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Development of Fragile Lands: Theory and Practice

DESFIL

Development Strategies for Fragile Lands
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Development of Fragile Lands: Theory and Practice

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by

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DEVELOPMENT OF FRAGILE LANDS: THEORY AND PRACTICE

INTRODUCTION

In this paper I shall attempt to synthesize an integrated approach to the sustainable development of fragile lands. While fully realizing that such terms as **sustainable development** and **fragile lands** are often emotion-laden and value-ridden, I shall nevertheless try to clarify their definition and use. This chapter is divided into four sections. In the first I shall deal with the problem of terminology and suggest definitions that will capture the breadth and complexity of the issues under discussion. In the second section, the causal factors in the creation of fragile lands will be briefly described. In the third, I shall present the DESFIL approach -- in both theory and practice -- and in discussing it I shall draw on recent experience in Latin America and the Caribbean. In the final section, I shall attempt to synthesize these various strands of thought and provide a set of guidelines for an integrated approach to the resolution of fragile lands issues -- specifically, the sustainable development of such lands.

KEY TERMS

Sustainable Development

There is no general consensus regarding the meaning of "sustainable development." Indeed, the keynote speaker at a recent World Bank symposium sidestepped the issue (Hopper 1987, 5):

> The temptation is to begin with a definition of "sustainability." To ask: What is it? Frankly, I don't think I can define it without unduly constraining the free flow of my thought. In other words, I don't know what it is. As it is something that is "sustained," it obviously has a time dimension.

Nevertheless, there is a rich and stimulating literature on the topic. Douglass (1984) identifies three schools of thought. The first regards sustainability as food sufficiency: agriculture is primarily an instrument, guided by conventional cost-

benefit analysis, for feeding the world. Sustaining the natural resource base is secondary. If the introduction of new technology leads to greater erosion of the soil, the price in lost fertility and loss of soil can be compensated for by increased yields. This is strictly a short-term view, however.

A second school regards agricultural sustainability as primarily an ecological question. An agricultural system that depletes, pollutes, or disrupts the ecological balance of natural resource systems needlessly cannot be sustained and should be replaced by one that is adapted to long-term biophysical constraints. Hence, a crucial measure of agricultural sustainability is the capacity of renewable agricultural resources, such as croplands, pastures, and forests, for sustained yields. Instead of taking population as a given, this group tends to espouse policies that limit population to those levels that can be sustained by a finite physical environment.

Closely related to this stewardship school is agroecology, which, like sustainability itself, has come to mean many things. According to Hecht (1987), the word loosely incorporates ideas about an environmentally and socially sensitive approach to agriculture, one that is focused not only on production, but also on the ecological sustainability of the production system. It has roots in the agricultural sciences, in the environmental movement, in ecology, and in the ecological anaivsis of indigenous farming systems.

While agroecology has produced many detailed technical recommendations (Altieri 1987; Harrison 1987; Tull, Sands, and Altieri 1987), it has also elaborated three emerging principles of general interest to those concerned with sustainable development (Dover and Talbot 1987, 50-52). First, there is no substitute for detailed knowledge of the specific environment being developed or managed. One way of obtaining this knowledge is through agroecosystem analysis, which is focused on what Conway calls the four properties of ecosystems -- productivity, stability, sustainability, and equitability (1985, 35):

> Productivity is the yield or net income per unit of resource. Stability is the degree to which productivity is constant in the face of small disturbances caused by the normal fluctuations of climate and other environmental variables. . . . Sustainability is the ability of a system to maintain productivity in spite of a major disturbance, such as is caused by intensive stress or a large perturbation . . . for example the effect of soil

> salinity or indebtedness . . . a rare drought or flood or a new pest. . . . Lack of sustainability may be indicated by declining productivity but, equally, collapse may come suddenly and without warning. Finally, equitability expresses how evenly the products of an agroecosystem are distributed among its human beneficiaries.

Of equal importance may be an understanding of the dependence of one agroecosystem on other agroecosystems -- or of its autonomy. In many areas of the world, lowland agriculture often depends heavily for its fertility on the washing of nutrients from higher altitudes. Thus, one ecosystem may be able to maintain its productivity only as another degrades (Rambo 1985).

