, between different crops, and between on-and off-farm production. This broader focus may be applied productively to other types of projects as well; such as considering the way an irrigation project fits into an overall watershed, or the effect of agricultural development activities on conditions downstream in the Selva Alta.

5.2.3. Increasing resource management awareness in the GOP and donor agencies. Peru is currently facing a crisis in agricultural production and productivity which needs to be addressed immediately, both to reduce the country's reliance upon imported foodstuffs to feed its population and to increase agricultural exports which will provide a source of foreign exchange. As a result, a great deal of emphasis is being placed upon achieving immediate gains in productivity and expansion of the land base. However, it is also important to stress the necessity of an appropriate resource management strategy, so that production and productivity can be sustained over the long-term without excessive expenditures for inputs. In the absence of wise resource management, it is quite possible that the money currently being spent to import food will eventually have to be spent on importing inputs to sustain domestic food production. An upcoming change in

government may provide an opportunity to initiate an appropriate resource management plan as a central part of agricultural development policy. USAID/P's experience in activities such as the Soil Conservation project demonstrates the gains that can be made in productivity simply through proper soil management. If the immediate crisis can be overcome, the lessons learned from projects such as this, incorporated into a comprehensive resource management, can provide the basis for sustaining long-term production and productivity increases.

5.2.4. Continued monitoring of project with potential long-term benefits. USAID/P is involved in several projects which will have results that will influence development activities on fragile lands in many countries in addition to Peru. In the Central Selva project, for example, three important experiments are taking place:

a. Establishing a natural forest sustained production management system;

b. Developing an agriculture and livestock production system appropriate to the Selva Alta; and

c. Supporting native communities so they can participate in the changes that are transforming their area.

All three will influence the course of development in other countries with humid tropical steeplands. However, the results of these amd similar groundbreaking efforts in the projects will not be apparent until well after the projects themselves have ended. So that the experience gained in Peru can be utilized and expanded upon, it is important to insure that they will be the object of continuing monitoring and analysis.

5.2.5. Consolidation of fragile lands experience. During the course the past 25 years, Peru has accumulated a tremendous amount of experience in attempting to develop its fragile lands areas in conjunction with USAID/P and other donor agencies. However, the record of most of this experience is contained in unpublished documents which are difficult to locate and which are not systematically saved. Furthermore, USAID/P and GOP officials involved in project management frequently find it difficult to keep track of published material relevant to their responsibilities; and agencies such as APODESA and ONERN, which are changed with research and planning, are frustrated in their efforts to have their work inform project design and implementation. Consolidation of Peru's fragile lands experience and the application of the lessons learned to continuing activities requires:

a. USAID/P would establish a Mission library containing project documents and materials on Peruvian development issues so that Project Officers' will have access to all information relevant to their activities;

b. Support is needed for research and publication (in Spanish) on topics related to fragile lands development by Peruvian scholars through

organizations such as APODESA in order to place USAID/P's experience in the context of general trends, and contribute to the awareness of fragile lands issues by Peruvian policy makers; and

c. A central fragile lands data bank should be established for donor agency and national personnel.

Taken together, these activities could provide the basis for a comprehensive resource management education program in countries involved in fragile lands development.

5.2.6. Institutional focus for fragile lands development. There are a number of possible institutional arrangements for organizing and administering resource management activities on fragile lands. These include working with existing GOP "line" institutions, creating new structures to manage special project, and strengthening the ability of regional and local institutions to design and implement project. Regardless of the particular arrangements decided upon as the best way to meet project goals, two levels require particular attention in coming years.

At the national level, fragile lands institutional strengthening efforts need to support the creation of a high level government body with direct access to the President and Ministries, which is competent in resource management issues and can review relevant policy in order to advise the GOP. APODESA was originally created for this purpose, and it possesses the technical capability to perform the task. However, its present location within the GoP does not permit it to fulfill this aspect of its mandate.

Local level institutions are also in need of support in order that they may conduct projects that are in accordance with the resource management needs of their area. Grants to local-level entities would also promote development action in the countryside rather than in Lima and the departmental capitals. Working through PVOs may also provide a productive means of promoting local development efforts.

