PD-ABE-190

PROJE SOVE TE
FINAL REPORT OF PROJECT ACTIVITIES

Prepared for:

U.S. Agency for International Development
Port-au-Prince, Haiti

Prepared by:

Associates in Rural Development, Inc.
110 Main Street, Fourth Floor
P.O. Box 1397
Burlington, VT 05402 U.S.A.
Under USAID contract number 521-0191-C-00-7091-00

Date: September 3, 1992

Table of Contents

Acronyms and Abbreviations

ARD	Associates in Rural Development
DCCH	Developpement Communautaire Chretien d'Haiti
DVM	Doctor of Veterinary Medicine
FAO	Food and Agriculture Organization of the United Nations
FME	Farmer-managed experimentation
GOH	Government of Haiti
IICA	Instituto Interamerican para la Cooperacion Agricola (agricultural development arm of the Organization of American States)
ILCA	International Livestock Center for Africa
IRD	Integrated Rural Development
MARNDR	Ministere de l'Agriculture, des Ressources Naturelles et du Developpement Rural
MCC	Mennonite Central Committee
NGO	Non-governmental organization
OFT	On-farm test
ORE	Organization for the Rehabilitation of the Environment
PADF	Pan American Development Foundation
PHL	perennial herbaceous leguminous
PID	Project identification document
PME	Project-managed experimentation
PMR	Project-managed research
PP	Project paper
PST	Proje Sove Te
SECID	Southeast Consortium for International Development
STAB	Secretariat Technique a l'Amenagement des Bassins Versants
TWM	Targeted Watersheds Management Project
UNICORS	Union des Cooperatives de la Region Sud d'Haiti
USAID	U.S. Agency for International Development

Executive Summary

The Proje Sove Te (PST) was the main component of the Targeted Watershed Management Project (TWMP), a major USAID-funded effort to decrease environmental degradation and improve agricultural productivity in the watersheds north of Les Cayes, southwest Haiti. PST was implemented from September 1987 to September 1991 by Associates in Rural Development (ARD), Inc. under USAID Contract No. 521-0191-C-00-7091-00.

The ARD team was forced to delay beginning project implementation until January 1988 due to political unrest. The original long-term Technical Assistance (T.A.) team was composed of six specialists; this number was gradually reduced to a total of three in 1991. The project office was located approximately 50 km north of Les Cayes in the town of Camp Perrin; a major effort was expended by project staff over the first year of the project to secure and renovate a project office and staff housing, and to establish communications and logistical links with Port-au-Prince and the ARD home-office in Vermont, USA.

ARD/PST worked closely with four local NGOs to assist them both technically and administratively. The NGOs received USAID grants outside of the PST contract, but ARD/PST was charged with assisting them to: account for the use of USAID funds; develop planning and budgeting systems; develop their own procurement and inventory systems; and work with local farmers and farmer groups to implement improved technologies for soil conservation and agricultural development.

The major focus of the T.A. team's work was assisting the NGO's, but the project also carried out its own research and extension activities. Several plots of land were secured for experimentation with various improved crops and combinations of soil and water conservation techniques, and a number of training activities for NGO staff were carried out.

Given the short effective lifespan of the project and the limited resources available due to the political problems of the period, PST managed to develop and implement a number of promising technical interventions, and to substantially raise the level of NGO activity and knowledge of effective technical and management strategies. Of particular importance were developments in the following areas:

- The four participating NGOs are now employing generally accepted accounting practices and are auditable. They are eligible to receive funds from USAID without the assistance of an outside contractor such as ARD, and can apply to USAID for funding after the official PACD of the PST.

- The NGOs have developed their own planning, monitoring, and evaluation systems which enable them to measure the impact of interventions and monitor progress;

- The NGOs are fully conversant with a wide range of technical interventions in soil conservation and agricultural production, and have carried out extensive work with their members to extend these interventions;

- Programs in improved seed collection, storage, and distribution have been started by the participating NGOs;

- Animal health and forage issues have received a good deal of attention, and a major program begun to train veterinary paraprofessionals in rural areas;

- The advantages and disadvantages of various soil conservation strategies have been thoroughly studied in the field, and the NGOs are in a position to make sound judgements on the most suitable interventions for a given site or area; and

- Several thousand hectares of agricultural land in the watersheds of southwest Haiti now feature improved agricultural and soil and water conservation strategies such as hedgerows planted on the contour, the use of herbaceous legumes for improved fallow and as intercrops, and the construction of furrows and berms along the contour. Through the work of the T.A. team and NGO staff these interventions are now a common sight in the project areas and farmers are generally well-aware of the benefits that such measures bring.

The PST ended in late September 1991 due to a lack of funding available to USAID/Haiti and due to the once again deteriorating political situation. With the coup against President Aristide on 30 September 1991 all U.S. development aid to the country ceased, and the remaining members of the T.A. team were evacuated in early October. Project records and team members personal effects were later shipped to the U.S. by USAID staff.

Although the PST was an extremely difficult project to implement due to a variety of social, economic, technical, and political problems, ARD feels that the project concept was and remains valid, and that many of the lessons learned and interventions developed and extended are worthy of continued support by international donor organizations.

I. INTRODUCTION TO THE PROJECT

A. General Background

The "Proje Sove Te" (or Project Save the Soil) was the major field component of the USAID/Haiti-funded Targeted Watersheds Management Project (521-0191). The TWM Project (see Figure 1 - Organigram of the Targeted Watersheds Management Project), also included efforts to establish the basis for a biosphere reserve in the areas surrounding the Pic Macaya National Park, which was implemented by the University of Florida. Additional resources under the TWM Project were set aside for companion studies and staffing, such as that set aside for the study of land tenure issues in the watershed areas and the funds used to hire and operate the office of the Project Coordinator based in Les Cayes. Assistance was also planned for the Government of Haiti (GOH) institutions concerned with watershed management. This component was shelved in late 1987 because of political upheaval in the country which prompted the suspension of all direct U.S. assistance to the Government. This report will deal exclusively with the activities carried out under the Proje Sove Te (or PST) component of the TWM Project by Associates in Rural Development, Inc. (ARD), the principal technical assistance contractor and designated grants manager; the other components are being reported on by the respective implementing organizations.

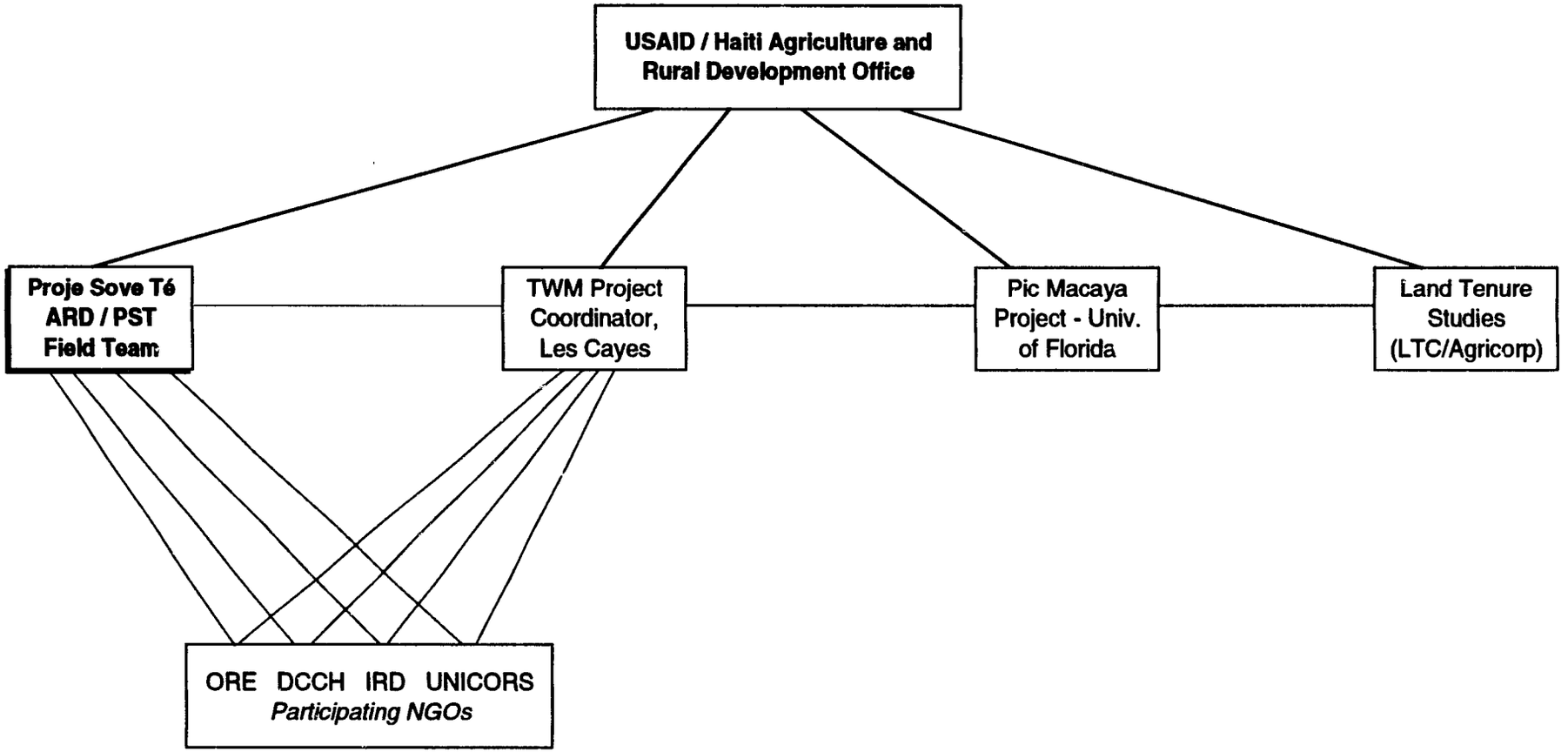
The Targeted Watersheds Management Project was designed over a three year period beginning in 1985. It was a period of great introspection[1] by USAID in conjunction with GOH authorities and professionals concerned with meeting the challenges of fostering sustainable development strategies in this country of high population density and rugged topography. During this same period, USAID assisted the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR) in establishing the Secretariat Technique a l'Amenagement des Bassins Versants (STAB) and undertaking a wide variety of soil erosion and conservation activities with PL 480--Title III funding. The USAID-funded Agroforestry Outreach Project had been underway for some years, and, although it was judged to be very successful in achieving its objectives, there was some concern that its narrow focus on planting trees was not enough to resolve the erosion and land-use problems.

In 1985, there was much accrued project experience related to soil erosion control, soil conservation, reforestation, and watershed management in Haiti and, as such, a wealth of experience on which to reevaluate the strategy and action options for the future. Some of the projects, of course, had been devoted to addressing the basic institutional strengthening and human resources development needs inherent to the sector in Haiti. Many of the others had had a predominantly technological if not technocratic approach to the problems, seeking to find new ways to control erosion or rehabilitate degraded areas. At the same time, there were a series of more traditional agricultural development projects aimed at commodity and productivity increases.

---

[1] See for example: Ehrlich, M. (et al.) Haiti Country Environmental Profile- A Field Study or Pierce, T.H. Watershed Management in Haiti: the STAB Experience, both of which were funded by USAID and appeared around this time.

Figure 1: Organigram of the Targeted Watershed Management Project - USAID / Haiti



Several of the latter agricultural development projects were modestly successful but few, it was felt at the time, had had any real impact on the rural poor who were farming the slopes and hillsides of the country. The result was a continuing and pervasive destruction of the ecological baseline, with attendant environmental and socioeconomic ills.

Irrigation in the relatively small percentage of suitable land in Haiti (approximately 11 percent) was a prime agricultural sector strategy. Then too, hydroelectrical generation capability was considered an important opportunity to meet the country's energy needs. Members of the development community were concerned that without stable watersheds, the downstream impacts which were becoming manifest (floods, uneven water regimes in major rivers, impeded hydroelectric generating capacity) would undermine the fabric of the overall socioeconomic development strategies in the country. In addition, the impact of continuing social unrest among a large majority of the disenfranchised rural population troubled Government and donor partners for both humanitarian and political reasons.

B. Development Needs and Opportunities in the Project Area

PST was originally called the Proje Sove Te O'Kay (Project Save the Soil at Les Cayes), but the Les Cayes denomination was later de-emphasized with the decision to concentrate project activities in the higher areas of the watersheds above the Plain de Cayes. Accordingly, PST was targeted at a series of watersheds that flow essentially south from the Massif de la Hotte and Monts du Plymouth in the southwest of Haiti (See Figure 2- The PST Project Area). These watersheds include those of the Cavaillon, Les Anglais, Grande Ravine du Sud, Acul, Port-a-Piment, and Torbeck Rivers, as well as several other minor drainages that flow directly into the Caribbean Sea. The project area covers a total of approximately 80,000 hectares.

1. Biophysical Setting

The topography in the area is characterized by highly irregular and steeply sloping terrain. For the majority of the project area, soils are of calcareous origin, weathering from karstic and crystalline limestones -- the karst also contributes to the irregular topography and drainage. There is also a smaller area of soils derived from basaltic parent materials at higher elevations just south of the crest of the Massif de la Hotte. Generally, soils in the project area are relatively young (Entisols and Inceptisols) owing to recent uplifts and the steep topography. There is also a broad occurrence of Mollisols which vary in color but are always characterized by clays throughout the profile. Of more importance than origin or taxonomy is soil condition. After years of abuse (and given the steep topography and local climate), the soils have been rendered thin and unproductive due to erosion and nutrient leaching. Organic matter has been seriously depleted and with it, the moisture- and nutrient-holding capacity. Parent material is appearing on the surface throughout the project area, with both large and small stones impeding cultivation.

The area's climate is tropical to sub-tropical and highly influenced by elevation. The mean annual daytime temperature varies from around 27 degrees C at Dubreuil and Camp Perrin (at 200 meters above mean sea level) and falls as low as 15 degrees C at Pic Formond (2,219 meters). Precipitation also varies with elevation and topography. The annual average is lowest around the coastal area from Les Anglais to Coteaux at approximately 1,200

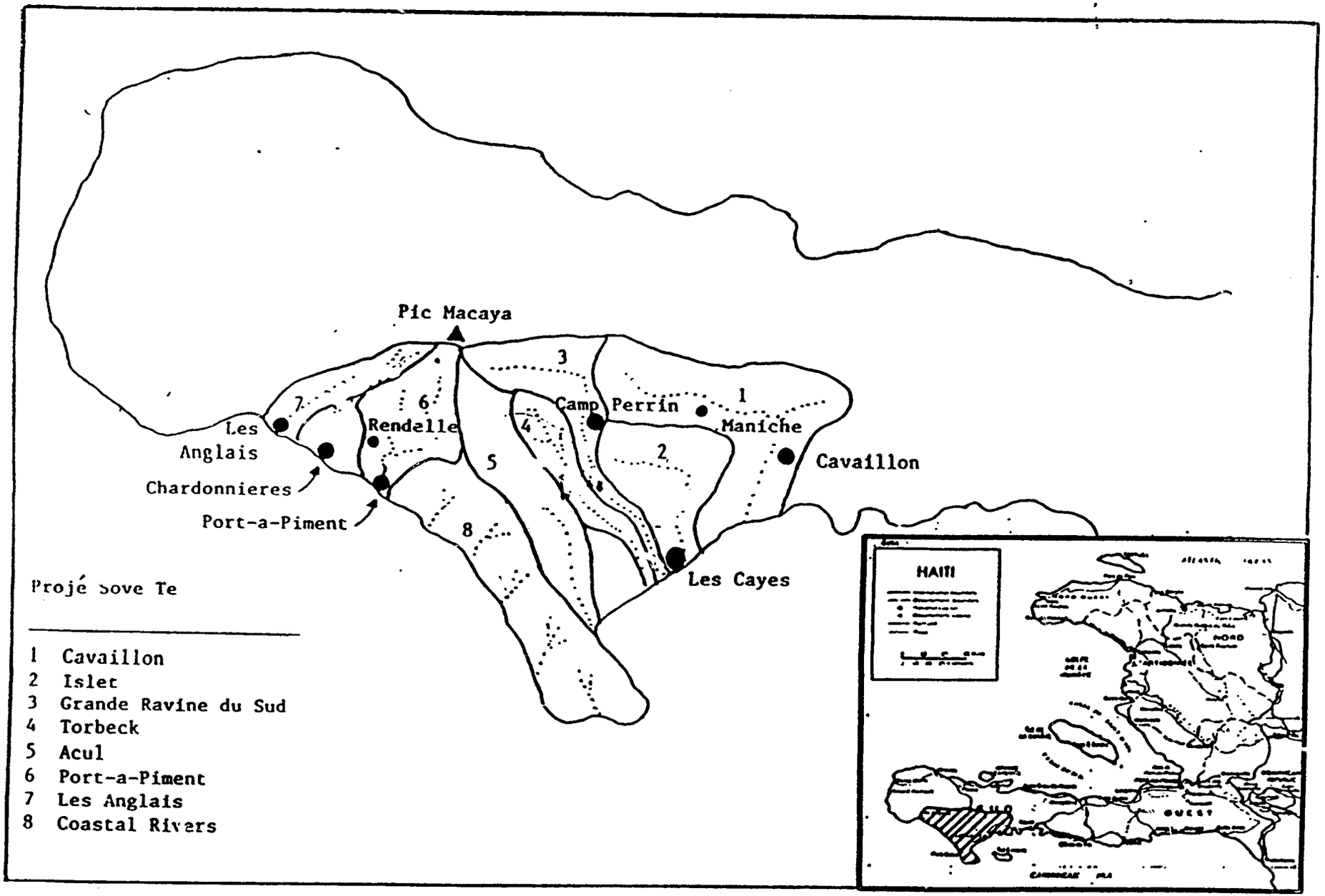


Figure 2: PST Area

millimeters and increases with elevation to an estimated 4,000 to 6,000 millimeters annually at Pic Macaya. Rains are bimodal, with a primary peak in October and a secondary peak in May. The driest months are December through February. Tropical storms bring the heaviest rains from late August through October and periodically devastate the project area, causing massive wasting on hillsides and damaging floods on the lower lying areas and plains. Cloud cover is common at higher elevations (over 800 meters) and tends to accentuate the moist, cool conditions that restrict the growth of certain crops.