Other ecosystem properties that may be of considerable importance are energy efficiency and the ability to substitute structure for energy in the maintenance of the ecosystem. Multistoried plant canopies, for example, can capture greater amounts of sunlight than single-storied canopies, which in turn can produce larger amounts of biomass that might otherwise need fertilizer. The addition of animals to the farming system means that more plant material is turned into usable food. Finally, increased diversity in the ecosystem may serve ecological, economic, and nutritional ends by increasing the productivity of biomass and spreading the risk, by giving farmers more products to sell at different times of the year, and by providing a wider array of vitamins and minerals for human diets.

The final school, identified by Douglass as the "alternative agriculturalists," resemble the ecologists in their desire to husband the permanent carrying capacity of renewable agricultural resources, but they differ in their emphasis on sustainable human communities. Not only must human beings establish a stewardship of the earth, they must also establish this sense in their relations with one another, particularly as it affects justice and participation.

In its more extreme form, this has come to be known as deep ecology, which, according to its adherents, is metaphysical at base and represents a search for a sustaining metaphysics of the environment (Redclift 1987, 43). Deep ecology rejects the anthropocentric view that humankind lies at the center of all that is worth while and that other creatures are valuable only as long as they serve us (Nations 1988, 79):

> In a nutshell, its basic tenet is that all living things have a right to exist -- that human beings have no right to bring other creatures to extinction or to play God by deciding which species serve us and should therefore be allowed to live. . . . Deep ecology says . . . that all living things have an inherent value -- animals, plants, bacteria, viruses -- and that animals are no more important than plants and that mammals are no more valuable than insects.

From my point of view, development includes a long-term concern for the future, and the principal objective of development initiatives should be to generate self-sustaining improvements in human capability and well-being. But however sustainable development is defined, two interrelated issues -- energy and population -- must be examined (Redclift 1987, 22):

> First, we need to consider to what extent we use energy efficiently within agriculture at the present time, since the development of more sustainable options may depend critically upon making better use of the resources we already command. Second, we need to consider population, together with ecological sustainability and energy efficiency, since the prospect of a decline in fertility in most parts of the South provides an incentive for more sustainable agricultural practices.

Historically, economic development has been linked to a progressive increase in the consumption of energy, and this is nowhere more apparent than in the development and intensification of agriculture. Agricultural intensification refers to the use of new technologies of a biological, chemical, or mechanical nature, or some combination of these, that will increase yields of plant or animal production per unit (Wilcock and Ndoreyaho 1986, 39). The conversion of energy has been the principal means through which, first, food production has kept ahead of population growth and, second, the number of people working in agriculture has been reduced. Fossil fuels have been used to drive agricultural machinery, produce agrochemical inputs, and transform agricultural production through food processing and marketing. The uses to which energy is put in the process of agricultural development are only one of several aspects of sustainability (Redclift 1987, 22-29).

The second crucial issue that must be faced is population and the effect of its rapid growth on the natural resource base. World population approached 4 billion in 1975 and is expected to double by 2025. What matters most for sustainability of development is not so much the net increase in population at the global level, but

the rate of change in population in the most critical regions. Population growth rates tend to be highest, for example, where basic needs are not met, particularly in Africa, where food production per capita has declined 10 percent since 1970 (Redclift 1987, 30). Sustainability is not static. Neither is development. Both are dynamic. Whereas nouns suggest substance and continuity, verbs suggest action and process and more faithfully reflect the realities of the Third World (White 1987:95). Sustainability is no exception and should be considered within its changing context. The question that must always be borne in mind is the following (Redclift 1987, 33):

> Is it possible to undertake environmental planning and management in a way that does minimum damage to ecological processes without putting a brake on human aspirations for economic and social improvement?

Fragile Lands

Bremer et al. (1984, 3) define fragile lands as lands that are highly subject to deterioration under common agricultural, silvicultural and pastoral use systems and management practices, demonstrated by:

- Declining short-term production;
- Loss of the long-term potential productivity of the resource base;
- Serious off-site effects of environmental degradation; and
- Slow recovery of the soil, water, plant, and animal resources after human or natural disturbance.