Annex 1

People Interviewed by the Fragile Lands Team
March 25-April 5, 1985

- Julio Alegre, Tropical Soil Management CRSP
- Jerome Arledge, USDA/USAID
- Dale Bandy, North Carolina State University/Tropical Soil Management CRSP
- David Bathrick, USAID
- Carlos Calderon, Oficina Nacional de Evaluación de Recursos Naturales (ONERN), GOP

- Howard Clark, LAC/USAID
- Ramon Cornejo, Proyecto Especial Alto Huallaga
- Walter Couto, Tropical Soil Management CRSP
- Frank Dall, USAID
- William Deese, USAID
- Eduardo Duran, Apoyo a la Politica de Desarrollo de la Selva Alta (APODESA)/GOP

- Francisco Espinoza, USAID
- Edward Farnworth, APODESA
- David Faulkner, USAID
- David Flood, USAID
- David Hess, USAID

- Michael Hirsh, USAID
- Frank Low, APODESA
- Fred Mann, USAID
- Hector Martínez, Universidad Nacional Mayor de San Marcos
- Oscar Pérez, APODESA

- Benjamín Quijandría, University of California at Davis/Small Ruminants CRSP
- Anthony Stocks, Idaho State University/Ronco Associates
- William Sugrue, USAID
- Robert Tillman, USAID

- Hugo Villachica, Tropical Soil Management CRSP
- Raymond Waldron, USAID
- Carlos Yañez, APODESA
- Carlos Zamora, ONERN

Annex 2

Soil Erosion and Management of Sierra and Selva Lands

Prevention of soil erosion is as important as erosion control in both Sierra and high Selva regions. Except for a few attempts to use known methods to assess soil erosion, such as Tosi's land use capability system, no data are available to determine the magnitude and extension of soil erosion problems and to ascertain what erosion control practices are needed to alleviate or prevent soil erosion. ONERN indicates that 6,000 x 10^3 and 53,193 x 10^3 has of Sierra and Selva lands, respectively, are subjected to moderate and severe erosion. These data come from reconnaisance studies conducted at macro scale which are of limited value to assess erosion problems of a given watershed.

What is needed in Sierra and high Selva is to select a few key watershed for a more detailed soil erosion inventory. Erosion inventory studies aimed to assess potential soil losses based on estimates of the K factor of the Universal Soil Loss Equation (USLE) are of practical value in areas with limited basic soil information. The K factor, which is an index of the intrinsic suspectibility of a given soil to erosion, can be quantitatively estimated from soil physical and chemical properties which are available in most soil survey studies conducted by ONERN.

A major criticism in the use of K in erosion assessment may be the fact that K is estimated using empirical equations and parameters developed for temperate regions, which may be inapplicable for use in tropical soils. Here, provision needs to be made to incorporate parameters such as structural characteristics, mineralogy, and soil solution and ion exchange capacity in the estimation of K in tropical soils. As a first approximation, soil erodibility maps based on estimated K values can be obtained to group and rank soils in terms of their susceptibility to erosion, which in turn, can be used for conservation planning purposes as well as for erosion control measures.

If additional information is available, such as rainfall intensity, slope steepness, slope length and crop management, soil erosion losses can be estimated by applying the USLE. However, soil losses computed by the USLE must be recognized as the best available estimates under a given set of conditions rather than absolute values. Further on-site research will be needed to calibrate and validate parameters of the USLE to allow adjustments for local conditions.

Studies assessing the impact of rainfall intensity on soil erosion are practically nonexistent in Peru. Analysis of existing rainfall data and expansion of current meteorlogical information acquisition to include rainfall intensity and duration are of foremost importance to evaluate rainfall erosivity in Sierra and Selva regions.

No information is available on the severity of gully erosion in Sierra

Annex 2, continued

and High Selva, which seems to be of greater proportion in areas completely denuded or under servere erosion. Gully erosion data is difficult to extract from basic soil information or soil survey studies; however, field techniques are available to assess gully erosion over different time intervals. Surface reconnaissance surveys are needed to assess the relative magnitudes of several forms of gully erosion. The remote sensing technology and computer capabilities of ONERN can be used to assess the extent and degree of gully erosion. This should give to ONERN an opportunity to apply its newly learned technology to environmental assessment and protecion assessment.

On soil management of humid tropical lowlands, INIPA has developed a network of experiment stations located in both Selva Alta and Selva Baja regions to tackle soil problems (soil acidity, nutrient deficiency, water logging) constraining production of tropical food crops. The aim of INIPA is to develop technological packages suited to the fragile environmental conditions of the Selva region. Through its extension service, INIPA is currently making this technology available to small farmers and native communities.