According to the Holdridge system of ecological associations, vegetative classes vary with elevation and precipitation:

- up to about 400 meters--the "humid subtropical forest" association predominates;
- 400 to 900--"very humid subtropical forest";
- 900 to around 1,700--"very humid lower montane forest"; and
- rising from this elevation to Pic Macaya and Pic Formond--"very humid montane forest."

These associations indicate a rather favorable moisture/temperature regime, capable of supporting lush natural vegetation and a wide variety of crops. The original natural vegetation, however, has been removed or otherwise severely affected by expanding agriculture and fuelwood cutting. In addition, these ecological associations appear to be changing to more ustic (drier) descriptions as a result of recent man-induced and apparently natural climatic and soil changes. The conditions brought on by historical land abuse in the project areas and inherent agroforestry and ecological limitations seem to be inducing increasing restrictions to local land use.

The loss of natural vegetation through agricultural conversion has been astonishingly rapid in the area's upper watersheds. Reportedly totally forested in 1956, the area around Pic Macaya is now estimated to have only 3.6 percent of the original vegetation remaining, or roughly 72 hectares of virgin forests in what has been designated as the National Park. In the project area, varying soils and slopes bring about different levels of erodability. In 1983, the U.S. Department of Agriculture estimated soil loss in the Acul watershed at 750 tons per hectare per year on slopes of 40 percent. Considering that continuous cropping is practiced on such slopes and those of even steeper incline, this figure may be considered conservative. Nutrient loss through erosion and leaching, as well as a relatively low fertility of the underlying subsoil, is having an immediate impact on crop productivity. In many areas, the extremely high pH of the soil (above 8.2) is also a limiting factor for the productivity of certain crops.

The uplands and the park area of the Massif de la Hotte are the source of three major rivers in the region. Although the park was created to protect and restore biological diversity, the watershed function which encompasses the surrounding hills is perhaps even more important. As a source for the rivers, local springs, and groundwater recharge, the area plays a vital role in the long-term development prospects for the Southwest of Haiti. These waters are used for irrigation purposes in the Cayes, Acul, Torbeck, and Les Anglais plains. The

infrastructure used to transport this water from upriver represents a major multimillion dollar investment. Maintenance and protection of the intakes, canals, and other civil works as a result of high silt and gravel loads, as well as occasional destructive flooding, have become major infrastructure problems.

2. *Socioeconomic Setting*

It is estimated that 60,000 families live in the PST targeted watersheds area, at a population density of 568 inhabitants per square kilometer of arable land, or .23 hectares per capita. These farm families are concentrated in the lower portion of the project area, living primarily along roads and paths. To a great extent in the lower watershed, they are gathered in concentrations that cannot rightly be called villages as they serve no real political, administrative, or economic function. Generally, the population becomes more dispersed higher in the watershed, up to the highest areas where intermittent squatter settlements occupying areas of so-called state forest land may be found.

The net rate of population increase for the PST area since 1971 is estimated at zero, since rates of out-migration and death are estimated to equal the birthrate (Locher 1985). According to studies carried out in the Acul watershed, approximately 39 percent of the population is under 15 years old and 9 percent is over 59. Rural life expectancy is estimated at 47 years. There are three primary forms of migration in the area. Some rural inhabitants migrate out of the area to Port-au-Prince or abroad. Others migrate permanently down to the Les Cayes Plain to work in the rice fields. Some farmers migrate seasonally high into the watershed to state land to plant short-season crops, then down to the Plains to work the rice harvest, back into the lower mountains for land preparation and planting, and finally back to state land to harvest the crops they planted there. These seasonal, vertical migrants probably own little or no land. The amount they plant depends on the amount of money available for seed and/or labor. These migration patterns have been extremely important for project-related development programs, as they underlie the localized labor instability of the area which must be taken into account in proposing farming system improvement approaches.

Differences among people in the project area are not great in terms of ethnicity, language, culture, or race. Schools and NGOs (nongovernmental organizations) sponsored by particular religious organizations are an important component of the rural scene in the area and traditionally work with people of all faiths. However, there are important differences that can be attributed to inequalities in wealth which, in spite of widespread landownership, are important in terms of access to resources and the distribution of society's benefits. Another difference that has important implications for development approaches is the division of labor between men and women. The rural population is primarily agriculturally oriented, although many people have secondary occupations that are often intermittent but still contribute to the household economy.

Cropping patterns vary according to the distance of the field (usually referred to as a "jaden" or garden) from the house, the tenure relationship, and the degree of environmental degradation, as well as the site's ecological characteristics (rainfall and soil type). Research in the Acul Watershed has shown a positive relationship between distance of a plot from the house and its degree of environmental degradation. This relationship is particularly strong on plots where the cultivator has little security of tenure. Uncertain tenure arrangements

involving renting, sharecropping and family land sharing are common in the area and constitute an important disincentive for longer-term investments such as that required for soil conservation or the establishment of perennial crops.

In these watersheds, gardens that are far away from homes are likely to contain less complex intercrops, fewer animals, and fewer trees than those nearer the residence. If a garden is sharecropped, it will probably be planted in corn, beans, and possibly sweet potatoes, rotated with sorghum. It will have few trees, might receive a short fallow, and is very likely to be eroded. Rented gardens typically include the above crops as well as such root crops as yam, manioc, and malanga. Above 1,200 meters, the most common intercrop is two to three rotations of beans interplanted with tubers such as malanga or yams. In the higher reaches of the watersheds, many farmers have coffee trees, albeit poorly cultivated and maintained in their gardens.

Studies in the Vallee de Jacmel found that as sites become more degraded in terms of soil erosion and nutrient loss, the mix of crops becomes less complex. The most fertile hillside plots are interplanted with as many as eight crops, whereas the most degraded can support only one. Concurrently, the type of agriculture changes as well. Peasants farming hillsides on the best lands plant a mix of staples that are largely consumed by household members, and crops such as beans and corn of which a larger percentage is sold. As the soil becomes poorer and more eroded, the mix of crops changes. Plots of medium fertility contain corn, beans and sweet potatoes; poorer ones include sorghum and pigeon peas; and the poorest sites are planted in peanuts or left to Vetiver grass (oil grass) production. Fallow periods throughout the project area have been declining to the extent that if a plot is fallowed at all, it is likely to be only for a few months when animals are brought in to browse on harvest refuse. The PST area exhibits these same characteristics, with land degradation reducing the number and diversity of crops on any given piece of land as well as yields, with concomitant reductions in income, nutrition, and access to education and social services--in essence, the poverty spiral.

Gardens in the "lakou" (land around the house) are most often planted in complex intercropping systems of pigeon peas, plaintains, malanga, manioc, corn, fruit trees, coffee, castor bean, and medicinal plants. This is also where farmers raise vegetables such as tomatoes, chayote, pumpkin, and eggplant. At higher elevations, lakou gardens may also be planted in such crops as mint, thyme, chives, carrots, and leeks. While the garden is rarely fallowed, its fertility is maintained by deposits of organic wastes such as kitchen refuse or animal manure. Animals such as pigs and chickens are raised in the lakou, and goats, sheep, cattle, and horses are most often tied close to the house for the night. Fields close to the house ("jaden pre kay") are also often planted in complex intercrops, although peasants plant vegetables in these locations less frequently.

Animals play an important role in peasant farming systems in the PST project area, far beyond what their absolute numbers would imply. They minimize risk and provide protection against losing everything. By owning animals, particularly larger species, a household will only rarely have to sell land when there are cash needs it cannot otherwise meet. The value of livestock also appears to appreciate quite rapidly, while requiring little intensive labor or costly inputs. Peasants thus aspire to be livestock owners. Animals are tended individually rather than in herds. At any given time, the average household owns one to two head of stock and perhaps two to three poultry. However, the inequality is greater in animal

ownership than landownership, in that larger landowners tend to have the greatest number of animals.

In general, livestock management practices are relatively unsophisticated, and animals are tended using low levels of management. They are most commonly tethered and moved by hand. Animals are often left to forage with little effort directed at feed or pasture management. They are also tied in fields to clean up harvest refuse and stubble. Peasants infrequently practice cut-and-carry feeding. Some animals, such as goats and sheep, are not watered. Little attention is given to deliberate, improved, breeding practices. Female animals are characterized by low milk production and there is little use of cow's milk and none of sheep or goat. There is also little deliberate use of manure although it does inadvertently fertilize fields where animals are tied. Protection for animals against illness is negligible.

The greatest agricultural activity in this region occurs in February, April, and July. Corn and beans are planted in February, although many farmers plant their high slope sites in January. Manioc, pigeon peas, and upland rice are planted in April while sorghum, yams and sweet potatoes are planted during July. The variety of beans that are planted in the watershed area are ready for harvest in 65 days and, under good conditions, can be planted up to three times a year.

Land preparation, the most labor-intensive activity, is done by hand using a pick and/or hoe. There is little use of the plow in the hillside agriculture areas, even in the high, relatively flat, Platon-Formond area. Chemical fertilizers and pesticides are infrequently used in the project area. Both availability and cost are the principal constraints to their use. Farmers do not plant most crops in rows. They plant in hills or mounds to provide drainage and sufficient growing medium for the crop. They may also cultivate in the form of irregular mounds situated roughly along the contour ("bit patat"), which are usually associated with sweet potatoes and yams. In some cases, it is done to take advantage of soil in and around rock outcrops, save labor during the most labor-intensive period of the season, and/or create small canals that slow the passage of water, thus conserving it.

Haitian peasant agriculture is characterized by seasonal labor bottlenecks which result in periodic labor shortages, particularly during the times for land preparation and planting. As peasants have become poorer, they have become more dependent on producing short-season market crops at the expense of longer-maturing subsistence crops. This is particularly true of the poorest peasants. The most important market crops in this area--corn and beans--have the same dates for land preparation and planting. They give increased and more frequent access to money and require less labor per planting than such crops as manioc, malanga, yams, cocoyams, and plantains. However, unlike these subsistence crops, timely labor inputs are crucial for market crops. Actual production conditions contribute to increased labor demand as well. As fields lose soil, farmers are obliged to spend more time gathering soil into hills or ridges to provide sufficient growing medium.

In peasant communities, there is highly unequal access to labor, particularly at times of peak demand. Although most households are their own primary source of labor, at times of heavy labor such as land preparation, the majority use outside labor. If sharecropping land is viewed as another way to obtain labor, the number of agricultural households using extra-familial labor increases considerably. Access to labor imposes real limits on the amount of

land any one household can crop, especially given constraints imposed by labor shortages and low levels of technology. Thus, reciprocal labor still plays an important role in the project area. The most common form is the "skwad" which rotates through the lands of all its members, working on the land of one member one day and the land of another the next. Members may sell the labor that is due them, so that skwads also work on the land of non-members. Skwads are usually composed entirely of one sex--men prepare and till land while women normally do weeding.

Although agricultural work is commonly regarded as a male domain, all the production tasks, planting, weeding, and processing are commonly (though not exclusively) performed by women. Women also participate in harvesting, particularly if the field is relatively close to the house. They are usually responsible for marketing household production and thus are highly involved in decision-making about the choice and timing of crops. Women are also responsible for tending pigs. Men usually move and water cattle and horses. Children sometimes perform the same agricultural tasks as women and also water and move the small animals.

3. *Objectives of Upland Farming Systems*

Peasant farming systems in the project area are organized around specific household objectives. How individual households meet these objectives is affected by their level of wealth and the stage of development in the family's life cycle. The following are vital objectives to consider when planning and implementing rural development programs for the area:

- *Safety net for consumption crises* -- Peasants favor investments in livestock for safety and liquidity reasons over non-liquid productive investments. They will also maintain relationships with "spekulate" or export crop (e.g., coffee or Vetiver) intermediaries that are disadvantageous in terms of prices received for goods but function as sources of emergency loans and steady markets for cash crops.

- *Liquidity of investments to meet regular - and especially crisis-consumption needs* -- As mentioned above, this objective provides strong motivation for raising livestock over other investments.

- *Maintenance of steady cash flow and income* -- This has resulted in a shift to annual and short-season crops and sub-optimal management of crops such as Vetiver. The total cash received from two sales of immature crops is less than the single sale of a mature crop, but more frequent cash flow is the objective in this case. It is worth emphasizing that, as with much of the farmers' production, profit maximization is not the goal.

- *Accumulation of cash aimed at allowing some family members to leave rural areas due to a perceived lack of future* -- This encourages disinvestment, a short time horizon (already true for many people due to their extreme marginality), and an orientation toward consumption rather than production.

- *Diversification of landholdings to reduce risk, rationalize labor, and meet diverse consumption needs* -- These objectives promote the fragmentation of landholdings and, in some cases, result in land being under steady production when it would greatly benefit from reduced land-use intensity.

- *Diversification of crops for reasons stated above and in response to variable land qualities and rain regimes* -- This objective is a strong factor that reinforces a tendency away from mono-cropping, even in the face of relatively favorable prices for certain crops. The emphasis on reduction of risk also results in overplanting of such crops as corn and sorghum by an estimated factor of two. This is due to the low rate of seed germination for these crops and losses to pests. The result is higher planting costs and reduced vigor and productivity of the surviving crop due to competition.

- *Most efficient maintenance of the productive base, particularly in the short term, which means husbanding the most productive resources first and most intensively* --Peasants prefer to upgrade their productive land before treating land that is degraded or yielding relatively little for the level of capital and labor input required.

- *Maintenance of social relationships that allow the mobilization of sufficient labor in the context of seasonal shortages* -- Female heads of household have only the cash alternative in this regard.

C. Project Goals and Purpose

The background section immediately above underlines the high level of complexity associated with achieving watershed management and rural development goals in the PST Project area. In many cases, biophysically determined needs and socioeconomic variables may conflict. Topography, soil type, and rainfall regimes are extremely variable, with the result that there are numerous micro-ecological sites. When the diverse socioeconomic variables such as land tenure, land-use practices, and household objectives are superimposed on field conditions, the result is even more complex. It is evident that implementing the number and choice of socioeconomic and technological interventions to satisfy all the potential problem situations would be a staggering task.

In approaching this complex undertaking, Associates in Rural Development, Inc. (ARD), the prime contractor for the project, chose a deliberate, focused-strategy approach. In broadest terms, the key to resolving the persistent problems of the Targeted Watersheds lies in reversing the degenerative spiral of improper land-use, soil degradation, and decreased agricultural production. PST was expected to reverse the process of degradation by assisting the local farmers to improve soil quality and gradually move back toward the more diversified, intensive farming systems they once practiced. With better soils, farmers can access alternative crops and enhanced production systems that increase on-farm income while, at the same time, they can improve on-site agro-ecological and overall watershed conditions in the area.

In keeping with the traditional USAID practice of outlining development projects in terms of a "logical framework," the following goal and purpose for the Proje Sove Te appeared in the project paper:

> **Goal: to arrest the process of environmental degradation in Haiti's watershed areas.**
>
> **Project Purpose: to extend soil-conserving and fertility-augmenting land management practices in the target area and to apply lessons learned from this field effort to national-level hillside management planning.**

D. Project Outputs

The two principal outputs of this project were intended to go hand-in-hand:

- to diminish the rate and incidence of erosion thereby transforming the physical watershed; and
- to raise the productivity of the farms and the incomes of the farm families.

These two objectives could best be achieved by intensifying the use of the land in sustainable ways, raising the productivity of the soil and the production from traditional crops, and diversifying the production base. These achievements could only be realized by the farmers themselves. The project therefore had to put in place other related outputs which led to the achievement of the principal outputs. These related outputs included the following:

- the strengthening of the Government of Haiti's capability for guiding, implementing, and supporting rural development and extension services aimed at improved production and soil conservation. A coordinating secretariat within the MARNDR was foreseen for this purpose (subsequently de-emphasized as a result of the withdrawal of USAID assistance to Government of Haiti agencies);
- upgrading of the managerial and technical capabilities of the nongovernmental organizations currently providing assistance and outreach services to the population of the project area;
- increased numbers of trained staff available to the program in the region;
- the completion of essential baseline studies and the establishment of a monitoring and evaluation system to use as a continuing guide for development activities in the area;
- the availability of improved technological packages compatible with the farming systems and markets of the area and the supply of seeds and plant materials essential to their field practice;

- farm input supply and logistical support, including improved infrastructure available to a larger number of farm households; and

- improved animal health and nutrition capabilities, including greater forage and pasture resources in the project area.

E. Institutional Framework

As has been pointed out above, peasant farm families are and must be the primary actors in achieving improved and sustainable productivity and soil conservation. In order to assist the farm families and communities in reaching the objectives of the project, the original design built in several tiers of organizational support.