All lands are fragile if mismanaged. Fragile lands do not pose a problem in and of themselves; it is only when destructive patterns of land use are combined with a delicate natural resource base, subject to deterioration, that the problem arises. In other words, fragile lands are vulnerable, they are lands at risk (Little, Horowitz, and Nyerges 1987).

Moran (1987) has argued for less vagueness and more precision in the discussion of fragile ecosystems. While some may use fragile lands and environmental degradation interchangeably, disciplinary specialists do not. Discussing a 1974 conference on fragile ecosystems, Moran (1987, 71) comments:

> Participants emphasized the importance of working toward a sustained yield of products useful to man without degradation of the productivity, richness, and viability of ecosystems. This is the ecologists' meaning of environmental degradation: a loss of natural habitat, whether to agriculture, pasture, mines or settlement. It is not the meaning I nor many others follow in talking about degradation. It is best always to clarify whether the subject is "environmental degradation," "fertility degradation" (the meaning used [here]), or "soil degradation" (referring to compaction, erosion, etc.).

For the purposes of this chapter, however, fragile lands are those lands that are prone to environmental degradation, leading to loss of both soil and fertility, and to concomitant decreases in productivity.

WHY FRAGILE LANDS ARE AT RISK

There is a growing consensus, at least among biological and social scientists, that the underlying factors responsible for the creation of lands at risk are complex and interrelated. According to Leonard (1984, 53), two broad assumptions have dominated the development community's thinking:

- Traditional systems of land-based production are inherently consumptive of soil fertility and other natural resource stocks and can only be perpetuated under low population densities.
- Rapid population growth in the second half of the twentieth century has fundamentally undermined the viability of pastoralism, shifting cultivation, and other traditional land-use systems heavily dependent on renewable resources; that is, population growth has inexorably pushed rural people to exceed the carrying capacity of the land under their traditional technologies.

But as these assumptions have been made, a growing body of historical evidence has often been ignored. This evidence shows that many societies, under a wide range of population densities, ecological conditions, and technical sophistication, prospered as a result of community-based management of crops, pasture, forestry, and water that permitted intensive exploitation without inducing degradation (Brokensha 1983).

Social scientists have demonstrated, however, that environmental degradation is often the result of much broader causal factors than a simplistic imbalance among the natural resource base, the level of technology, and the population density. Among the more important causal factors are the following:

- **Poverty:** Recent work on deforestation has indicated that the real cause is poverty, a consequence of skewed land distribution and low agricultural productivity (Caufield 1984: World Resources Institute 1985). Large farmers tend to own land in the valleys, which is less prone to erosion, they have ready access to government-supplied development resources, and they have alternative sources of employment and income. In contrast, small farmers on the hillsides usually have few such resources, and must continue to exploit marginal resource bases (Hansen and Erbaugh 1987, 84).

- **Policy:** There is growing evidence, particularly for Central America and Latin America, that government policies in such areas as credit, land titling, and marketing work against systems that will produce sustained yields and force farmers to orient production toward short-term gain. There are few incentives to encourage sustainable land use (Collins 1986; Collins and Painter 1986).

- **Technology:** Research and testing to improve agricultural technologies have been concentrated on flat areas that most closely resemble the temperate zones. The technologies developed for these areas are rarely applicable either on steep hillsides or in the humid tropical lowlands. Worse, their use may limit production and promote rapid deterioration of the productive resource base (Bremer et al. 1984; Hansen and Erbaugh 1987). But this situation is changing. In specific instances, suitable technologies are available as a basis for action (Hanrahan 1988). In addition, indigenous methods offer a wealth of technical approaches with potentially broader applicability.

- **Institutions:** The long history of neglect of fragile lands has not fostered strong institutions to manage them. Often many local, regional, and national institutions with conflicting or overlapping functions are active in a single location (Bremer et al. 1984). The problem is that national and local institutional capabilities to mobilize people and induce them to promote, implement, and maintain the sustainable use of their natural resource base are lacking. Some commentators believe that the technical ability to manage and improve renewable natural resource systems threatens to outstrip the ability of institutions to organize people so that they can apply improved techniques at the local level (Leonard 1984:49).