Annex 3

Summary of Team's Recommendations

1. Support and supplement existing projects

a. Identify at-risk lands in Selva Alta where intervention could reverse both impoverishment and environmental destruction.

b. ONERN should be encouraged to upgrade their erosion maps for all of Peru.

c. T.A. to ONERN to expand environmental profile and prioritize fragile lands.

d. Continue to monitor natural forest management, agriculture and cattle management, and social organization in the Central Selva project.

e. Extend Central Selva to include research on mulches, green manure and cropping systems for Selva Alta and Selva Baja.

f. Develop soil conservation package for Selva.

g. Extend soil conservation package for Sierra.

h. Deploy people with competence in natural resource economics, especially at watershed and micro environment levels who will test economic viability of soil and water conservation (and other) practices.

i. Integrate research efforts of national and regional institutions working on fragile lands subjects.

j. Prepare technical summary of state-of-the-art lessons learned about production on fragile lands.

k. Consolidate data into a library and a computerized data base (on floppy disc).

l. Share info. on fragile lands systematically (including Missions, APODESA, etc.).

m. Continue close dialogue with APODESA.

2. Provide integrating capability of components and projects at policy, program and watershed/area level

a. Consider establishing a central core of planning and policy people at the top of GOP who can perceive the broadest dimensions of resource management.

b. Provide technical assistance to Mission and GOP parties to agricultural policy dialogue to develop alternatives to expanding the land base onto fragile lands.

Annex 3, continued

c. Support with TA and funding initiatives of GOP or CORDEs in land titling and forestry which might address these problems:

1. A national forest policy;

2. Identifying potential conflicts/coincidence between private commercial interests and the maintenance of a stable ecosystem, especially in the humid tropics (Missouri or New York Botanical Garden studies good input);

3. Develop workable interface (at CORDEs level) between lumbering and forest management in the Central Selva; and

4. Identify land tenure issues which constrain long-term, sustained resource use practices and develop rational-policy (should address titling problems in Central Selva).

d. Take advantage of Descentralization Project's potential to be an integrating force if such issues as land titling and forest management can be tackled at the level of CORDEs.

e. Target future Sierra projects according to their probable effect on Selva Alta.

f. Develop a standard, integrated methodology for action research with indicators that are standardized for monitoring fragile lands across projects.

3. Short-term research on specific issues

a. Investigate potential for private and public interventions or improved fragile land management, initially oriented toward protecting the investment in the Carretera Marginal.

b. Quantify damage done to fragile lands:

1. Assess wind and water erosion based on existing soil surveys;

2. Inventory areas identified as fragile to assess degree of differents soils, etc.

c. Develop research (on-farm, action) to develop feasible, affordable cropping systems for increased productivity on fragile lands; and utilize existing, indigenous technologies and local expertise to improve land use.

4. Training and human resource development

a. Provide short-term training of agronomists and other field personnel in resource management issues.

Annex 3, continued

b. Organize seminars on natural resource management goals for mission and GOP personnel

c. Provide instruction in resource economics to show the value of natural ecosystems, nutrient cycling, and soils for long term, sustainable yields.

d. Create awareness of problems and constraints to production on fragile lands (query the "breadbasket" approach)

e. Conduct a regional workshop sharing resource management experience.

5. Possible free-standing fragile lands projects

a. Approach institutions at bottom level, municipalities or communities, with new project for grants in aid for a varity of small investments and activities in high priority watershed(s).

b. Reinforce grants with training and extension.

c. Address Sierra area (similar mode) for range pasture and forest manage

REFERENCES

APODESA

1984 Evaluacion del desarrollo forestal en el ambito de los proyectos especiales de selva: analisis comparativo. Documento de Trabajo No. 4. Lima: Apoyo a la Politica del Desarrollo de la Salva Alta.

Bremmer, J., T. Babb, J. Dickinson, E. Hyman, and M. Andre

1984 Fragile Lands: A Theme Paper on Problems, Issues, and Approaches for Development of Humid Tropical Lowlands and Steep Slopes in the Latin American Region. Washington, D.C.: Development Alternatives, Inc.

Clark, K.

1984 The Significance of Fishing Activities for Human Nutrition in San Carlos. Presented to and to be published in Symposium on the Structure and Function of Amazonian Forest Ecosystems in the Upper Rio Negro: A Synthesis of the San Carlos Project. Caracas: Instituto Venesolano de Investigaciones Cientificas.

Collins, J.