1. Nongovernmental Organizations (NGOs):

Nongovernmental organizations have had a great deal of experience in Haiti. Their early efforts were based on missionary endeavors and humanitarian relief. Over the years, however, the NGO community has become increasingly involved in development activities. During project design, the merits of a number of different institutional scenarios to provide the field extension capability for the Targeted Watersheds Management Project were examined. With the concurrence of the Government of Haiti, and based on good experience with the operations of local NGOs under the Agroforestry Outreach Project, agreement was reached to engage local NGOs operating in the project areas to undertake the fiel l implementation. To help assure that PST would not be working at cross purposes with the Haitian Government, USAID required that each NGO demonstrate that it had been recognized by the authorities. Four local NGOs were ultimately selected to participate in PST. A brief synopsis of the organizational profile for each of these organizations follows below.

a) Developpement Communautaire Chretien d'Haiti (DCCH)

Started in 1964 by a Haitian priest as an emergency relief operation after a hurricane, this NGO has, to date, concentrated its assistance on improving local health, education, agricultural production and the situation/role of women in Haitian society. DCCH, which is affiliated with the Catholic Diocese of Les Cayes, is organized around the parish structure (it attends to 20 in the Region) and has outreach programs in the areas of Grande Ravine du Sud, Torbeck, Islet, Acul, and Cavaillon watersheds. However, most of its program concentrated in the plains and associated with irrigated agriculture, especially rice.

DCCH helps people understand their own situation and problems as the first step in getting them to develop solutions. A kinship is engendered first around the family and its values, and then around the community through the formation of "groupements." These groupements begin to understand that solutions to their problems also demand certain resources which DCCH can help to obtain. There are two principal types of groupements--those organized through water-user associations and those for any other activity. They may participate in one or several activities, including health, rice production, raising pigs, planting trees, irrigation infrastructure, and family literacy. The groupements formed by DCCH also

act as a type of informal "pre-cooperative" in purchasing tools, animals, or agricultural inputs as a group. By the same token, they may arrange to transport and market their production together.

At the outset of the project, DCCH had a staff of 60 full-time paid personnel and a cadre of 80 voluntary outreach (animateurs) personnel. Its seven agronomists (both professional and technical-level staff) each supervise six to ten animateurs who in turn work with 2 to 10 groupements. DCCH has a facility at Laborde, on the road between Les Cayes and Camp Perrin where training for peasants, animateurs and its agronomy staff is normally conducted. DCCH officials expressed much interest in working with Proje Sove Te in the higher areas of the watersheds in order to protect the investments in irrigation infrastructure and the agricultural productivity of the diocese.

DCCH's experience in extension and training revealed that farmer adoption of different methods of soil conservation depended upon local needs and resources that were available. At Pereny, farmers chose living hedges of Napier grass, Leucaena, and sugarcane. It was expected that farmers who owned livestock would utilize the grass fodder by the cut, carry, and feed method. Instead, they let their animals loose on the hedges which led to their eventual destruction. Evidently, intensified training on hedge-row management as well as the use of such hedges as stabilizers for the ridge/furrow structures was necessary. Farmers showed themselves to be very sensitive to the loss of cropping area taken up by living hedges on contoured ridge/furrow structures. A compromise was reached by recommending the use of sugarcane, in addition to Napier grass, as a living hedge. At Bellevue, where stones were abundantly available, dry rock walls were preferred.

b) Integrated Rural Development (IRD)

The Evangelical Baptist Missions of Southern Haiti have been active in the PST area for more than 30 years, concentrating assistance on developing educational and health care facilities (e.g., several schools and the Bonne Fin Hospital). In 1977, the Baptist Mission and World Concern (a religious NGO from the United States) began IRD with the objective of improving the quality of life of its collaborators through an integrated approach including education, health, agriculture, entrepreneurial development, and community amenities. This NGO is organized around a philosophy of self-help and self-sufficiency for its groups. The majority of IRD activities are localized in the lowlands of the Cavaillon, Ravine du Sud, and Islet rivers in the PST area, although it does work with about 20 groups in the mountains, primarily on reforestation and raising pigs.

IRD approaches its role by acting as a catalyst to bring people together in their communities and as a liaison in obtaining material and financial assistance so these communities can realize their development objectives. In dealing with the communities within the project area, IRD followed a sequential process of motivation and training at the community level designed to form a "groupement paysan." Once formed, these groupements serve as the focal point for initiating the technical training and support services available through PST.

c) Organization for the Rehabilitation of the Environment (ORE)

This secular Haitian NGO was founded in 1983 with a primary base of operations centered on its large nursery and headquarters in Levy near Camp Perrin. ORE's objectives have focused on the provision of improved plant materials, particularly grafted fruit trees, as a more sustainable land-use alternative and means to increase small farm incomes. In addition to grafted fruit trees, ORE provides seed stocks of tuber and vegetable crops, and trains farmers in grafting improved material on established local varieties of fruit trees. The principal fruit species are avocado, mango, and citrus for which there is high interest and demand among its farmer clientele.

The organization's extension efforts under PST are being carried out in the Grand Ravine du Sud, Cavaillon, and Acul River watersheds, with important activities in the higher elevation sites around Formond in areas adjacent to the Pic Macaya designated Park. As part of its participation in the Proje Sove Te, ORE has added a wide variety of conservation and improved agronomic practices to its previous plant materials-focused outreach program. Over the life of the project, ORE has also produced seeds and plant materials for the other PST participant NGOs and provided training courses for their personnel in plant materials-related techniques.

Also of note is the ORE vegetative propagation facility, which employs sophisticated methods of tissue culture to produce clonal material of a variety of important crop and fruit species for the Southwest of Haiti. This technology has aided in obtaining disease- and virus-free planting material of the important sweet potato varieties in the project area which typically suffer from virus and nematodes reducing their yields. These vegetative production techniques make it possible to provide farmers with planting stock and enable several years of higher production before the planting materials are re-infested.

Some of the most significant extension work and technology transfer have been achieved by ORE at various locations in its zone. These will be described here and essential principles and lessons enunciated, which will be of use for the successful dissemination of effective conservation technology and economically profitable farming.

ORE's approach to extension involves working with existing, independent farmer groups or "koumbites," the members of which take turns to work in the fields of individual members. Extension staff initiate activities following clear-cut programs, beginning with a review of the soil conservation achievements of each farmer who participated and an evaluation of the list of potential participants. A participant registration and planning meeting follows, in which participant numbers, programs, and maintenance standards are definitively decided upon and set. Farmers are given the benefit of choosing their own technology regarding crops and soil conservation methods.

The implementation of the extension program, under the technical supervision of ORE's staff, follows a clearly defined time table throughout the year. Visits of inspection and evaluation ensure quality control, and a final evaluation meeting is held with farmers at the end of the season.

ORE's extension strategy is thus based on a close interaction with, training of, and "feedback" from farmers.

d) Union des Cooperatives de la Region Sud d'Haiti (UNICORS)

UNICORS began its work in the southwest peninsula of Haiti over 25 years ago when it was founded by the Oblate Fathers of the Catholic Diocese of Les Cayes. UNICORS is dedicated to community development through economic activity, which, in the past, centered primarily around coffee production on private and cooperatively held lands. This NGO has organized eight major cooperatives within the project area with a total membership of approximately 15,000 people. These groups are organized in communities that lie in a large geographic area – primarily the upper watersheds of the Anglais and Port-a-Piment rivers.

UNICORS has organized its members into highly structured cooperatives with strict rules for operation and accounting of their assets. The cooperatives carry out their activities with their own personnel supervised through administrative boards and councils. UNICORS' central office provides technical and administrative assistance to the member cooperatives. The organization has utilized its large-scale presence in the area as the basis for its PST organization and activities, although the project-related activities are treated as a separate program within the overall structure of the NGO.

The UNICORS extension/outreach approach has centered on choosing and training lead farmers to carry out demonstration activities on their own lands and to work with their neighbors to encourage the activities throughout the watershed area. The PST-related functions of UNICORS are carried out by an agronomist, assistant agronomist, 4 to 6 technicians each of whom interacts with 4 to 8 of the lead farmers or TAPs (Technicians Agricoles Polyvalents), who in turn work with up to 80 farmers each. Because of the availability of cooperative lands, UNICORS has been involved in plant multiplication and seedlings production as an adjunct to its extension activities.

In the domain of extension, UNICORS worked through its team of TAPs, who were designated by the collaborating cooperatives that make up the main body of the PVO. Three main activities constituted the major thrust of UNICORS conservation strategy: establishment of anti-erosive structures, reforestation, and composting. Revenue-earning activities included livestock rearing and the improved management of "Jaden Lakous," which involved work with women farmers.

In conservation, the TAPs worked with farmers on the installation of soil conservation measures. They organized teams, utilizing existing structures such as "skwads," self-help groups, or "principal rule." Participants were initially required to implement anti-erosion measures on one-fourth of their land. Secondly, UNICORS/PST was obliged to exclude farmers who were primarily interested in aims other than soil conservation.

The great variability in dimension and shape of farmers' plots created a problem in achieving the goal of targeted land area for some of the teams, but other teams made up for this. Due to other problems and difficulties, there tended to be a time lag in achieving completion of all anti-erosion structures proposed. The majority of the living hedges desired

by farmers comprised Elephant and Guinea grasses, ostensibly because they served as fodder for livestock.

2. ARD/PST

Since USAID wanted to create an effective model in PST which could be used elsewhere in the country, it included a team of expatriate advisors in the project who could increase the chances that the basic ideas used in PST would be successful and could be transferred to other hillside projects. USAID also felt that this outside technical assistance group would be required to strengthen the administrative and financial structures of the NGOs so that they could meet USAID requirements for the use of economic assistance funds.

Based on USAID's experience with PADF and CARE, the drafters of the Project Paper (PP) envisioned that the USAID Mission would sign a basic agreement with the expatriate organization and that this organization would serve as the intermediary with all other organizations working with the project (page 26 of PP), and would play the central role in implementation. The expatriate organization was to be known as the "umbrella organization." Originally, USAID funds were to be passed via the umbrella organization. Subsequently, however, USAID decided that it would be more appropriate to make the funds available directly to the NGOs via individual Cooperative Agreements.

The arrangements for the project thus included an umbrella organization (ARD) and the USAID Project Coordinator in Les Cayes, and also the provision of an advisory group composed of NGOs, the ARD field team, USAID, and other interested parties. In line with the suggested Scope-of-Work for the umbrella contractor contained in the RFP, ARD placed a team of six long-term advisors in the project area to carry out the technical assistance and institutional strengthening activities of the contract. The team included the following positions (a full summary of ARD's personnel and their level of effort that were involved in the project is included in Appendix A):

- Economist/Chief of Party
- Administrative Specialist
- Soil/Watershed Management Specialist
- Agronomist/Tropical Horticulture Specialist
- Livestock/Forage Specialist
- Farming Systems Specialist

In addition to the long-term personnel, short-term specialist consultants were also foreseen and included in the project team over the life of the project. Positions for which such services were utilized included: post-harvest advisor, financial management and budgeting specialist, computer programming and MIS specialist, agroforestry advisor, veterinarian (through an arrangement with IRD), vehicle maintenance specialist, operational planning specialist, and monitoring and evaluation advisors (local).

3. *USAID*

The primary USAID/Haiti responsibility for the Proje Sove Te rested with the Agricultural Development Office, where the Project Officer carried out the typical functions of decision-making, project monitoring, and review. In addition, and in order to further decentralize its operations, a field coordinator position and office was created in Les Cayes. This office provided field-informed advice and channels of communication from USAID to the participant NGOs and ARD/PST. Radio, telephone, and fax communications linked it with the main office in the capital Port-au-Prince.

Staffed by an experienced contract Haitian agronomist, this office greatly expanded its role in the latter half of the life of the project with the decision to diminish the role of the ARD/PST team as its related to grant management.

4. *Government of Haiti (GOH)*

Although both USAID and the GOH agreed that the fieldwork of Proje Sove Te was to be performed by NGOs, they also planned to have the Ministry of Agriculture play a major role. With help from USAID and the international assistance community (as mentioned above), the Ministry formed a special branch to deal with hillside agriculture and watershed management issues: STAB (Secretariat Technique de l'Amenagement des Bassins Versants, which is known in English as the Technical Secretariat for Watershed Management). STAB was to play a major, formal role in directing the project, as was the regional office of the Ministry in Les Cayes. With the subsequent cessation of U.S. assistance to the Haitian Government, these relationships became informal, and the role of the ministry and STAB was deleted from the project.

However, useful and productive discussions continued between PST and STAB as well as with the Ministry of Agriculture. The early discussions with the regional office of the Ministry of Agriculture in Les Cayes involved the consideration of different methods of approach to project implementation in the PST zone and the various problems to which these methods gave rise.

There was also a period of some tension between local MARNDR officials and the Project as a result of the cutoff in USAID assistance to their activities. This unfortunate resentment of the otherwise well-funded project activities in the region led to a series of disputes with and efforts by the Ministry staff to undermine the effectiveness of the Project. Considerable USAID staff and project personnel time and effort were expended in trying to reconcile this situation.

In a meeting held in early 1990, the new head of the regional office outlined a series of studies where Ministry officials and PST personnel could work together on the agricultural problems of the South. This proposed working relationship did not flourish, however, due to the almost virtual collapse of Government services in the area and the already heavy workload of all Project personnel. ARD/PST did continue to send progress reports to the local Ministry

office and invited them on a number of occasions to take part in the Advisory Council meetings of the Project.

II. OVERVIEW OF THE PROJE SOVE TE

A. PST Interventions and Innovations for Sustainable Development in the Project Area

1. Agriculture

The basic agricultural entity in the project area is the "jaden lakou" which comprises the land in the immediate vicinity of the rural household and which is usually planted up as a multi-storied complex garden, with coffee under shade, fruit trees, and root and tuber crops. Soil fertility is maintained by the recycling of organic matter and the addition of household and animal wastes and harvested crop residues from the garden or from distant hill-slope fields. Soil erosion is practically non-existent.

On the sloping fields distant from the households two cereal/leguminous grain associations are grown--maize/beans and sorghum/pigeon peas. The maize and pigeon peas are sown together while the beans are planted in association. The maize and beans are harvested by June and the pigeon peas are allowed to complete their cycle in association with late inter-planted sorghum.

The roots and tubers in association with pork from rustic Haitian pigs constituted a complete diet until the pigs were eradicated. The cereal/leguminous grain associations constituted seed culture which also provided complete diets which the rural population fell back on with the disappearance of the pigs. To supplement these diets, a wide range of horticultural crops are grown in the "jadens lakou," such as salads, cabbages, tomatoes, peppers, and aubergines (eggplants).

a) Ag Sector Problems and Constraints

The problems and constraints of the farming systems of the project area and the approach taken with each are discussed briefly below.

- <u>Soil/Moisture Conservation</u>

  A major problem which the project sought to address was the high rate of soil loss from sloping fields. Arable cultivation of sloping land is the root cause of erosion (i.e., the annual production of maize, beans, and sorghum [piti mi] involving the working and disturbing of the soil on exposed, unprotected slopes) gives rise to rates of erosion that can vary between 20 to 40 tonnes per ha. over two months on a 17 degree slope with about 270 mm. of rainfall (Cunard (1) 1991).

  Because of the thinner soils resulting from continued erosion, soil moisture reserves also fall. Evidence of this became apparent in the yellowing and wilting of crops growing on hillsides during prolonged dry periods (Cunard (5) 1991) and the rapid rise and fall of streams and rivers after rainfall. Rainfall which accumulated to replenish soil moisture reserves had to be harvested and made available to trees and crops, contributing an estimated 20 to 25 percent of production increase. Although less emphasis was given to the problem at the

beginning, soil moisture conservation was inherent in the design of the conservation technology proposed for implementation.

- Decreasing Soil Fertility

Since the major part of the soil that erodes is found in the upper 10 cm of the profile, much of the inherent fertility that resided in the organic matter and its cation exchange capacity was also lost, along with the major nutrient elements, Nitrogen, Phosphorus, and Potassium. Measures to conserve soil are inadequate and incomplete unless steps are taken also to restore soil fertility and rehabilitate the land.

- Low-Yielding Crops

Local varieties and cultivars of crops, although they were well-adapted to the existing environment, were low-yielding and produced poorly. The need to introduce higher-yielding and better-quality crops became very apparent with positive farmer reaction to the higher-yielding (50 percent) Tapato variety of sweet potatoes, originating from Puerto Rico. The same may be said for maize and bean seeds with higher germination percentages and pest (nematode)-free seed sets of yams.

- Lack of Production Inputs

To increase revenue a whole range of inputs for farmers, such as improved technology, equipment, materials, and supplies needed to be made available. The foundation of private enterprise upon which the supply of most of these inputs should have been based was not emphasized. Improved seeds, planting material, and other inputs were provided for farmers in order to motivate them to participate in the Project.

- Land Tenure and its Effect

It has already been stated that the most serious erosion occurs on exposed, cultivated slopes for annual crops. However, erosion rates also vary according to the form of land tenure that prevails, either ownership (low), sharecropping (average) or indivision (high) (Cunard (6), 1991). Consequently, farmers who work land under sharecropping and indivision are not particularly interested in implementing soil conservation or soil fertility improvement as they fear that the proprietor will repossess the field. The majority of the participant farmers thus mainly tend to be owners of their fields, although the positive effects of improved technology has resulted in such significant advantages that even sharecroppers and tenant farmers have opted to participate.

- Participant Farmer Recruitment

A major problem to contend with was the natural skepticism of conservative farmers to the value of the recommended technology in their own systems. In

order to induce them to participate, various incentives were offered to them under the Project. As the project progressed, there were fears that farmers would cease implementation of conservation technology when the incentives were stopped and were not basing the development of their farming systems to the actual, prevailing economic situation.