THE DEVELOPMENT STRATEGIES FOR FRAGILE LANDS PROJECT

DESFIL in Theory: The 1984 Concepts Paper

At present I am working on a project entitled **Development Strategies for Fragile Lands (DESFIL)**, funded by the United States Agency for International Development (AID). The principal objective of DESFIL is to improve ways of addressing fragile lands issues at the policy, strategy, planning, design, and implementation levels (Plunkett 1987). The ideas for this project evolved from needs identified by AID field missions. One of the important milestones was a review paper on the problems of and approaches to sustainable development of fragile lands (Bremer et al. 1984). The most interesting section deals with alternative approaches to the solution of fragile lands problems. The interventions proposed are divided into three broad categories (Bremer et al. 1984, 61-87):

- **Direct Interventions in Fragile Lands**
  - -- Investments in land maintenance
  - -- Investments in land productivity
- **Indirect Interventions in Fragile Lands**
  - -- Generation of technology
  - -- Measuring and monitoring of resource status
  - -- Planning and reform policy
  - -- Tenure reform
- **Interventions outside Fragile Lands**
  - -- Alternatives to use of fragile lands
  - -- Measures to reduce off-site effects

Direct Interventions

The classic approach to slowing degradation of the land is through investments in land maintenance, a term that covers all expenditures to preserve, protect, or

restore the productivity of the land, including, but by no means limited to, soil conservation. Many of these measures increase production, and some, such as reforestation, are themselves production methods. On-farm land-maintenance investments consist primarily of the construction of land- and water-control structures to limit erosion and maintain soil productivity, such as terracing, planting of vegetative barriers, repair of gullies, placement of water-control structures, and planting of grasses on fallow land or waterways.

Among off-farm investments, control of waterways is a necessity in any comprehensive watershed program, but it is extremely costly; land-conserving construction techniques, particularly for roads, often cost more, but they may reduce maintenance costs in the future and limit downstream effects; reforestation programs and the creation of reserves can also maintain the productivity of lands and other resources downstream.

A second category of investment comprises those intended to increase the productivity of land-use systems, including agricultural, silvicultural, and pastoral systems. Defined broadly, such interventions include all the technical approaches to increasing traditional agricultural production, such as the introduction of improved crop systems, improved agroforestry and livestock systems, and mixed systems. It is important to point out that many techniques for increasing short-term productivity also increase degradation of the environment. Without a parallel increase in land-maintenance efforts, measures to promote short-term gains in production may be at the cost of long-term production or stability. At the same time, many land-maintenance technologies cannot be implemented economically in the absence of other measures to increase production in the short term.

Indirect Interventions

The first approach recommended is the generation of technology for fragile lands. This approach is focused on four closely related but distinct technological questions:

- What is the state of the resource base and our knowledge of it?
- Do technologies exist for controlling erosion and loss of productivity that are profitable under prevailing economic conditions?
- Do technologies exist that will increase the sustainable productivity and sustainable net income that can be achieved from the land resource base?
- Do research systems exist that can continue to develop the necessary information and technologies in ways that will ensure their applicability by users of fragile lands?

The last question may be the most important. Without recognition of the reason research has failed to address the needs of fragile lands and of special requirements of this research, it is not possible to establish priorities for action. Strengthening or redirecting the research establishment may itself need to be given priority.

The second approach is through the measurement and monitoring of resource status. The need for better information on changes in the resource base, particularly in critical areas such as important watersheds, creates numerous openings for government or donor-supported programs, including the strengthening of organizations charged with the monitoring of natural resources and the introduction of cost-saving monitoring techniques.

The third approach is through discussion of the role of planning and policy reform -- particularly land-use planning, land-development policies, regional planning, agriculture sector policies, and macroeconomic policies. Emphasis is placed -- when it is necessary -- on strengthening the government capacity to formulate and analyze policy so as to permit full consideration of the economic and environmental implications of proposed policies. Since the institutional responsibilities for fragile lands programs are typically spread across numerous agencies, it is unlikely that funds allocated to fragile lands will be applied effectively. Concentration of efforts in high-priority areas will require coordination among national agencies and donors.