1981 Kinship and Seasonal Migration among the Aymara of Southern Peru: Human Adaptation to Energy Scarcity. Ph.D. dissertation. University of Florida. Gainesville.

1984 The Maintenance of Peasant Coffee Production in a Peruvian Valley. American Ethnologist 11(2).

DESFIL/PID

1985 Development Strategies for Fragile Lands. Project Identification Document. Washington, D.C.: U. S. Agency for International Development.

de Janvry, A.

1981 Reformism and the Agrarian Question in Latin America. Baltimore: Johns Hopkins University Press.

Dourojeanni, M.J.

1981 Estudio sobre el impacto ambiental de los proyectos de carreteras en la selva alta. Lima: Ministerio de Transportes y Comunicaciones.

Farnworth, E.G. and F.B. Golley, eds.

1974 Fragile Ecosystems: Evaluation of Research and Application in the Tropics. New York: Springer-Verlag.

Farnworth, E.G., T.H. Tidrick, W.M. Smathers, Jr., and C.F. Jordan

1981 The Value of Natural Ecosystems: An economic and ecological framework. Environment Conservation 8:275-282.

1983 A Synthesis of Ecological and Economic Theory toward More Complete Valuation of Tropical Moist Forests. International Journal of Environmental Studies 21:11-28.

References, continued

Gentry, A.H. and J. Lopez-Parodi
1980 Deforestation and Increased Flooding of the Upper Amazon. Science 210:1354-1356.

GCP/UNEP/INP
1984 An Environmental Management Plan for the Huallaga Central. Mexico, D.F.: United Nations Development Programme.

Grillo, F.
1980 Historia de la explotacion del campo peruano. In Realidad del campo peruano despues de la reforma agraria. Lima: Editoria Ital Peru.

Hecht, S.B., ed.
1982 Amazonia, Agriculture, and Land Use Research. Cali, Colombia: CIAT.

INIPA
1984 Programa Nacional de Investigación y promoción agraria en Selva. Documento Base. Instituto Nacional de Investigación y Promoción Agropecuaria.

Low, F.K.
1967 Estimating Potential Erosion in Developing Countries. Journal of Soil and Water Conservation 22:147-148.

Martinez, H.
1969 Las migraciones altiplánicas y la colonización del Tambopata. Lima: Centro de Estudios de Población y Desarrollo.

Nelson, M.
1973 The Development of Tropical Lands. Baltimore: Johns Hopkins University Press.

OAS/UNEP/ONERN
1984 Guidelines for Planning the Development of the Humid Tropics - Case Study of the Central Selva, Peru (manuscript).

Odum, E.P., J.T. Finn, and E.H. Franz
1979 Perturbation Theory and the Subsidy-Stress Gradient. Bio-Science 29:349-352.

Painter, M.D.
1983 La utilización de recursos en el valle de Tambopata, Perú: cooperativas estatales y liderazgo comunitario en la frontera cafetalera. Binghamton, New York: Cooperative Agreement for Settlement and Natural Resource Systems Analysis.

Pool, D.J.
1981a Environmental Perspective and Agricultural Development in the Upper Huallaga, Peru. Report prepared for USAID/Peru.

References, continued

Pool, D.
1981b Agricultural Potential and Natural Resource Management of the Palcazu Valley, Peru. Central Sevla Resource Management Project. JRB Report. Appendix K.

Scudder, L.
1981 The Development Potential of New Lands Settlement in the Tropics and Subtropics: A Global State-of-the-Art Evaluation with Specific Emphasis on Policy Implications. Binghamton, New York: Institute for Development Anthropology.

1984 The Development Potential of New Lands Settlement in the Tropics and Subtropics: A Global State-of-the-Art Evaluation with Specific Emphasis on Policy Implications. Executive Summary. A.I.D. Program Evaluation Discussion Paper No. 21. Washington, D.C.: U. S. Agency for International Development.

Smathers, W.M., Jr., C.F. Jordan, E.G. Farnworth, and T.H. Tidrick
1983 An Economic Production-Function Approach to Ecosystem Management. Bio-Science 33:642-646.

Stearman, A.M.
1973 Colonization in Eastern Bolivia: Problems and Prospects. Human Organization 32:285-293.

USAID/P
1981 Environmental Assessment of the Upper Huallaga Area Development Project in Project Paper, Annex II, Exhibit E, Project No. 527-0244.

Welcomme, R.L.
1979 Fisheries Ecology of Floodplain Rivers. London: Longman.