- Lack of Market Outlets

  If soil conservation and improving soil fertility resulted in higher yields, demand would absorb the higher productivity, implying that markets and market organization are needed. Then again, if markets for specific commodities were identified and developed, this would induce farmers to increase production, presumably under conditions of environmental conservation that would ensure sustainability. Except in a limited way, this particular aspect of the project did not receive much attention. The conservational aspect received the greatest emphasis, while economics were secondary.

The Project had to provide adequate and farmer-acceptable technology for soil and moisture conservation and appropriate technology to improve and maintain soil fertility. In addition, it had to ensure the provision of sufficient seeds and planting material of high-yielding, good-quality, disease-free varieties and cultivars of local crops. Furthermore, it had to overcome farmers' skepticism and reluctance to employ the new technologies and somehow persuade them to participate as members of the project. As will be seen later, some outstanding successes have been achieved in winning their cooperation and collaboration (Cunard (7) 1991). Almost all these problems were addressed by the Project. The achievements in finding solutions for them are delineated and discussed in the sections that follow.

b) Ag-Related Technological Achievements

The approaches to resolving the problems described above included the following technologies.

- Conservation Technologies: Soil

  The soil conservation technology that was already available was the ridge/furrow system constructed on contours and stabilized by living hedges of either leguminous tree or grass species; the contours were spaced between five to ten meters apart. The barriers not only entrapped silt and soil but also water that would have escaped downhill, adding it to the soil moisture reserve. The alleys between the living hedge barriers were intended to be cultivated with prevailing cropping systems. One of the consequences of such arable exploitation was that the furrow tended to fill up with silt, so that water from subsequent rains would continue to spill over and continue downhill. This necessitated a regularly clearing out the furrows, throwing the soil upslope in the alleys, which required considerable labor inputs from the farmers.

At Formond, the system that was implemented in the ORE demonstration center to halt erosion and rainwater run-off was the Wynne canal, developed at the Wynne farm at Kenscoff. The effect on the prevention of flooding on the area below the slope was so dramatic that farmers immediately began asking for the implementation of the technology on their own fields. To this day they prefer the Wynne system to the other more economic ridge/furrow system. The Wynne canals, although deeper than the furrows, would ultimately clog up with silt, necessitating a clearing out. However, this problem was almost completely solved by planting Guinea grass on the upper edge of the canal, which filtered out the major part of the silt. The same method has been found to be effective in preventing the furrows in the ridge/furrow system from filling up.

- Conservation Technologies: Soil Moisture

Although the conservation of soil moisture was never fully emphasized in the project paper, the concept of it was inherent in the conservation technologies proposed and implemented. Thin, eroded soils on slopes drain very rapidly and become dry sooner than even sandy soils on the flat. Consequently, a semi-arid type of condition prevails and the farmer resorts to drought-resistant crops such as sorghum (*piti mi*) and cow peas (*pwa nkonni*). The ridge/furrow conservation structure ensures the harvesting of rain water that would otherwise spill over the barriers and make its way down the slopes.

The harvested water percolates into the soil and becomes available as soil moisture to the root systems of the living hedges growing on the ridge and of crops growing in the alleys. Farmers noticed that pineapples planted on the lower edges of a Wynne canal were larger than those growing in the alleys (ORE 1991) and sorghum planted in the alleys remained green under prolonged drought conditions of several weeks (UNICORS 1990).

It has already been pointed out that with continued cultivation, the furrow tends to get silted up. When this happens there will be a loss of water unless the furrow is cleaned out. To prevent this, a strip of Guinea grass is planted on the upper edge of the furrow or canal, which acts as a filter for the silt and prevents its transport to and accumulation in the furrow. However, this measure does not preclude the build-up of silt behind the Guinea grass barrier, since cultivation always causes erosion. It does keep the furrow unclogged so that rain water can be harvested and utilized.

With "zero" tillage, the soil in the alley is almost completely protected from erosion and the furrow remains unclogged for greater lengths of time.

- Conservation Technologies: Living Hedgerows

The technology recommended for stabilizing the ridge/furrow structures was the planting of living hedges of either leguminous tree or grass species on the ridges. Initially, the species recommended were *Leucaena leucocephala* for low and *L. diversifolia* for high elevations. However, because *Leucaena* is vulnerable

to psyllid attack, another species, *Calliandra calothyrsus*, was recommended, which apparently has experienced greater success than *Leucaena* in parts of the PST zone.

The living hedges were to be coppiced at a height of 50 cm when they had attained a height which, by shade, would interfere with light incidence to the crops in the alleys. The prunings were to be applied as a mulch to the soil in the alleys.

In practice, these technologies were never fully implemented nor faithfully followed by all the NGOs. For example, when the furrows became silted up, they were never cleaned out, simply because the operation entailed excessive labor input by the participating farmers. Some NGOs preferred to plant species other than leguminous trees or grasses, such as sugar cane or pineapples, thus attempting to valorize the loss of cropping area incurred by the installation of the conservation system. There were gaps in the living hedges which, because they were unfilled, ultimately resulted in breaches and erosion initiation. There was considerable doubt on the farmer's part as to the value of a leguminous tree species used as a living hedge. Here, a second important point may be enunciated: valid, appropriate technology which might appear perfectly logical to the development agency may not make any sense to the farmer, unless he is convinced of and perceives its value to his farming system. It is evident that the successive implementational stages of a development program must be based on "feedback" from farmers.

- Conservation Technologies: Soil Fertility

The greatest problem that the Project had to address was the rehabilitation of soil fertility in the soils of the alleys between the living hedge barriers. Use of chemical fertilizers, as was being done in the plains below, was out of the question, since it was uneconomic. A way had to be found that provided the farmer with a regenerated soil, with its fertility maintained on a sustainable basis. This would ensure the continued existence of his hillside farm. The implementation of "zero" tillage solved this problem.

The appropriate technology for the rehabilitation of soil fertility in the alleys on hill slopes was implemented by ORE. It involved the application of "zero" tillage, which entailed the application of a thick mulch of vegetative matter, ostensibly from the living hedges, on the soil surface in the alleys. However, it was found that *Leucaena* did not produce sufficient vegetative biomass to facilitate this practice, but that Elephant grass did. Consequently, this technology was tried at demonstration sites at Saut Mathurine and Camp Perrin. After three seasons, soil fertility and productivity began to improve. For example, the production of beans in a maize/beans association under "zero" tillage (850 Kg. ha^{-1}) showed a difference of 625 Kg. ha^{-1} from beans produced under the traditional cropping system (225 Kg. ha^{-1}) (Cunard (7) 1991).

In order to introduce this system, ARD and the ORE Agronomists had to contend initially with the skepticism of the ORE agricultural technicians themselves, who were only convinced after they saw the results. This points to the importance of the establishment of demonstration centers in the midst of farmers, where whatever is done is highly visible and evokes sustained interest from farmers. This was achieved at Formond by ORE, although by virtue of the establishment of Wynne canals that brought about a dramatic and immediately perceptible advantage to farmers. Other advantages which they saw increasingly and which they desired to adopt were the larger pineapples that were produced when the plants were sown at the lower edge of the canal, the larger yams that were produced when they were sown close to Calliandra trees, and the increased crop yields that resulted from "zero" tillage. The advantage of the demonstration center is that in its environs, yields and production can be quantified so that differences due to improved crop husbandry can be pointed out to farmers.

The use of "zero" tillage gave rise to several problems: not all farmers desired to use the Elephant grass from the living hedge as a mulch, since it had considerable value as a livestock fodder and some farmers complained that the vegetative mulch caused an infestation of snails.

The ORE Agronomist decided to integrate Velvet bean into the cropping system in order to cover the soil and prevent erosion, increase the level of soil nitrogen by N-fixation, and add organic matter to the soil. However, the Velvet bean requires time to grow and cover the soil and thus displaces a crop that would serve as food. The argument for growing the cover crop is that not much food can be produced from an exhausted soil and the increase in fertility conferred by the cover crop would result in higher crop yields in the succeeding season. The work with Velvet bean is ongoing, although more than 25 farmers have volunteered to try out "zero" tillage on their own fields (ORE 1990).

See Figure 3 on the following pages for a breakdown of conservation interventions by NGOs and by technology.

Figure 3: Summary of NGO Outputs

1 OUTPUT	2 UNIT OF MEASURE	3 8/1/88-1/31/89	4 2/1/89-7/31/89	5 8/1/89-1/31/90	6 2/1/90-7/31/90	7 CUMULATIVE TOTAL 8/88-7/90	8 6 MO TARGET 2/1/90-7/31/90	9 6 MO OUTPUTS AS % TARGET	10 ONG 6 MO OUTPUTS as % Total (2/90-7/90)	11 ONG CUM OUTPUTS AS % CUM TOTAL
TOTAL CONTOUR CONSERVATION	LINEAR METERS									
DCCH		0	14.021	14.395	81.757	110.173	54.500	150%	11%	5%
IRD		0	25.244	26.334	78.596	130.174	30.000	262%	10%	6%
ORE		0	65.270	133.320	157.569	356.159	590.000	27%	21%	17%
UNICORS		177.295	336.392	526.931	437.048	1.477.666	1.232.000	35%	58%	71%
TOTAL PST		177.295	440.927	700.980	754.970	2.074.172	1.906.500	40%	100%	100%
Tree Hedgerows	Linear Meters									
DCCH		0	300	2.112	6.388	8.800	20.000	32%	5%	4%
IRD		0	15.470	16.918	54.793	87.181	20.000	274%	40%	44%
ORE		0	16.584	6.060	21.312	43.956	124.000	17%	15%	22%
UNICORS		1.792	0	0	55.103	56.895	88.000	63%	40%	29%
TOTAL PST		1.792	32.354	25.090	137.596	196.832	252.000	55%	100%	100%
						Tree Hedgerows as a percentage of total contour conservation				9%
Grass Hedgerows	Linear Meters									
DCCH		0	7.626	6.130	13.452	27.208	31.000	43%	3%	2%
IRD		0	1.748	3.018	7.581	12.347	10.000	76%	2%	1%
ORE		0	23.658	9.294	57.337	90.289	186.500	31%	12%	6%
UNICORS		175.503	336.392	526.931	381.845	1.420.771	1.056.000	36%	83%	92%
TOTAL PST		175.503	369.424	545.373	460.315	1.550.615	1.283.500	36%	100%	100%
						Grass hedgerows as a percentage of total contour conservation				75%
RAMPE PAILLE/FURROW-BERM	Linear Meters									
DCCH		0	0	633	17.922	18.555	1.000	1792%	19%	8%
IRD		0	0	0	0	0	0		0%	0%
ORE		0	23.897	117.711	77.782	219.390	248.500	31%	81%	92%
UNICORS		0	0	0	0	0	0		0%	0%
TOTAL PST		0	23.897	118.344	95.704	237.945	249.500	38%	100%	100%
						Rampe Paille-Furrow/berm as a percentage of total contour conservation				11%
MIXED GRASS TREE HEDGEROWS	Linear Meters									
DCCH		0	4.612	2.314	7.171	14.097	0		32%	33%
IRD		0	7.207	5.963	15.202	28.372	0		68%	67%
ORE		0	0	0	0	0	0		0%	0%
UNICORS		0	0	0	0	0	0		0%	0%
PST TOTAL		0	11.819	8.277	22.373	42.469	0		100%	100%
						Mixed grass/tree hedgerow as a percentage of total contour conservation				2%
Digue Canals ("Tranches")	Linear Meters									
DCCH		0	467	1.491	1.061	3.019	2.500	42%	48%	54%
IRD		0	0	0	0	0	0		0%	0%
ORE		0	1.131	255	1.138	2.524	31.000	4%	52%	46%
UNICORS		0	0	0	0	0	88.000	0%	0%	0%
TOTAL PST		0	1.598	1.746	2.199	5.543	121.500	2%	100%	100%
						Canals as a percentage of total contour conservation (less than 0.5%)				0%
Stone walls + Other	Linear Meters									
DCCH		0	1.016	1.715	35.763	38.494	0		97%	94%
IRD		0	819	435	1.020	2.274	0		3%	6%
ORE		0	0	0	0	0	0		0%	0%
UNICORS		0	0	0	0	0	0		0%	0%
TOTAL PST		0	1.835	2.150	36.783	40.768	0		100%	100%
						Stone walls as a percentage of total contour conservation				2%

Figure 3: Summary of NGO Outputs

1 OUTPUT	2 UNIT OF MEASURE	3 8/1/88-1/31/89	4 2/1/89-7/31/89	5 8/1/89-1/31/90	6 2/1/90-7/31/90	7 CUMULATIVE TOTAL 8/88-7/90	8 6 MO TARGET 2/1/90-7/31/90	9 6 MO OUTPUTS AS % TARGET	10 ONG 6 MO OUTPUTS as % Total (2/90-7/90)	11 ONG CUM OUTPUTS AS % CUM TOTAL
TOTAL PRODUCTION TREES	# TREES									
DCCH		0	32,476	28,421	50,513	111,410	50,000	101%	14%	7%
IRD		0	0	0	9,347	9,347	6,000	156%	3%	1%
ORE		286,769	164,47	122,937	36,125	610,303	73,500	49%	10%	36%
UNICORS		177,408	262,47	247,387	266,467	953,735	655,000	41%	74%	57%
PST TOTAL		464,177	459,421	398,745	362,452	1,684,795	784,500	46%	100%	100%
TOTAL DISTRIBUTION TREES	# TREES									
DCCH		0	13,753	60,129	51,350	125,232	51,500	100%	16%	9%
IRD		0	11,157	11,159	13,521	35,837	6,000	225%	4%	3%
ORE		41,902	220,212	34,418	97,151	393,683	60,250	161%	31%	28%
UNICORS		340,000	262,473	110,506	155,037	868,016	345,000	45%	49%	61%
PST TOTAL		381,902	507,595	216,212	317,059	1,422,768	462,750	69%	100%	100%
Note: Trees produced by ORE & sent to PVO are listed as distributed by other PVO. ORE Distribution target for 89 = 1/2 ORE's est. yr. production										
Production of Forest Trees	# Trees									
DCCH		0	25,986	25,986	35,358	87,330	30,000	118%	16%	10%
IRD		0	0	0	3,035	3,035	0		1%	0%
ORE		64,273	111,143	79,449	44,333	299,198	37,500	118%	20%	35%
UNICORS		81,177	118,569	131,087	140,392	471,225	330,000	43%	63%	55%
PST TOTAL		145,450	255,698	236,522	223,118	860,788	397,500	56%	100%	100%
IRD's cumulative production of forest trees is less than 0.5% of PST Total & thus registers as zero per cent.							Forest trees as a percentage of total production			51%
Final Distribution of Forest Trees to Farmers	#Trees									
DCCH		0	1,269	51,204	34,250	86,723	30,000	114%	17%	11%
IRD		0	8,298	8,299	3,035	19,632	0		2%	2%
ORE		7,858	75,112	25,026	69,435	177,431	37,500	185%	35%	22%
UNICORS		210,000	118,569	110,506	90,863	529,938	263,500	34%	46%	65%
PST TOTAL		217,858	203,248	195,035	197,583	813,724	331,000	60%	100%	100%
							Forest trees as a percentage of total distribution			57%
Production of Coffee Trees	# Trees									
DCCH		0	0	0	0	0	0		0%	0%
IRD		0	0	0	0	0	0		0%	0%
ORE		109,288	5,441	47,891	(7,372)	155,248	17,500		-8%	29%
UNICORS		82,680	120,000	76,300	95,300	374,280	250,000	38%	108%	71%
PST TOTAL		191,968	125,441	124,191	87,928	529,528	267,500	33%	100%	100%
ORE attrition exceeded production by 7,372 in period 2/90-7/90							Coffee trees as a percentage of total production			31%
Distribution Coffee Tree to Farmer	# Trees									
DCCH		0	9,631	0	0	9,631	0		0%	2%
IRD		0	0	0	0	0	0		0%	0%
ORE		2	103,361	0	22,684	126,047	17,500	130%	29%	31%
UNICORS		100,000	120,000	0	55,501	275,501	46,500	119%	71%	67%
PST TOTAL		100,002	232,992	0	78,185	411,179	64,000	122%	100%	100%
							Coffee trees as a percentage of total distribution			29%

Figure 3: Summary of NGO Outputs

1 OUTPUT	2 UNIT OF MEASURE	3 8/1/88-1/31/89	4 2/1/89-7/31/89	5 8/1/89-1/31/90	6 2/1/90-7/31/90	7 CUMULATIVE TOTAL 8/88-7/90	8 6 MO TARGET 2/1/90-7/31/90	9 6 MO OUTPUTS AS % TARGET	10 ONG 6 MO OUTPUTS as % Total (2/90-7/90)	11 ONG CUM OUTPUTS AS % CUM TOTAL
Production Fruit Trees	#Trees									
in Nursery -									20%	8%
DCCH		0	6,490	2,435	15,155	24,080	20,000	76%	12%	2%
IRD		0	0	0	6,312	6,312	6,000	105%	-2%	53%
ORE		113,208	47,888	(4,403)	(836)	155,857	18,500	-5%	60%	37%
UNICORS		13,551	23,904	40,000	30,775	108,230	75,000	41%	100%	100%
PST TOTAL		126,759	78,282	38,032	51,406	294,479	119,500	43%		17%
ORE attrition exceeded production in 8/89 - 1/90 and in 2/90 - 7/90							Fruit trees as a percentage of total production			
Distribution Fruit Trees --										
all types to farmers	# Trees								41%	15%
DCCH		0	2,853	8,925	17,100	28,878	21,500	80%	25%	8%
IRD		0	2,859	2,860	10,486	16,205	6,000	175%	12%	46%
ORE		34,042	41,739	9,392	5,032	90,205	5,250	96%	21%	32%
UNICORS		30,000	23,904	0	8,673	62,577	35,000	25%	100%	100%
PST TOTAL		64,042	71,355	21,177	41,291	197,865	67,750	61%		14%
							Fruit trees as a percentage of total distribution			

- New Crop Introductions

PST staff worked closely with ORE in the introduction of new crops into the zone. Using the ORE nursery at Lamartiniere as a multiplication center, the project undertook a serious program of crop introduction, testing, multiplication, and distribution to farmers of varieties and cultivars of fruits, cereals, leguminous grains, tubers, vegetables, and condiments and spices. The importance of the crop introduction program lies in its principle of crop diversification and the often profitable discovery of high-yielding cultivars and varieties.