Finally, the specific ways in which land is owned and used can have a significant effect not only land use, but also investment behavior and land management in general. One approach to the encouragement of desired management behavior is to improve the tenure situation of users of fragile lands by making their

tenure more secure, regularizing it legally, making it easier to sell and buy land, or changing the structure of land rents, taxes, and other payments. This may involve actions such as titling and registration, improvement of land markets and related credit markets, and rearrangement of incentives created by existing tenure, legal, and tax systems.

Nevertheless, there is a growing body of knowledge that shows the causal assumptions of some of these actions to be questionable. The evidence for Central America, for example, indicates that land titling may be self-defeating, leading to an increase in the price of land, land speculation, and land concentration -- which combine to drive the small farmers off the land (Collins and Painter 1986).

Outside Interventions

Historically, only two situations have led to a reduction in the intensity of land use: destruction of the land and transfer of resources to more attractive uses. Land users cannot be persuaded to reduce the intensity of their use of the land without an alternative that will yield greater income, since reduced intensity nearly always means reduced income. Possible alternatives include:

- Resettlement and colonization -- activities with a checkered track record in Central and Latin America.
- Increased transformation of local products, which can provide an alternative to agricultural work and encourage the use of less intensive farming systems, with fruit trees and cattle, instead of potentially more damaging systems based on annual crops.
- Off-farm employment, which may call for seasonal migration.
- Land reform in other areas in which lands are not fragile.

The second intervention outside fragile lands is action taken to reduce off-site effects. In some instances, it may be more practical to limit the downstream effect of the misuse of fragile lands than to try to stop the destructive practices at their source. These measures, however, do not help users of fragile lands. They encourage further delay in addressing the problems of fragile lands and tend to provide only temporary solutions, possibly at considerable cost.

DESFIL IN PRACTICE

The Technical Secretariat for Watershed Development in Haiti

During the 15 months that DESFIL has been in operation, several activities have been undertaken, all of which shed light on the problems of the development of fragile lands, specifically in Haiti and Peru. The most ambitious -- and unfortunately the most abortive -- was support to the Technical Secretariat for Watershed Management (STAB), a small division within the Haitian Ministry of Agriculture, Natural Resources, and Rural Development. STAB was established to develop a concerted, effective approach -- both technically and institutionally -- to reverse the degradation of Haiti's upper watersheds.

Although a Division of Natural Resources already existed within the ministry, its principal preoccupation was the daily management of natural resource projects. Little time and few resources were available to address the larger policy issues, and there was no time to develop a national strategy for addressing the problem or to establish a comprehensive data base for sound management decisions. Hence, STAB was created to improve:

- The effectiveness of watershed management projects through technical inputs and evaluations; and
- The institutional capacity within the government to address these problems through coordination and resolution of conflicting policies and development of both a strategy and a data base (Pierce and Tremblay 1988).

In essence, STAB was designed to meet the need for exchange of information, resolution of conflicts, evaluation, and strategy. It pursued a coordinated approach and included activities undertaken by nongovernmental organizations and the private sector.

In February 1987 DESFIL placed two long-term personnel with STAB, a natural resources adviser and an agricultural economist. One of STAB's first tasks was to find out what was already known about hillside agriculture and watershed management. Given that development assistance from the government was virtually

nonexistent in the rural areas, nongovernmental organizations of various hues and stripes stepped in to fill the gap. As a result, there was -- and still is -- a multitude of development projects, large and small, often pursuing their own strategies and objectives independently.

STAB created an inventory of 116 watershed-management projects, developed a project-tracking system, and established tangible measures for project evaluation. Other activities included evaluation of ongoing projects, identification of their effects and the reasons for their success or failure, and development of new ideas and designs for fragile lands and watershed management projects.

Equally important, however, was the creation of a workable network for the dissemination of sound technical approaches and innovations. This required that the information developed by STAB be packaged effectively and distributed, so the following actions were undertaken:

- Production of maps indicating the location of watershed management and hillside agriculture projects;
- Preparation of technical bulletins for fragile lands and watershed management; and
- Creation of a documentation center to collect and disseminate relevant information, reports, bulletins, and audiovisual materials.