Most of the cultivars and varieties of tree fruit crops that have been introduced included mangoes, citrus, avocados, and bananas. At least 10 varieties of mangoes have been introduced, among which is the variety called Zillate, which, because it has red flesh, low fiber, excellent taste, and is late-bearing, offers considerable economic potential to farmers. More than 20 cultivars of the following citrus varieties have also been introduced: oranges, tangelos, tangors, mandarins, limes, lemons, and grapefruit. The Jamaican variety, Ortanique, is a very sweet orange and planting material is much sought after by farmers. Five early and late imported varieties of avocados have also been introduced. The late-season Chocquette variety, of excellent quality, with an average fruit weight of 1 kg fetches premium prices on the market when avocados are scarce. About 50,000 grafted plants were distributed to the other NGOs. About 10 banana/plantain cultivars were introduced and are being tested in ORE's Camp Perrin multiplication center. Other interventions included:

One of the most successful plant introductions was the Tapato variety of sweet potato, originally imported with five others from Puerto Rico in 1988. On testing it was found to yield about 50 percent more than the best local variety. It was then multiplied and about 1,000,000 cuttings distributed in 1990.

Seeds of a smooth-skinned variety of Mirliton (Chayote), obtained through Brooks, Fruit/Vegetable Importers/Miami, have been tested successfully at Formond and Camp Perrin. According to Brooks, only smooth-skinned varieties are commercially acceptable.

Two varieties of Amaranth spinach, one imported, were multiplied for testing and distribution. Amaranth spinach is a widely used local vegetable, rich in protein and of considerable nutritional value to farmers and their families.

Garlic varieties introduced from Mexico, the Dominican Republic, and China were tested at Levy and Formond. Only the variety from China produced bulbs at Formond, and they were exceptionally large.

A single vine of black pepper imported from Mayaguez, Puerto Rico is currently being tested under drip irrigation at ORE's Central Nursery in Camp Perrin. About 100 cuttings have been made from the original vine and planted in association with living trainers. They are already producing pepper-corns and show economic promise as a crop that could be grown in association with coffee.

Imported Hawaiian ginger has shown a very good performance at Formond, producing roots that are two to three times larger than local varieties. If successful, this would be a stockable and easily transportable cash crop for farmers.

Varieties of hot peppers, one imported (Al Guyane) and the other local (A2 Local) have been tested. Both produce larger capsules than the locally available variety and show promise of economic viability for farmers during certain seasons.

Contacts were made with The Plant Introduction Center at Beltsville, Maryland/USA, ICRISAT/India, and the Ministry of Agriculture/Indonesia in order to obtain seeds of various leguminous food and cover crops for introduction to the PST Zone. These included the following:

Dolichos lablab - The Lab Lab bean, which not only generates a thick vegetative cover over the soil, but also produces edible seeds, unlike the Velvet bean, the seeds of which are poisonous. Other than at Laborde (DCCH) where the Lab Lab bean grew luxuriously, its performance was poor on hilly sites.

Psophocarpus tetragonolobus - The Winged bean has earned a considerable reputation as a leguminous creeper that produces delicious edible pods and beans. It was intended to be introduced into the "jadens lakou." Its performance on the Perrin Site was poor.

Vicia spp. - A series of tropical vetches were obtained for ORE for testing at Formond. None of them apparently grew well.

- Crop Improvement

The best form of crop improvement is to base it on the foundation of local varieties and cultivars of crops. Although these may be low-yielding, they have generally developed considerable resistance to local pests and diseases. They can be improved by crossing (maize) or by mass selection (beans).

Crosses were made of the local variety of chicken corn and tested out at Formond (1,000 m elevation) and at Levy (120 m elevation). Twenty of these

crosses yielded more than 4.0 tonnes ha.$^{-1}$, 72 crosses between 3 - 4 tonnes ha.$^{-1}$, and 47 crosses between 2 - 3 tonnes ha.$^{-1}$. At Levy the estimated mean yield from farmers' fields is 1 tonne ha.$^{-1}$.

Mass selection has been conducted on black (two local varieties and Thamazulapa) and red beans (Salagnac 90) since 1987. The improved-quality seed resulting from ORE's multiplication process has given better germination (95 to 100 percent) than that of locally obtained seeds (30 to 70 percent).

Improvement of food crop planting material can also be effected by producing disease- and pest-free seed or sets. In the case of yams, which are generally infested with nematodes that reduce yields, mini-setting techniques can be used to multiply and produce seed material, at a ratio of 1:15, that is relatively free of nematodes.

Crop planting material improvement of pineapples, bananas, mangoes, yams, and potatoes was also achieved at ORE by using tissue culture techniques which ensured freedom from diseases, accelerated multiplication, and increased numbers.

c) The Generation of Concrete Data on Conservation Technology

ARD used several sites for experimental and multiplication purposes in the Camp Perrin and Laborde areas. The Perrin Site was planted up in October 1989 with plots of contoured living hedges consisting of 6-m rows of leguminous tree and other species placed on four different soil types. The contours were spaced approximately 5 m apart and the barriers were ridge and furrow structures stabilized by the living hedges. The areas between the living hedges were used for studies in alley cropping.

On the Brutus Site, collaborative trials with the Livestock Specialist were carried out. These consisted of a major cropping systems trial, a cover crop (Siratro)/maize/bean association trial, and an Elephant grass biomass production trial. The interesting and valuable results that were obtained from this experimental work may be classified as follows:

- Inexpensive Erosion Measurement Technology

  One of the mandates of the Technical Team Leader and Agronomist was the development of technology for erosion measurement on sloping soils. To this end the experimental plots were deployed in such a way as to facilitate the collection of data that would result in a rough evaluation of the rate of erosion on sloping soils in the PST area. It was found that over a 62-day period (between April 11 and June 11, 1990), with a rainfall of about 270 mm, the amount of soil eroded from cultivated plots on an average slope of 17 degrees varied from 20 to 30 tonnes ha.$^{-1}$ (see Cunard (1), 1990).

  Erosion plots were also established on the Perrin Site following the method used by SECID, which was much simpler and required less inputs of time and labor. Erosion on uncultivated plots over a 143 day period with twice the amount of

rainfall on an average 17 degree slope varied, from 1.5 to 16 tonnes ha.$^{-1}$ depending upon the magnitude of natural vegetative cover (see Cunard (2) 1991).

Thus, without recourse to expensive equipment and installations, estimates of soil erosion are possible.

- Demonstrating Importance of Moisture Conservation

  Issuing from the erosion study following the SECID method, it was also found that living hedges planted on the slope without the ridge/furrow structures did not conserve soil moisture--of utmost importance to living hedge and crop growth in the alleys. The biomass of Elephant grass produced without soil moisture conservation only amounted to 6.2 tonnes ha.$^{-1}$, compared to about 15 tonnes ha.$^{-1}$ with conservation (see Cunard (3) 1991).

d) Technological Recommendations in Agronomy Made to the NGOs

The ARD/PST technical assistance team provided advice and support to particular interests and needs of the participant NGOs. Topics that received specific attention included the following:

- IRD/Tricon, Rehabilitation of Degraded Soils

  The Tricon area under the mandate of IRD is a highly degraded environment with excessively eroded soils on hill slopes due to continued Vetiver cultivation. Many of these fields have been abandoned and/or used as poor-quality pastures for goats. The previous ORE Agronomist had installed ridge/furrow structures on contours stabilized by living hedges of *Leucaena leucocephala*. He had also conducted inter-cropping trials in the alleys on the lower, relatively more fertile parts of the slope, while leaving the alleys on the upper portions to be colonized by weeds and brush. The living hedges had not been coppiced.

  It was recommended that the soils in the upper alleys be rehabilitated in the following manner. The hedges should be coppiced at a height of 50 cm and the branches laid in the alleys until all the leaves had fallen off. The wooden branches could then be removed for use as firewood. Velvet bean should be planted throughout in the alleys so that it could grow and cover the soil with a thick layer of vegetative mulch. A year later, it should be killed after seed collection and, without clearing away the dying vines, Pois Congo should be planted at a spacing of 1.5 m x 1.5 m. This should produce a reasonable harvest of the leguminous grain. The following season, the Pois Congo should be harvested and the stems cut near ground level. A subsequent planting of Pois Congo could be done without any further cultivation. The primary principles of the fertility rehabilitation process are the addition of organic matter in the form of a mulch and the non-disturbance of the soil.

- ORE/Introduction of New Crops

The ORE Agronomist was provided with seeds of planting material of tropical vetches, and a few amendments and improvements were suggested (seeds of Mung and Garbanzo beans were also provided for testing). One of these suggestions was that somehow farmers should be persuaded to plant up the sloping stream banks at Formond with *Calliandra* to totally eliminate erosion. Another was that alley cropping with pineapples sustained by *Leucaena* hedgerows as at the ORE Brutus Site at Camp Perrin was the best means of profitably exploiting sloping fields. The project also provided monthly publications of the American Society of Agronomy.

- UNICORS/Kos, Use of Fertilizer in Maize Production

There was a considerable amount of interaction with the UNICORS Agronomist. Recommendations were made for On Farm Trial design with inter-cropped maize and beans on slopes, with provisions for fertilization with a compound chemical fertilizer (12:12:24) applied by spot localization at the rate of 20 Kg. ha.$^{-1}$. (This fertilizer was available at Les Anglais, where it was used for the production of irrigated maize on the plain.)

A brief course of instruction was also given to the Agronomist on the use of SYMPHONY software for statistical analysis. This involved the generation of a template which was used to go through all the procedures of analysis up to the ANOVA table. All that was necessary thereafter was to enter the raw data in the first table and the analysis was instantaneous. The value of this system, if there were 30 sets of data available, is uncontestable. It was unfortunate that the software could not be installed in the UNICORS computer because of regular power source and computer breakdowns.

- DCCH/Pereny, Integration of Velvet Bean into Yearly Cropping Cycle

The Agronomist of DCCH was advised on the inclusion of Velvet bean into the yearly cycle of the traditional cropping system used by watershed farmers. Since the introduction of Velvet bean into the system would displace another food crop, it could only be done in a system in which the farmer only took off a single crop at the beginning of the year. This implied a soil in a relatively low state of fertility. The farmer would then leave the field under a state of fallow for the rest of the year, allowing weeds and grass to take over. The innovation was to plant the Velvet bean immediately before the beans were taken off in May and allow it to cover the field. In the following season, it would be killed and the field cropped with beans again. As fertility improved gradually, maize could be introduced.

e) Comments on Research/Demonstration of Technology

Before any serious extension work can be done, there needs to be workable technology available the advantages of which are perceptible to the farmer, and which he can apply himself without undue inputs of labor, time, or energy. At Formond, the available technology was effective and workable, and was implemented in a demonstration center located in the midst of the farming community.

The initial technological innovation implemented at Formond by ORE was the Wynne canal, which, when installed on the sloping fields of the demonstration center, completely stopped the downrush of water after heavy rainfalls to the fields below. This aroused immediate curiosity. Previously, the water not only reached the bottom of the slope, but flooded the residences of the inhabitants who happened to have their houses sited there. Farmer interest was captured. Thenceforth they wanted Wynne canals on their own farms.

Farmer-Managed Experimentation (FME), unless it is closely supervised by capable, concerned, technical staff, will always be fraught with the risk of failure. One of the greatest dangers lies in the strategy of testing out new and improved crop varieties in On-Farm Tests (OFTs). If any new variety performs poorly in comparison with local varieties, the confidence of the farmer begins to be undermined.

Project-Managed Experimentation (PME), as is being conducted by the NGOs in research/demonstration centers situated in the midst of the farming community, offers the most effective and successful means of technology development and dissemination. Farmers, even though skeptical initially, become convinced as they see the improvements that are derived from Wynne canals, living hedges, "zero" tillage, and leguminous species such as *Calliandra*.

f) Farmer Motivation

Very little farmer motivation is required when farmers see for themselves the advantages that new technology brings them. At the center, over a period of time, they noticed the larger pineapples that grew at the lower edges of the Wynne canals and the larger yams that were produced when the vines grew beside Calliandra trees. The motivation to consider new technology with an open mind was reinforced by these step-by-step advances, especially when the effects were found to be reproducible on their own fields.

ORE's policy is to motivate farmers by providing incentives in the form of good quality seeds of yams, sweet potatoes, corn, sorghum, and black beans to all farmers who implement soil conservation technologies on their land. Once the farmers see that these technologies begin to bring them economic advantages, they don't need any more incentives, since the advantages are sufficient to motivate them.

ORE has also initiated an indirect incentive program under which tools, a blacksmith's services, veterinary services, and agricultural supply stores are provided for farmers. The aim is to gain and reinforce farmer participation in the project.

g) Scale of Operation

The scale of operation should always be small and localized at the beginning. For example, Formond farmers discovered the advantages of planting the N-fixing leguminous tree *Calliandra calothyrsus.* They found that besides increasing yam yields, it also had aesthetic qualities. The women appreciated the beauty of the flowers so much that they insisted on planting it in avenues leading up to the front door, simply to enjoy a flowering avenue pointing the way to their residences. Calliandra trees became so numerous that the taste of the honey produced by the bees in the vicinity began to change, a fact much appreciated by the Formond villagers. In addition, farmers found that the tree branches provided easily obtained yam supports and that they did not need to spend $80.00 every year to purchase supports consisting of saplings cut from the forest. There was and continues to be a significant reduction in deforestation pressures. The news about Calliandra has begun to spread to other nearby communities. Farmers are collecting seed by themselves and selling it at about $5.00 per kilogram. It is clear that if the technology works, then the operational scale only needs to initially be small.

h) Feedback from the Farmer

Feedback from the farmer implies that the developing agency is listening. It is important to know what farmers are thinking. When the ORE demonstration center was first rented and work was initiated, all the farmers in the area thought that the Project personnel were fools to lease land that was totally infertile and useless. They changed their opinions when they saw the land begin to regain its fertility under "zero" tillage. At the present time the project personnel are special people who signify progress and who bring technology that means economic advantage.

2. *Forage and Livestock*

With the objective of raising the productivity of the animal husbandry activities of the typical farm household in the PST target area, a number of livestock-related interventions were undertaken over the life of the project. They included the following:

a) Promotion of Grass Contour Conservation Barriers

Elephant or Napier grass (*Pennisetum purpureum*) and Guinea grass (*Panicum maximum*) have been in Haiti for decades, and have even seen some applications for soil conservation. PST vigorously promoted the use of these grasses for living conservation barriers planted along the contour. These species establish quickly by vegetative propagation, can yield a first harvest in three to six months, and generally form an effective soil conservation barrier within a year. Napier grass in particular produces a substantial biomass of good-quality fodder. Many farmers already knew of this grass, and were anxious to acquire planting material.

One reason for the rapid expansion of this intervention was that the demand for planting materials was foreseen by the PST Livestock/Forage Specialist. Major efforts were devoted during the first year of the project to the multiplication of Napier grass. After the harvest of the first 1/4 hectare plot established by the PST team at an ORE-provided site, that

organization expanded multiplication efforts to manage over 4 ha at the peak of project activities. During the first UNICORS planting season, at least seven large transport trucks of planting material were procured and delivered by ARD. Towards the end of the first project year, USAID approval was obtained to establish an ARD plant multiplication plot, and all NGOs were regularly supplied with additional plant material for several seasons.

The success of grass barriers is clearly reflected by the number of linear meters planted by participating farmers. Of a reported total of 1,789,916 linear meters of vegetative conservation barriers established under PST, approximately 75 percent are planted with grass species. Grass has become a marketable commodity in some localities. DCCH has reported a groupement from the Pereny region selling the biomass production. ORE reported that some farmers near Saut Mathurine have actually produced and sold planting material after PST quit making deliveries.

By early 1989, the PST Livestock/Forage Specialist was also promoting the use of these species to other projects in Haiti. Technical presentations were made to PADF and during the annual Haiti Health and Agricultural Conference. Although use of these species has increased substantially in many parts of Haiti, most programs will not be able to meet the near-term demand because inadequate efforts have been devoted to multiplication of plant materials. Given the farmer interest in Napier grass, however, and the indications that this is a marketable commodity, it should be possible to develop more innovative approaches to the production and distribution of planting materials. Such innovations should address this activity more (even if not entirely) as a commercial undertaking rather than as a project subsidy.

Several agroforestry reports have cited damage caused to hedgerows by livestock as a detrimental impact. While this may be true if the sole purpose of the hedgerows is to produce green manure for adjacent alleycrops, the PST team argued that rather than viewing livestock use of agroforestry plantings as detrimental, this is in reality a major economic benefit. The farmer who permits this usage is aware of this advantage, but since the projects have been too narrowly oriented towards agroforestry rather than agrosylvopastoral applications, this divergence has continued. Hopefully, the recently completed economic analysis of the Agroforestry II project, which clearly indicates that fodder is a major economic benefit, might result in a more equitable and integrated approach to the development of hillside farming in Haiti.

b) ARD Seed Depot and Multiplication Site

Early in the project, it became obvious that plant materials and seeds would be a limiting factor to PST implementation of the vegetative contour barrier soil conservation intervention. Although there were differences of opinion as to whose role the production of these materials was, it was decided that ARD should both promote NGO independence in this regard and backstop when required during the institutional development phase of PST. A small outbuilding adjacent to the home of the Livestock/Forage Specialist in Camp Perrin was modified into a rat-proof, climate-controlled seed depot. This work was completed in August 1988, and ARD began the procurement and distribution of seeds. With approval from USAID, ARD rented a 1-ha, irrigated parcel for the multiplication of plant materials and production of seeds from herbaceous leguminous plants.

During three years of operations, over 270 accessions were registered through the seed depot, and approximately 3,200 kilograms of seeds were packaged and distributed. A three-part tag was prepared and attached to each of the nearly 300[2] separate distributions to facilitate tracking of this germplasm. Unfortunately, it was rare that reports of final destinations (planting sites) were returned by the NGOs. Germination tests were routinely made prior to seed distribution. Full accession records detailing plant species/cultivar, provenance, supplier, phytosanitary permit number, and other relevant information were maintained, as well as a log of distributions. These records, along with residual seed stocks, will be given to the central seed laboratory maintained by PADF under the Agroforestry project.

The 1-ha ARD plant multiplication site was first established in September 1988. Vegetatively propagated plants such as Napier grass (five varieties), Guatemala grass, Guinea grass (two cultivars), *Andropogon gayanus*, *Brachiaria* spp., African Star grass, and nine cultivars of sugarcane occupied approximately one-half of the irrigated site. As these plants matured, they were harvested and distributed to all NGOs and some individual farmers. Based on the results of a qualitative trial using the entire range of sugarcane cultivars provided by ARD, UNICORS determined that "Medialong" was a superior selection for high elevation sites. A wide variety of herbaceous leguminous species were planted in other parcels (ranging from 200 to 400 m^2) to produce seeds. As many as 25 different species were under management at the site at one time. Although good seed harvests were obtained for a number of leguminous plants (e.g., Velvetbean, Siratro, Terramnus, Glycine, and Tropical Kudzu), the goal of preparing a seed production manual for these plants was not achieved for lack of time.

In order to locate commercial sources of seeds for the forage species listed in the Project's Working Document No. 22, a mass mailing to over 100 companies and organizations involved in seed production or marketing throughout the world was made in the spring of 1988. Based on the replies received, a cross-referenced report was prepared by species (divided into tree/shrub, grass, and forage legumes) which indicates which company handles the species, the current price, and the availability of provenance and/or germination certifications. Sources for 9 species of trees, 13 grasses, and 12 forage legumes are identified, along with complete addresses (including phone/telex/fax numbers) for 23 companies.

c) Applications for Herbaceous Leguminous Plants

Applications of "green manure" plants as cover crops for soil conservation and to enhance soil fertility are well known. This technology requires only the selection of appropriate species, and experimentation to determine the best ways to integrate them into local farming system practices. These plants were especially important because most of the species also provide high-quality (i.e., high protein content) livestock forage.

The first PST experience with herbaceous legume cover crops was a joint field trial conducted by both ARD and ORE. The trial objective was to evaluate a corn/Velvet bean

---

[2]. Estimated number; sudden evacuation from Haiti precluded access to records during preparation of this report.

intercrop technique widely used in Honduras by World Neighbors, and introduced with some success by MCC in the Plateau Central. Seeds were obtained from MCC with the assistance of IICA. ORE did not elect to continue the trial after the first season, and Velvet bean was "shelved" for a time until later adapted with considerable success for a fallow/minimum tillage system by the ORE Agronomist. Other annual herbaceous legume species used by PST were Jackbean (found to be more suitable for the skeletal soils common in many areas where IRD worked) and Sunnhemp, a species imported by ARD from Hawaii at the suggestion of the Livestock/Forage Specialist. Sunnhemp, although questionable as a fodder species, does hold considerable promise for substantial green manure biomass production during short fallow periods.

A major effort was also made to develop applications for perennial herbaceous leguminous (PHL) species. Over 25 species and cultivars were screened and a number of species (most notably Siratro, Glycine, and Teramnus for the lower elevations, and Desmodium and White Clover for high-elevation localities) were identified as well adapted and highly productive. In fact, data from the ARD-managed Brutus Site indicates that a Siratro/Teramnus mix produces more green manure biomass than *Leucaena*. Successful applications developed for these perennial species include:

- Planting narrow strips every 1 to 2 meters along the contour to provide physical barriers, green manure, and more substantial ground cover during the cropping seasons. Trial results indicate that this technique is not only compatible with annual field crops, but increased corn yields by a factor of four.

- Underplanting coffee plantations to control weeds and produce green manure/livestock fodder. Although the trial for this application involved *Desmodium* at elevations over 1,000 meters, this technique, using other PHL species such as Siratro, may also be suitable for lower elevation fruit tree orchards.

- Underplanting grass contour barriers. This technique is a modification of the common practice of planting mixed grass/forage legume tropical pastures. In addition to the nitrogen contributed to the grass by the legume species and the improved fodder value of the mixture, there are two distinct advantages that this technique has over the more typical improved pastures seen in other tropical countries. First, the 5 to 10 meter interval commonly used for the establishment of these contour barriers allows sufficient sunlight to reach the legumes and precludes the shading problem often encountered in mixed tropical pastures. Second, since it is recommended that these plants be cut and carried to animals, preferential grazing by livestock is also eliminated.

- Underplanting tree protein fodder banks with PHL species to provide additional ground cover (erosion control) and additional biomass production for livestock fodder.

d) Animal Health Program

The recommendation in the PID and Project Paper to include a program to train local residents as veterinary aides was based on two factors. First, the major livestock health problems identified in Haiti were poor nutrition and parasites. Incidence of two other afflictions, anthrax and tetanus, could be significantly reduced by regular vaccination campaigns. Health problems at this level can be handled by veterinary aides. Second, a program initiated at the Albert Schweitzer Hospital in Deschapelles by Dr. Rodney Frank in the early 1980s had successfully trained local residents to undertake these kinds of treatments.

At the commencement of PST, a World Concern DVM assigned to work with IRD and the Director of IRD were approached to persuade them of the potential benefits of a program to train veterinary aides under the auspices of PST. The DVM expressed his interest, and the Director of IRD was willing to share this program with the other participating NGOs. Accordingly, the ARD/PST Livestock/Forage Specialist worked with the DVM and World Concern to prepare a budget for this work and to facilitate the contracting arrangement. The concept and value of this program was also explained to the other PST NGOs, and help was provided to them to budget for the necessary supplies and pharmaceutical stock.

The first series of courses was conducted in August/September 1988. In addition to conducting the training program, the DVM and two IRD staff assistants scheduled follow-up on-site visits with the graduates and assisted the NGOs in organizing clinics and vaccination campaigns. A total of 45 veterinary aides were trained during the initial series of courses; 40 are still practicing their new trade. Another 23 students have completed one half of the curriculum, which had to be suspended due to political unrest in October 1991.

A fundamental precept of the program was that the veterinary aides trained by PST would not receive salaried positions. The assumption was that they would be able to sell their technical skills via services to local residents. Initially, this radical departure from the more typical development programs in Haiti was not very popular. But as veterinary clinics and vaccination campaigns were scheduled, it was seen that farmers were indeed willing to pay for these services. During the two years that the program has been operating in the field (post-training), approximately 8,000 animals have been vaccinated and another 22,000 have received some other form of treatment (most commonly an anti-parasitide). This program has exceptionally high potential to be sustained post-project, and even expanded to other areas of Haiti. Farmers are definitely willing to spend reasonable money to maintain healthier animals.

Once the training courses were underway, it was not necessary for ARD/PST to devote significant amounts of time to this aspect of the veterinary program, but other contributions were made as required to further the program. These included preparing a waiver for AID/Washington approval for the procurement of pharmaceuticals - restricted commodities under the terms of the NGO grants. Assistance was also provided for the sourcing and procurement of the first shipments of veterinary products. As the program progressed, ARD/PST was instrumental in the design and promotion of two field record forms used by veterinary personnel to document the treatments performed. These forms were the only record of technical activities used by all four of the participating NGOs.

The veterinary program as developed by PST has successfully trained local farmers to perform some of the basic but necessary services required for improved livestock production.

It has furthermore demonstrated that peasant farmers place a high enough value on their animal holdings that they are willing to pay for reasonable fees for these services. This is in sharp contrast with other agricultural activities in which farmers still appear unwilling to make such investments. Since this program is based on fees paid by the recipients of the service (i.e., the farmer), it has strong potential for being self-sustaining. However, after only three years it has not yet reached the stage where the program can function without continued technical assistance. Since healthier animals are more productive, and actual losses of some animals have been reduced by effective treatments, this program has successfully addressed one of the two goals of PST--increased revenue for the farmer.

e) Livestock Improvements (Genetics)

Ideas concerning the role of livestock per se in PST have varied considerably during the project. During the first half of the project it was frequently stated that PST was a soil conservation project and not a livestock project. This viewpoint reflected a misunderstanding of the term watershed management. It also neglected to consider peasant strategies for increasing their revenue. During the last year, partially due to the success of the veterinary program, livestock became a more promising and acceptable intervention with PST. USAID eventually supported the importation of improved sheep and goats from the Dominican Republic.

There was little general support for genetic upgrading as a project activity during the development of the grant agreements with the NGOs. Given the time and expense required for livestock improvement programs, and the overall goals of the project, it was felt that the fundamentals of animal husbandry--feed and health--should be addressed first rather than adopting the genetic "quick-fix" approach. It was also felt that with the increased production of fodder obtained from the vegetative contour barriers, all participating farmers would be able to attain the attendant benefits of increased livestock production, even if limited by the genetic potential of their indigenous breeds.

Although genetic improvements never constituted a major project activity, the ARD/PST Livestock/Forage Specialist did undertake certain preliminary efforts as opportunities arose with the idea of setting the stage for a second phase of Proje Sove Te. The following activities in that regard were undertaken through the efforts of the ARD/PST Livestock/Forage Specialist:

- The University of Florida Pic Macaya Project team was assisted during their initial introduction of the "rustic" swine to the Formond locality. This assistance included arranging for temporary quarters in Camp Perrin and caretaking for the first two groups of animals prior to their delivery to Formond. Subsequent assistance included vaccinations and other treatments as required at Formond. Two UF/MBRP participants were aided in obtaining training under the IRD veterinary program.

- ARD/PST also provided initial advice to PST NGOs when the USAID project coordinator in Les Cayes arranged to acquire additional rustic pigs for the project. In general, however, PST did not devote much time to swine repopulation efforts. The reasons for this avoidance were threefold: (1) both

the NGOs and Haitian farmers were capable of basic swine husbandry; (2) swine repopulation activities in-country were more a political endeavor than a technical livestock activity; and (3) the majority of feedstuffs produced from the living conservation barriers were better suited for ruminants than for monogastric swine.

- In July 1988, a purebred male Nubian goat was purchased from CODEPLA. The purpose of this acquisition was to develop a pilot breeding program. It was hoped that the experience gained from this pilot program would assist with the design of a more appropriate approach. The breeding program began towards the end of 1989, and slowly expanded by word of mouth.

3. *Agroforestry and Tree-Planting*

Building on past accomplishments of tree-planting efforts in Haiti, and cognizant of the fact that for many of the steeper lands in the watersheds, perennial crops were the only production alternative, the project designers were convinced that agroforestry would play a significant role in the Proje Sove Te. There appeared to be many choices of agroforestry options ranging from random and occasional trees planted in farmers' fields, as typified by the "Bwa Blan" (*Simarouba glauca*) commonly seen in the project area, to much more sophisticated inter-cropping of multi-purpose trees in close association with traditional crops, to the even more complex multi-tiered associations of trees, shrubs, and crops in the "Jaden Lakou."

In the absence of more widespread experience testing various models, the ARD/PST team chose a few of the simpler models. Most of the rationale for these choices was based on the socioeconomic considerations related to peasant farming in the hillside areas rather than on the biophysical conditions. This approach, parenthetically, is perhaps one of the more general lessons of PST which may be applicable elsewhere in Haiti (and in other countries with similar conditions) both for watershed management and agroforestry projects.

Confronted with the wide variety of circumstances involved in addressing the constraints associated with hillside agriculture, an experienced technician can discern innumerable needs and opportunities for the introduction of agroforestry and tree-planting from the analysis of the bio-physical environment. However, knowing what could be done is not the difficult part. Selection of the right technologies, selection criteria, and priorities are all keys to a pragmatic approach to the integrated activities inherent in watershed management.

Personnel involved in such agroforestry-cum-watershed management projects need to recognize early on that they cannot and should not attempt to address all of the needs and opportunities for including trees in the local farming systems. Their limited resources, typically human resources and time, and sometimes funding, simply will not allow it. How then to make the selection? The answer, although simple, is often overlooked. A comparison of the bio-physical situation filtered by a thorough understanding of the socioeconomic circumstances and constraints of the key actors--the farmers--often, if not always, provides the common denominators for selecting project interventions of highest priority and maximum impact.

This point is being made here because, in the case of agroforestry, PST was fortunate to have someone on the team who was well-versed, better than most (including some of the Haitian agronomists of the NGOs), in the socioeconomic components of the PST area. The work of the Farming Systems Specialist and in particular, her analyses of the farmers' interests in trees highlighted important realities which guided the selection of the earliest agroforestry experimentations. Applying agroforestry techniques to save soil and raise farmer incomes seemed to be conditioned by the following socioeconomic circumstances:

- the small size of the farm holdings and individual plots that made up the farmers' production base;
- the varied tenurial arrangements which militated, at least at the outset, against long-term investments on the lands of the farm community;
- the realization that labor was occasionally/sometimes/often a constraint during the farming year;
- little capital other than labor, land and a willingness to work; and
- the general experience in the area of the past highly subsidized conservation efforts which had left a legacy of dependency rather than self-help attitudes among the farmers, especially as this related to soil conservation and watershed management.

With these considerations in mind, the ARD/PST project team, in close collaboration with the partner NGOs who were very interested in agroforestry, studied, researched, and developed a series of interventions in that area. The most promising of these interventions was contour hedgerows planted by direct seeding of multi-purpose leguminous tree species.

a) Contour Hedgerows[3]

Living hedgerows ("haies vives" or "ramp vivan") are defined as a series of relatively narrow bands of perennial vegetation planted on the contour with the objective of improving the soil and micro-climate of the site, helping to raise the overall productivity of the site and also producing goods of interest to the farmer (e.g., green manure, forage for animals, and sticks for firewood). The species employed for this practice are typically small- to medium-sized nitrogen-fixing trees capable of coppicing after being pruned.

The advantages of contour hedgerows, from both the production and protection viewpoints, are as follows:

- acting as a physical barrier along the contour and thus helping to control rainfall runoff, improving water infiltration and thereby reducing soil erosion;

[3]For further more detailed information on contour hedgerows, refer to the Proje Sove Te publication: "Guide PST Pour L'Etablissement et L'Amenagement des Haies Vives", March 1990.

- aiding in stabilizing the slopes through the binding action of the roots;
- fixing nitrogen in the soil for use in plant growth;
- providing a source of leaves rich in nitrogen that can be used as a green manure, protecting the soil and adding organic matter which in turn will improve the cation exchange capacity of the soil;
- improving soil structure through root action and encouraging the propagation of beneficial soil micro-organisms;
- exploiting the nutrients deeper in the soil layers and depositing them through leaf litter;
- improving the micro-climate for crops planted between the hedgerows;
- providing significant quantities of high-quality fodder for animals; and
- providing stick materials, resulting from the regular pruning exercises, that can serve as fuelwood for the farm household.

It should be recognized that the establishment and management of living contour hedgerows will raise the costs associated with the traditional farming systems practices. Discussing this problem with the participant farmers has proved vital to ensuring that they fully understand both the benefits and the costs of the technique. Such an understanding will aid in helping them to understand how to maximize their advantages through the correct application of the technology. For example, the establishment of the hedgerows, including the preparation of the furrow/berm along the contour on which they are sown, will demand more labor than traditional field preparation. The hedgerows may also impede the practice of burning crop residues and weeds. During the early period of establishment, it will be necessary to protect the growing hedgerows from damage by animals. This should be well understood even if their long-term goal is to provide additional fodder for the same animals. Finally, in order to minimize the competition between the hedgerow trees and the crops planted in between them, the farmers will be obliged to prune the hedgerows to 50 cm. in height at regular intervals during the crop season. Up to four to six such prunings will be required depending on site quality.

Perhaps one of the most important lessons to be drawn from the experience of Proje Sove Te with contour hedgerows is the fact that they are not a panacea for all the problems of hillside agriculture in Haiti. Indeed, even on modest slopes for which they are intended, they should be understood as only one small part of the complete package of interventions required to improve the productivity and sustainability of peasant farming systems.

b) Experience with New Hedgerow Tree Species in the PST Area

In addition to the use of *Leucaena leucocephala* which has been widely used in Haiti as a multi-purpose tree species, both for tree-planting and hedgerows, PST promoted the introduction and experimentation with a wide variety of other similar multi-purpose

leguminous tree species. These introductions and experimentations were put in place for a variety of reasons, including: avoiding the dangers of monoculture, overcoming farmer resistance to *Leucaena*, finding species better adapted to the soil and altitude conditions throughout the project area. That experience is briefly summarized below:

Calliandra calothyrsus was a relatively unknown species in Haiti at the beginning of Proje Sove Te. PADF had produced trial quantities of the species at some of their nurseries in 1987. Similarly, the IICA project working on alternative swine feed resources was producing and distributing *Calliandra* seedlings. The PST project obtained approximately 4,000 seedlings from IICA during the first half of 1988, and distributed 2,000 each to ORE and UNICORS, the only two PST NGOs operational at the time. Most of the trees provided to UNICORS were planted along the newly constructed road between Rendel and Grande Plaine. Although there were relatively high mortalities, many of these trees did survive and are now serving as a source for seeds. ORE took maximum advantage of this distribution and planted these seedlings in a number of configurations (e.g., hedgerows, border plantings, and even a seed orchard) at Formond. *Calliandra* has since become the most popular and useful agroforestry species in that locality. *Calliandra* has also demonstrated reasonably good growth on a series of different sites around the PST Project area. It was subsequently included in ARD/PST hedgerow species trials, and found to be similar to *Leucaena* in overall performance.