The development of a strategy had to include participation and acceptance by representatives of all the principal organizations involved in watershed management in Haiti. This was done by establishing the Committee of Reflection, which served as the institutional forum for discussion and resolution of watershed issues within the public and private sectors, and also for the sharing of technical approaches and information. Development of a strategy was part of its mandate. The project inventory represented the first step in establishing priorities on the basis of geographic, technical, and socioeconomic considerations. For the first time, the ministry knew what work was being done and where. Maps were developed to identify areas where watershed activities were under way as well as areas without projects. On the basis of these maps, STAB was able to advise on the location of new projects.

The success of STAB, short-lived as it was, owed much to the simplicity and directness of its pragmatic approach. The secretariat wanted to become the institutional memory for watershed management in Haiti by investigating what was actually happening on the hillsides, what had worked and where, and what had been learned from these experiences and by making this information available in a simple, straightforward format to all interested parties. In this initial phase of consolidation and dissemination of information that was already available, STAB was not seen as a threat. It had not reached the stage at which it would be determining policy and strategy, deciding which projects should be approved, and allocating resources accordingly.

Biological Diversity in Peru

The 1986 Amendments to the Foreign Assistance Act, Sections 118 and 119, dealing with tropical deforestation and biological diversity, require that each AID mission provide information in the country development strategy statement, its principal planning document, on the following:

- The status of host country efforts to maintain biological diversity and conserve tropical forests; and
- Actions that the AID mission could take to maintain biological diversity and conserve tropical forests.

Maintenance of biological diversity and conservation of tropical forests is important to the world scientific community, to growing numbers of the public in both developing and developed countries, and to local populations. In addition, it is a basic assumption that such efforts will improve the possibility of economic development in the long run.

Although there is some debate about which neotropical country is biologically the richest in Latin America, there is little doubt that Peru is among the top three, along with Colombia and Brazil. In Peru, the threat to individual rare or endangered species -- and to a certain extent to natural and agronomic ecosystems -- originates from a complex mixture of social, economic, demographic, political, and ethical

factors. Although not all commentators are in agreement, the principal causes are poverty, inadequate policies, inappropriate development strategies, and lack of resources (Gow et al. 1988).

In the development of the high selva and the resulting deforestation, structural factors have been crucial. In the specific instance of southern Peru, the Tambopata Valley has been the site of coffee cultivation by seasonal migrants from the sierra since the 1940s. Extremely steep slopes -- rarely less than 40 percent -- make the region highly susceptible to erosion. Farmers producing coffee in the valley face a variety of production and marketing constraints, including a lack of access to credit and to inputs such as fertilizers and pesticides, poor transport, insecure titles, and a government-backed monopsony on the purchase of coffee. These constraints mean that farmers have neither the time nor the resources to invest in land-maintenance technologic ollins 1986).

Another factor that has aggravated the problem of deforestation is the changing political commitments of the government. Under the previous administration, development of the high selva given a top priority. President Belaunde subscribed to the last-frontier perception of the Amazon -- as a vast, underexploited region that could help solve Peru's development problems (Smith 1982). From this belief followed the development paradigm pursued in most government-sponsored development efforts in the high selva: high-input agriculture with an emphasis on short-term gains. Such an approach is difficult to maintain through the long run because of the high costs -- both financial and environmental -- that are involved.

In making recommendations to AID, attention was paid to the comparative advantage that Peru enjoys in biological diversity and environmental awareness, as demonstrated by the following:

- Peru's rich ecological diversity, ranking first in the world in life zones;
- Peru's young but active and growing environmental conservation movement among nongovernmental organizations (NGOs);
- Peru's position as a major stakeholder in the selva of western Amazonia, a region commanding world attention because of the critical social and ecological issues that converge there; and

- Peru's historical position as one of the world's outstanding sources of wild plants and animals for domestication and commercialization.

The recommendations made to AID/Peru all involve information and the uses to which that information could be put. Briefly, the four proposed program areas encompass the following (Gow et al. 1988):

- **Conservation Policy and Education:** To enhance conservation policy-making capabilities and increase efforts to promote public awareness of environmental issues in Peru, especially those most closely related to biological diversity.

- **Conservation and Development:** To establish and enhance activities will show that economic enterprise is consistent with economic diversity.

- **Research:** To expand current taxonomic, ecological, and economic knowledge of Peru's wildlands, especially as they are related to the status of threatened and endangered species.

- **Training and Institution Building:** To assist with the strengthening of Peru's data centers and conservation units within the national park system and to improve the research and managerial capacities of wildlands conservation and protection of biological diversity.

AN INTEGRATED APPROACH: WISHFUL THINKING OR PRACTICAL REALITY?

The DESFIL experience so far, together with a review of the relevant recent literature, indicates that enough is known to sketch the broad outlines of an integrated approach to the sustainable development of fragile lands. Such an approach would include the following:

- **Political Commitment, Policy, and Planning:** If such an approach is to have any chance of success, there must be a commitment on the part of national governments (Heaver and Israel 1986). Such a commitment must be demonstrated through the enactment of appropriate policies and development strategies and provision of the necessary resources to implement them (Gow 1987). Without these, plans for sustainable development will never move beyond the drawing board. This was possible for STAB in Haiti until the political climate changed. The work in Peru has not yet moved beyond the planning phase and will not until this political commitment has been made, not only by the national government, but also by the respective donor agencies.

- **Technological Interventions, Adaptive Research, and Monitoring:** Enough is known about technological interventions, using both Western and indigenous models, to improve the sustainability of present land-use systems greatly. Many of the possible technical interventions are site-specific and must be adapted to the prevailing environmental conditions. There is no standard technical package that can be extended willy-nilly -- just as there is no standard way of disseminating these interventions, since they must be adapted to prevailing social and political conditions. The interest in Haiti is therefore in finding out more about what has actually worked and why, then disseminating the results to those who are interested. Of equal importance, however, is the need to monitor the effectiveness of these technological interventions and, whenever it is necessary, to modify them.

- **Institutional Strengthening and Coordination:** Public sector institutions dealing with fragile lands issues are often weak and fragmented -- whether they are in the Ministry of Planning, the Ministry of Agriculture, or the Ministry of Natural Resources. The necessary conditions for their strengthening include political commitment, the availability of resources, and well as the required technical competence. In Haiti, STAB met all three conditions.

- **Enhancing Local Organizational Capacity:** Local organizations of farmers and their families fulfill important functions in the sustainable development of fragile lands by acting as vehicles for (Honadle and VanSant 1985, 53):

  -- Adapting project activities to local conditions, particularly proposed technical interventions;

  -- Marshaling local resources;

  -- Sustaining project benefits;

  -- Achieving greater political and economic leverage for local people by exercising influence over local administrators and asserting claims on government; and

  -- Managing the natural resource base rationally through education and training and by enforcing rules, incentives, and penalties.

  Equally important in this connection are the NGOs working in natural resource management, which often serve an intermediary function as indigenous grassroots support organizations (Carroll and Baitenmann 1987). In Haiti, STAB worked closely with the NGOs, which have fueled much of the interest and initiative in biological diversity and conservation in Peru.

- **Environmental Education and Extension:** This is the most realistic and practical way of disseminating what is known about fragile lands issues to those most affected by them. It is also the first step in translating this knowledge into action -- an important component of DESFIL's planning activities in Peru. In addition, it reinforces the admonition to planners (Friedmann 1987, 306) that they resist the tendency to concentrate

information, knowledge, and decision making in a small leadership elite and that they share their expertise with those most likely to be affected.

- **Conservation and Development:** There is no essential contradiction between sustainable economic development and conservation of the natural resource base. There is a growing realization on the part of the environmental community that conservation and economic development are complementary concerns, particularly of those people -- often already marginal -- who are trying to live off fragile lands. The development community does not yet fully accept this necessary complementarity. In Peru and elsewhere, local expectations were built up when national parks and reserves were declared, but these quickly turned into frustrations when it was perceived that few or no economic benefits were forthcoming. A whole set of issues depends on rectification of this problem and assistance to local enterprises that derive their income from the existence of protected lands. Potential activities include nature tourism, natural-forest management, game cropping, and sustainable extraction of minor forest products (Gow et al. 1988).

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