Gliricidia sepium was another species which, although apparently well-suited for hedgerow applications, had produced poor results during the first year of field plantings. In an attempt to determine if a different provenance selection might be more suitable for PST conditions, a set of seeds assembled for the Gliricidia Provenance Trials by the Oxford Forestry Institute in England was procured. Seven of the provenances were planted according to the "fuelwood" trial protocol at the UNICORS multiplication site in Rendel. Although one provenance did prove superior to the others (including the local variety), overall performance of the species was still judged to be poor. Another set of seeds for the "hedgerow" trial protocol were provided to the University of Florida, but the seedlings were inadvertently mixed at the Formond farm nursery, and the provenance data rendered useless.

Sesbania grandiflora was formerly a widely used tree in the Agroforestry project, but was subject to attacks by caterpillars and therefore decreased in popularity. The author identified sources for *Sesbania sesban*, another species reported not to be subject to infestations. *S. sesban* proved to be a fast growing, but relatively weak statured tree, which produced only modest amounts of green leaf matter and large quantities of seeds. It did not coppice well. Although ILCA[4] is currently researching a large number of *S. sesban* varieties, the species cannot be highly recommended for most conditions found within the PST project area. The one exception to this position might entail using the species as a pioneer hedgerow plant on poor skeletal soils which do not seem to support most of the other tree or grass species.

[4]International Livestock Center for Africa, Addis Ababa, Ethiopia.

In a report entitled "Forage and Selected Hedgerow Species Suitable for High Elevation Sites in Haiti",[5] five species of trees (not including cultivars) were included. In addition to general observations pertaining to their performance under PST conditions, information is presented on their value as fodder plants. While the toxicity of mimosine contained in *Leuceana leucocephala* is well known in Haiti (even at the farmer level), most of the tree species also contain high levels of tannin or similar compounds. Thus, even though these tree species contain high levels of protein, it is recommended that fodder from these trees be limited to 30 to 40 percent of the ruminant ration in order to avoid complications.

In order to augment the number of tree species available for high elevation site applications, the project facilitated the establishment of performance/seed production trials at the UNICORS Grande Plaine sheep farm. With the collaboration of Mr. Joel Timyan (SECID/Auburn Agroforestry Research Team) species/provenances of trees were planted either as fencelines, windbreaks, or trial plots. The results of this work should not only identify additional species suitable for high elevation sites and serve as a source of seeds, but should also serve to demonstrate new options for the integration of sylvo-pastoral applications in Haiti.

c) Coppice-based Charcoal Production

One other forestry technique that was much discussed during the period of implementation of PST was the establishment of coppice-based fuelwood or charcoal production woodlots. Charcoal is the preferred source of domestic energy in the urban areas of the country. Demand for woodfuels is driving the constant advance of deforestation of the natural woodlands and forests of the country, to the point where woodfuel deficits loom large on the horizon. Farmers thus may wish to take advantage of the cash marketplace for woodfuels, particularly charcoal, by planting some of their more degraded and steep sites with fast-growing, nitrogen-fixing woody species and cutting them on a coppice basis for the production of charcoal. Unfortunately, unrealistic attitudes about the charcoal industry (i.e., that it must be banned) prevented the project from making any real inroads in advancing this proposed technology as a more appropriate land-use option for the PST area.

B. Socioeconomic Considerations

1. Land Tenure Issues

The design of Proje Sove Te was based on the assumption that the system of land tenure in the project area would greatly influence the possibilities of success of the project. The University of Wisconsin Land Tenure Center was given a contract to work in collaboration with Haitian sociologists on studies of land tenure conditions in two subsectors of the project area.

---

[5]Forage and Selected Hedgerow Species Suitable for High Elevation Sites in Haiti. B.D. Treadwell. PST Livestock Working Document Series Report No. 15. September 1991.

The studies were completed relatively early in the project and the results were presented at a seminar/workshop to the central staff of the NGOs and their extension workers. The ARD staff and key USAID officials also attended. The Wisconsin staff presented the results of the study, supplemented by the results of an ARD sociologist's Ph.D. thesis carried out earlier in the general area of Proje Sove Te. The Wisconsin study confirmed that farmers with secure rights to their land were more likely to want to participate in Proje Sove Te than farmers with less secure rights (e.g., farmers who were sharecroppers). As a result of the seminar/workshop, the PST extension workers were sensitized to the importance of the land tenure issue.

During the workshop sessions and at later meetings, there was considerable discussion of the implications of the Wisconsin study. The NGOs generally concluded that their early efforts should focus on finding technical packages and an extension methodology which would be effective with farmers who are secure in their land tenure. Since the PST program was voluntary and did not involve wages, farmers who volunteered to take part in PST could be expected to be farmers with secure land tenure.

Several NGOs remained alert to the possibility of using their offices to help sharecroppers negotiate an agreement with their landlords which would provide the sharecropper with an incentive to undertake the soil conservation measures advocated by the project. The NGOs also included technical packages in their program which might be of interest to farmers with relatively insecure tenure rights. The "rampe paille" system of soil conservation does not give as great benefits as the recommended hedgerow technology, but the "rampe paille" does give significant short-term benefits, and the expenditure of labor is much less than the labor required for a hedgerow. Thus, the NGOs included the "rampe paille" technology in their programs as one means of encouraging farmers with relatively insecure tenure rights to participate in Proje Sove Te in a manner which didn't require them to invest heavily in land which they might use for only a short period of time.

In view of the importance of the land tenure issue, USAID/Haiti signed a contract with a local Haitian firm, AGRICORP, to study on a continuing basis the interrelationship between land tenure issues and the work of Proje Sove Te. This work was carried out by one of the Haitian sociologists who had participated in the Wisconsin Land Tenure study. A number of very useful reports were prepared under this contract with AGRICORP.

PST officials also discussed informally with their colleagues in the Ministry of Agriculture the possibility of the government turning over government land to Haitian farmers as a means of encouraging these farmers to participate in Proje Sove Te. Most of the government land in the project area had been rented in large parcels to persons who then turned around and made the land available to farmers under cash-rent or sharecropping arrangements. Thus, the farmers actually working the government land had little incentive to undertake soil conservation practices. These informal discussions did not lead to specific proposals, although the University of Florida worked in a sister project under AID's Watershed Management Project umbrella and discussed a specific proposal with the Government to turn government land over to farmers.

The land tenure conclusions discussed above were a starting point for the NGOs in planning their outreach/extension programs.

2. *Outreach/Extension Approaches*

The outreach/extension approaches of Proje Sove Te were based on a fundamental assumption: nearly all farmers in the project area are interested primarily in increasing their standards of living and will participate in soil conservation efforts only if they believe these efforts are an essential part of a program which will increase their incomes.

The extension approaches also had to take into account an attitude held by many peasants: the USAID-financed Proje Sove Te had a moral obligation to provide minimum-wage jobs to large numbers of farmers in the project area.

In order to maximize the chances of success of their outreach/extension programs, the four NGOs emphasized the following:

- organizational concepts which would be effective with farmers in their regions;
- programs of educating farmers on the advantages for them and their communities of participating in Proje Sove Te;
- training of farmers in techniques to increase their incomes and to conserve their soil; and
- incentives (i.e., premiums ["primes"]), for farmers participating in Proje Sove Te.

As for organizational concepts, the major issue was whether an NGO would stress working with individuals or working with groups of farmers. Two of the NGOs (DCCH and UNICORS) had had experience in working with groups. DCCH had pioneered NGO efforts in the 1970s to persuade farmers to join together to have a voice in society and to improve themselves and their communities. This position was based on the philosophy of the CARITAS movement. As a coffee cooperative, UNICORS decided to set up relatively small groups of approximately eight persons based on the work squads which farmers form in many parts of Haiti.

IRD also had worked previously on the basis of forming groups and this approach was stressed in IRD's early project work. However, farmers in the new areas where IRD started to work had had unsatisfactory experiences with such groups formed by other organizations during earlier periods. IRD found that the early groups it formed did not work smoothly. Thus, IRD decided not to rely exclusively on groups and placed more emphasis on working with individual farmers.

ORE began its outreach program by stressing contacts with individual farmers. However, based on its early experience, ORE adopted the policy of working with groups of farmers.

Regardless of the approach used, the NGOs had to overcome the common farmer attitude that the project should give jobs. The demand for jobs had several roots. The project was undertaken in the aftermath of the overthrow of the Duvalier regime. The public felt that

earlier programs had favored the wealthy and those connected to the Duvalier regime; now it was time that the benefits of foreign aid should be distributed directly to the poor farmers.

The economic and social dislocation following the revolt against the Duvaliers--and the sharp reduction in foreign aid flowing to Haiti after the military refused to hold democratic elections--had created economic hardships for a number of people.

In Duvalier's time, the Ministry of Agriculture had been undertaking a program which involved farmers constructing stone soil conservation structures and the farmers had been given compensation for their work. Farmers felt that any new projects should also provide compensation and some Ministry of Agriculture officials argued that the poverty of the countryside required programs which provided jobs. Finally, the publicity for the project stated that $15 million would be spent to help 20,000 farmers. Farmers jumped to the conclusion that the project would give minimum-wage jobs to 20,000 farmers. This problem was particularly acute in the areas where DCCH operated, and there were also serious problems in part of the ORE project area. To offset this attitude, the NGOs held frequent meetings with the farmers to explain that PST would provide training, planting materials, and incentives in the form of modest premiums, but that the basic responsibility for raising incomes and saving the soil would rest with each farmer.

To increase the effectiveness of their outreach programs, three of the NGOs (UNICORS, IRD, and ORE) recruited their extension workers on a paid basis from among farmers in their areas. UNICORS signed renewable contracts involving the payment of money in order to encourage these farmers to consider themselves as farmers who were given special responsibilities, rather than farmers who had been promoted out of the farmer category and transformed into bureaucrats. IRD and ORE hired local farmers to serve as extension agents. DCCH wished to avoid designating farmers as project employees. Accordingly, DCCH recruited persons with higher levels of education who were not farmers as paid staff and started a program of providing special training to farmers in the DCCH groups. Thus, one farmer would be trained as a nursery specialist, another as a specialist in soil conservation structures, etc.

The NGOs provided incentive premiums to farmers. To encourage participation in the soil conservation effort, all of the NGOs provided basic soil-conservation planting materials to participating farmers. Thus, a farmer who wanted to plant tree hedgerows would be given the necessary seeds for direct-seeding of the trees and farmers who wanted to plant grass on the contour would be given the necessary grass cuttings. IRD had the most restrictive policy, although it did provide materials such as cement to some progressive farmers who wanted to construct cisterns as a means of collecting water for their kitchen gardens. ORE distributed improved seeds for basic crops such as beans and corn on liberal repayment terms (e.g., the farmer could repay the seeds with an equivalent amount of seeds from his harvest). During the early period of the project, ORE helped farmers lay out and construct the basic contour hedgerows. UNICORS had a program of distributing beans as a premium to farmers who participated in the program and met certain prescribed standards. DCCH, which was faced with the most difficult public-relations problem, had the most liberal premium policy. DCCH also adopted a policy of decentralized nurseries and signed contracts with its local groups to produce trees in return for a payment for each tree which was produced and planted by the group in question. IRD, in contrast, had a small decentralized nursery program which

involved giving only basic supplies to farmers who then supplied all the labor needed to raise the trees in the nursery.

Since the entire extension effort was based on the assumption that large numbers of farmers would participate only if they saw ways of raising their incomes, the NGOs and ARD placed a heavy emphasis on finding new technologies which would increase the productivity of farmers. (See later sections for a discussion of the technical packages and/or improved planting material which were developed.)

The development of these technical packages/improved varieties was based on a two-part system. First, there was practical research carried out by the four NGOs and ARD. This applied research under PST has been designated as Project-Managed Research (PMR). In order to determine whether these technical packages/improved planting materials would actually increase a farmer's income, the project adopted a system of Farmer-Managed Experimentation (FME). Under this approach, promising technical packages/improved varieties were tried out by farmers on their own fields. This system of Farmer-Managed Experimentation obviously also served as a key part of the extension program. If a farmer had success with his on-the-farm experimentation, there was a high probability that neighboring farmers would try the new approach.

As discussed below, the training program of PST also played a key role in the extension effort. Farmers were sent to the FAO training center at Limbe, to other projects, and to other activities of PST (e.g., DCCH farmers would visit the work done by another NGO).

3. Market Linkages

In a project such as PST, which stresses increased production as a means of augmenting farmers' incomes and soil conservation, it is important to assure that a market exists at a favorable price for the agricultural/animal husbandry/forestry products which are expected to be available in larger quantities.

Much of the soil conservation work is designed to stop and then reverse the soil degradation which has been reducing farmers' incomes year by year. It is thus unlikely that the results of a single season of soil conservation work will have a major impact on production and prices in the market.

Many of the technical packages deal with traditional Haitian crops which are widely produced and consumed (e.g., beans, sweet potatoes, and corn). While dramatic success in increasing production could lead to some significant drop in prices in the local market, there is a built-in safety net: the PST farmers would clearly not increase their production of these basic crops enough to have a major impact on prices throughout Haiti. If PST production did increase dramatically, the effect would be to lower the prices to PST farmers by enough to pay for the transportation costs of these products to other markets. Even under this unlikely assumption, PST farmers' incomes would be greater, since the effect of greater production would undoubtedly be more important than the effect of lower unit prices.

However, the project concluded that prices of crops in several of the key markets in the PST area should be collected weekly. The data were available for the NGOs, and ARD

published several reports which listed prices and analyzed the reasons for price movements of key crops. The reports included an analysis of seasonal price changes so that NGOs could determine if growing conditions in their areas might permit production which could be marketed during periods when prices are normally high.

PST also hoped to find specialty crops, particularly tropical fruits, which might find a good market in either Port-au-Prince or abroad. The NGOs undertook efforts to keep in touch with potential purchasers and ARD followed up on AID's support to APA--an organization of Haitian exporters of agricultural produce. This organization collected information on the exporters of Haitian agricultural products and also compiled a list of the products which the exporters wished to purchase. APA agreed to make this information available to any group participating in PST. This information presumably will be used in any subsequent phase of PST.

A thriving market economy is not only important for the sale of agricultural outputs, but also as a means of supplying farmers with vital inputs. Several of the NGOs (e.g., IRD and ORE) established small stores where farmers could purchase tools and seeds.

PST also trained persons in the project area as veterinary assistants who would operate as private entrepreneurs rather than as government bureaucrats. These persons were helped in purchasing basic medications (e.g., medications to deworm animals). The veterinary assistants then sold veterinary services to local farmers. Thus, a basic step was undertaken to make a project activity self-sustaining by using the market mechanism.

C. Institutional Strengthening

1. Planning and Budgeting

In establishing Proje Sove Te, USAID Haiti wanted to support four NGOs working in Southern Haiti. Since AID also wanted to be substantively involved as the project unfolded, AID signed Cooperative Agreements with the four NGOs. AID also established ARD as the Designated Agreement Manager for Proje Sove Te. ARD worked closely with the NGOs on a number of planning and budgeting questions. Because the Cooperative Agreements with the NGOs were signed on different dates, the project started with all four NGOs on different budget cycles.

As part of its project responsibilities, ARD initiated work on a PST planning system which was discussed with the four participating NGOs. As finally agreed among the concerned groups, the PST planning system

- established an agricultural planning year which runs from February 1--the general starting date for the first agricultural season of the year--and terminates on January 31 when the second agricultural season of the year has finished; and

- established a planning process which involves nine steps:
  - identifying the needs and interests of peasants,

- planning PST outputs/interventions for each of the two agricultural seasons,
- determining inputs needed by the project (the NGO plan document includes a financial budget for the year),
- planning activities to achieve the outputs and assigning responsibilities for these activities,
- scheduling monthly activities and outputs,
- calculating the impact of the program (e.g., have the outputs actually increased farmer incomes?),
- questioning peasants to get feedback on PST activities, and
- evaluating the PST program--and then repeating the cycle (see pages 18-20 of the Midterm Report for a fuller discussion of PST's planning process).

Each of the four NGOs prepared its own annual plan. The draft plan and attached draft budget was discussed with ARD and the AID Project Coordinator in Les Cayes. ARD then forwarded the plan to AID with comments on points of interest. AID then reviewed the plan/budget and approved the agreed plan and budget by signing an amended Cooperative Agreement with the NGO in question.

ARD used a six-month planning cycle to plan the work of its own staff. Each staff member would prepare a six-month plan of activities which was based on conversations with NGO technical staff and on personal observations in the field. The plan of proposed activities was distributed for comments to NGO staff and then issued in a final form (see page 24 of Midterm Report).

The planning process also included a system of regular Advisory Board meetings which brought together the NGOs, ARD, and USAID representatives and interested observers every three months. Based on experience, the meetings held every three months were renamed Working Group meetings and limited to NGOs, ARD, and USAID. Special meetings were held every six months which also included representatives from other projects in the area and the Ministry of Agriculture.

The system of quarterly meetings led to a development which strengthened the institutional capacity of the NGOs to carry on development work without technical assistance: the NGOs developed a pattern of meeting together the day before the formal Working Group meetings. Thus, the NGOs developed a system which could help assure that each NGO could carry on self-sustaining economic development activities through a system of interaction among the NGOs that would enable each NGO to benefit from the experience of other NGOs.

2. *Financial Management*

Proje Sove Te placed a major emphasis on improving the capacity of the NGOs in the area of financial management. AID asked ARD as the Designated Agreement Manager to review the financial management of each NGO and to certify that each NGO was capable of properly managing AID funds. In the case of several NGOs, ARD first provided technical aid in the form of assistance from the ARD Administrative Specialist and from an ARD consultant financial training advisor, who trained the new NGO accountants and bookkeepers. In several cases, the NGOs were given assistance in installing new accounting systems.

The vouchering process involved the four NGOs sending their vouchers to ARD for review and ARD then forwarding them to Port-au-Prince for review by the AID Controller's office. The actual check was prepared in Mexico City based on an authorizing cable from USAID/Haiti. Under this complicated vouchering system there were often delays and, in at least one case, an NGO had to suspend field operations because of a shortage of funds. In several other cases, the field operations could only be continued on the basis of loans from ARD (see pages 26-27 of the Mid Term Report).

In view of these problems, ARD arranged for a financial consultant to make several visits to assist the NGOs and to prepare an improved system for handling vouchers. In his last visit, the consultant worked with several of the NGOs to help assure that their accounts were in proper condition for the outside audits which were performed by local audit firms. The ARD Administrative Specialist and the ARD accountant also stepped up the pace of visits to the NGOs to work on financial matters.

3. Monitoring and Evaluation

To permit effective monitoring and reporting on progress, each NGO devised a system for recording outputs of individual farmers (e.g., meters of hedgerows planted and numbers of compost pits for each of the farmers in the NGO). Each NGO used a definition of outputs which was compatible with the definition of the other NGOs so that the outputs from the individual NGOs could be added together to give a total for Proje Sove Te. Nearly all of the NGOs prepared a table of results each quarter. All of the NGOs prepared a six-month report on the first agriculture season as well as an annual report which covered the results of the second growing season and summarized the results for the agricultural year. By periodically collecting information on outputs, the NGOs were able to monitor whether they were attaining the quantitative goals of their annual plans.

These six-month reports also served as the factual basis for the Six-Month AID Review of Project Progress which was held by the USAID Director or his designee in the project area. These reviews served as a system for AID monitoring and evaluation of the project.

ARD reviewed these NGO reports and provided comments either orally or in writing. These comments reflected ARD's monitoring and evaluation of project progress and were taken into account by the NGOs in preparing their new annual programs.

In response to a request from the NGOs, ARD arranged for an experienced Haitian agronomist to work with two of the NGOs in evaluating their work. A second Haitian agronomist was later contracted to work with the two remaining NGOs. These outside Haitian evaluators were able to provide useful advice to the NGOs on how to improve operations.

AID arranged for an American evaluation team to evaluate USAID/Haiti's hillside agricultural strategy, with particular emphasis on Proje Sove Te. The field work for this evaluation was performed in the spring of 1990 and the report was submitted later in the year.

4. Training

A major emphasis was placed on training as a means of strengthening the NGOs who were implementing Proje Sove Te. This training activity took many different forms:

- training by PST staff,
- training at other institutions in Haiti,
- field trips,
- short-term training outside of Haiti, and
- study tours overseas.

The high-level staff of the NGOs and ARD helped to train the field staff which was recruited by the NGOs. Each group provided training in the subject area where it had the most experience. Thus, ORE provided a wide variety of courses relating to the production of trees while the DVM of IRD provided veterinary training. ARD's Rural Sociologist helped UNICORS provide training in vegetable production to women interested in starting vegetable gardens. ARD's Soil Specialist provided on-the-job training in soils analysis to NGO field staff as he did his soil reconnaissance work. ARD's Livestock/Forage Specialist provided on-the-job training to NGO staff in planting hedgerows which mixed grasses and herbaceous legumes. ARD's Agronomist helped to train NGO staff in integrated pest management programs, and trained the UNICORS Agronomist in the use of a computer to quickly analyze data on project outputs. The ARD Administrative Specialist continued the work of his predecessors in training the financial staff of the NGOs.

A number of training trips were organized to the FAO-sponsored Limbe Training Center in the north of Haiti. This center has been one of the pioneers in training Haitians in soil conservation practices. NGO and ARD staff also went to the Madian-Salignac Training Center to study how field staff should interact with farmers when carrying out extension work.

The NGOs organized field trips. In some cases, extension workers and/or farmers would go from one NGO to see the work being carried out by another NGO. Farmers who had been skeptical that hedgerows would be effective were convinced when they visited farmers in other areas who had built effective hedgerows. NGOs also sent field workers and participating farmers to visit other projects (e.g., Save-the-Children's soil conservation project at Maissade in the Central Plateau area of Haiti).

Several trips were arranged to study developments in other countries. ARD arranged a trip in 1989 for the Directors and Technical Directors of the NGOs to study developments in Nigeria, Kenya, and Rwanda and a second trip in November 1990 for the top staff of the NGOs to study soil conservation and research programs in Central America. The NGOs also arranged a trip to study relevant programs in the Dominican Republic.

In view of the urgent need to use all highly-educated NGO staff on the project, no project personnel went on long-term academic training. However, the project did send several Haitians to the United States for short-term training. As a means of emphasizing the importance it gave to education and training, USAID/Haiti gave each NGO $100,000 which was earmarked for training activities. As part of the training programs, the NGOs and ARD produced a number of training materials in the form of pamphlets and short hand-out information sheets. ORE also produced training films. ARD produced a Hedgerow Manual in French and English. Thus, by the end of the period in question, a large number of Haitians had been effectively trained to carry out programs to increase farmer incomes and to conserve the soil.

III. LESSONS LEARNED

Some Introductory Remarks

The intention of this final section is to compile and reiterate some of the most salient aspects of the Proje Sove Te as "lessons learned" for those who will carry on with the project or with similar efforts in the area or in Haiti.

It would be beyond the scope of this report, and perhaps of little lasting interest, to attempt to reconstruct the details of the difficulties suffered by PST during the tumultuous period of its implementation from 1988 to 1991. A major hurricane, continuing serious political unrest and uncertainties, and more than its share of personal and personnel problems, brought on in part because of the difficult times suffered by Haiti and its people over the last several years, all contributed to the problems experienced by the project. Despite all, one thing is nevertheless very clear:

The basic rationale for this project, i.e., that unless the pervasive and progressive degradation of the area's upland watersheds is reversed there will be significant negative social, economic and environmental impacts, remains valid and vivid today.

A number of other factors contributed in significant ways to affect the implementation experience of the project. They include the following:

- *Basic Project Design Issues* - The original design documents included clear statements of goal and purpose, i.e., "to arrest the process of environmental degradation in Haiti's watershed areas" (goal), and "to extend soil-conserving and fertility augmenting land management practices in the target area" (purpose). In retrospect, however, these larger aims were not fully disaggregated into immediate and actionable objectives. An overall "output" orientation seems to have caused a tendency among all concerned to focus on final outcomes without adequate attention, time, or sometimes resources to achieve them.

- *Confused Working Relationship between NGOs/USAID/ARD* - The original intent of the design was to channel all the resources intended for the NGOs through the "umbrella contractor," thereby providing clear lines of communication, authority and management. Just after contract approval, a decision was made to provide the NGO funding through cooperative agreements, thus compounding the administrative relationships of the project operations. Linked to this issue (and to be discussed at further length in the section on institutional issues below) was the autonomy this decision implied for the NGOs which made it difficult for ARD to challenge or guide the important objective of strengthening their respective competencies.

  The technical assistance team also ran afoul of the familiar difficulties associated with the reality that their presence in the project implied that someone (namely the NGOs) needed assistance. Strong personalities and mixed capabilities exacerbated the relations between ARD and the NGOs in this regard which was

compounded by occasionally ambivalent attitudes on the part of USAID towards the role and responsibilities of the technical assistance team. Despite the best efforts of almost all involved, these tensions were a day-to-day factor in the smooth implementation of the project. At the field level, on the other hand, there existed excellent collaborative relations between NGO and ARD project staff.

- *Fluctuating Attention to Step-by-step Implementation* - A variety of factors did not allow the project participants to see activities through the full cycle of development action: problem identification, R&D for an intervention to resolve it, field testing, staff and farmer training and wider distribution in the field of promising technologies. This failure to follow the implementation plan set out for the project, exacerbated by start-up delays and the planting season lost to the effects of Hurricane Gilbert in 1988, was very much driven by the output orientation and the understandable impatience of some project beneficiaries. The fact that *replicability is the key to implementation success and the eventual sustainability of project interventions* was often overlooked under the pressure to deliver the prescribed outputs.

- *Funding Uncertainties* - Recurrent uncertainties regarding the continuing availability of project funding and its level, owing to political events and the year-to-year allocation of budget levels, made it difficult to take the long-term view so essential in natural resources management projects. These uncertainties were unintentional; indeed the original project documentation suggests a project of ten years duration. They came about largely as a result of the unusually unstable political situation in the county. Their impact, however, was serious because they made it difficult for the NGOs to concentrate on institutional and staff development, and resulted in the gradual diminution of the ARD field team.

The remainder of this section of the report will present and briefly discuss the major findings to-date of the project experience in the form of "lessons learned." In many cases, the analysis is somewhat subjective, based on the viewpoints of the ARD authors (all of whom were intensively involved in the project over several years or more). The somewhat truncated project period and the uneven nature of its implementation make it sometimes difficult to link cause and effect in absolute terms.

The lessons are therefore somewhat speculative but, it is believed, well worth considering nevertheless. The interested professional familiar with watershed management as well as those whose task it will be to carry on with or follow up on the Proje Sove Te should find them useful.

This section is organized by major theme areas; many, of course, are interrelated but separated here for ease of presentation. Where pertinent and useful, suggestions and/or recommendations concerning the lessons are also included.

A. Policy and Strategy Issues

Watershed management is by definition a form of integrated rural development albeit focused in the main on the natural resources elements of the rural scene. As such it is affected by a wide range of decisions in the policy arena. Accordingly, a number of policy lessons although certainly not all, have emerged in the course of the last few years of PST experience.

1. Broad-based Rural Development Strategy

As part of the programming and planning for its agriculture portfolio, USAID/Haiti carried out a review of its "hillside" agriculture strategy. Although quite controversial, the study clearly came down on the side of the more integrated and broad-based approach to rural development in Haiti's hills and mountains. There is, however, an emerging understanding of the fact that the basic ills of rural Haiti - disenfranchised peasants eking out a living on poor soils and consequently causing grave environmental degradation - cannot simply be overcome with soil conservation and improved farming practices.

The past USAID emphasis on "agroforestry" (really tree-planting on the farms) under conditions of sloping land has overshadowed the importance of interventions in the agriculture and livestock sectors. More and continuing attention in this direction will be needed given the inherent limitations of the resource base. Too many projects of this nature, i.e. inherently top-down, start with the premise that they must "sensibilize" the peasants. Farmers in such conditions live the degradation from day-to-day and are very aware of the impact of their practices.

The reality of very limited natural resource capabilities dictates *a wider range of rural and regional development options* that must accompany the focus on the agricultural sector. Decentralizing the industrial base to provide local or regional employment and promoting off-farm income earning opportunities need to be considered and the investment mustered to put them in place. In general, it would seem that *agricultural development must be accompanied by a parallel effort to get people off the hills if real impact is to be ultimately achieved.*

2. Raising Expectations

Closely linked to the above considerations is the need to avoid inciting the interest and involvement of the farmers to think that there is really a future as a farmer under the "minifundio" conditions of upland Haiti. Projects should not be palliatives for more drastic socio-economic and political changes that may be required. They must avoid reinforcing the unfortunate "status quo". Haiti has embarked on an era of political change from which there can be no turning back. Development projects must provide the positive stimulus to further inculcate those changes and ensure their socio-economic feasibility and sustainability.

It has often been stated that in rural Haiti, land tenure and land security continue to play an important role in the ability and willingness of the farmers to accept some of the long-term investments associated with improved conservation based farming practices. *The various hypotheses about land tenure must continue to be explored and studied.* Although it is highly controversial, shying away from this important issue may only postpone real solutions.

3. Credit and Investment Issues

Credit programs were not implemented under this phase of PST although they were envisaged in the planning documents and will certainly be an important part of more modern approaches to smallholder farming in the area. Future efforts must ensure that credit programs (and untested technologies as well) do not further weaken the farm households' tenuous hold on financial and subsistence stability by burdening them with credit for new interventions that cannot pay off, given the inherent resource limitations. Directly related to credit is the potential need for incentives and subsidies to offset the production tradeoffs often associated with establishing improved conservation technologies or mitigating the extremely fragile production circumstances of the family farm.

Over the near term, ***it is recommended that government and its donor partners devote more resources to both the macro-economic study of watershed management in general as well as the cost/benefit analysis for new technological interventions.*** Such studies must be the ultimate proving ground for watershed management strategy options. They will enable all concerned to define whether either the government or the farmers will be able to sustain the levels of investment essential to restoring degraded areas and improving livelihoods in the area.

4. The Role of the NGO Community and the Government of Haiti

In the absence of operational government services in this distant part of the country, the NGO community has come to gradually replace the role of government, particularly in terms of social welfare and development. They have proved themselves effective and committed to the task. The role of coping with the GOH vacuum, and indeed occasionally having to confront outright antagonism from Departmental staff who were left out of the project at the last minute because of the political situation, was not, however, foreseen as part of the policy environment for the project. Although the Government of Haiti, under pressure from USAID, sanctioned the NGO mode of project implementation, it is clear that NGOs cannot and should not operate without the policy guidance, governance arrangements and support functions of central or regional authorities. ***USAID and its NGO associates should assess the prospects of a future GOH role in watershed management planning, administration and execution in order that some of these important functions have a long-term institutional home beyond the life of the project.***

5. Historical Legacy of Employment Projects

In the past, many of the soil conservation efforts undertaken in Southwest Haiti were carried out through food-for-work, local currency generation projects and paid labor. These programs provided highly visible impact and quick and direct returns to the participants, both key considerations in a participatory approach to watershed management. Local people clearly welcome these types of programs. There are, however, unavoidable questions that must be raised about their overall effectiveness and efficiency. The recurrent costs of such programs reduces the scale of the overall effort possible in any given year. They are also somewhat transitory in nature and only limited follow-up is usually accorded the treated areas, again because of the recurrent costs. The tendency in the past has also been to focus on the

rehabilitation of degraded areas, often state lands which were cultivated informally on a shifting cultivation basis.

The scale of the problem of watershed degradation in rural Haiti suggests that these "jobs" based programs can barely scratch the surface of the needs. In order to achieve realistic impact, projects aimed at self-help among the principal actors and building on the resources already available to them- land, labor, technology and capital- decreases the costs per unit area treated and provides better assurances of long-term maintenance. The Government of Haiti Agriculture Department personnel in the project area (Les Cayes Region) were clearly skeptical and occasionally vociferously opposed to the self-help approach. This created an early measure of resistance to PST among the farmers. Any future efforts will need ***a clear policy position among GOH personnel*** to prosper.

As the section immediately above suggests, self-help may not be enough; incentives and subsidies may be needed to offset production tradeoffs and protect the farm families involved. They may be justified because of the otherwise devastating downstream effects resulting from watershed degradation. ***It is recommended that these incentives and subsidies should be clearly explained to the farmers and directly linked to measurable investments and accomplishments in order to avoid having them seen as pseudo social welfare programs.***

6. Land-Use Regulations

One of the important inconsistencies in the Haitian policy approach to watershed management is the fact that while tree cutting is not sanctioned, a farmer can do whatever he likes on the land after the trees are gone. Here again one encounters the bias regarding the relationship between tree cover and erosion and hence the conviction that tree-planting will solve the problem. Even intensive tree-cutting for charcoal production so common in many areas of Haiti is less ecologically damaging than the traditional open furrow agriculture which follows it.

Over the long run, ***the Government may have to impose suitable land-use regulations,*** perhaps for the most sensitive areas (above impoundments or in the watersheds feeding irrigation systems) to ensure environmental stability. Such regulations must, of course, be accompanied with PST type programs aimed at assisting the farmer to avoid the inappropriate practices. One alternative which has worked in other countries (eg. the Cauca Valley Corporation in Colombia) is to create a local or regional entity charged with the management of the watersheds and natural resources. This approach vests local interests in local hands and provides them with the knowledge and leverage often necessary to take on some of the more intransigent problems and to lobby for support for their action program from central government.

B. Planning Concerns

There can be no underestimating the importance of planning for localized field activities aiming at watershed management. The PST target area covered 80,000 hectares and was expected to involve 20,000 client farmers. Even with the combined capacity of the various

organizations involved (and perhaps because of it), analysis and planning were seen as essential first steps to project implementation.

1. Baseline Data Collection and Monitoring and Evaluation

Substantial efforts were undertaken to develop the baseline data and information sets essential to implementation planning and subsequent monitoring and evaluation. These efforts, however, were incomplete because of the loss of key staff members and the overall impatience of many to "get on with the job". Baseline data collection of this type must begin with a preliminary assessment of the situation, followed by discussion and planning, among all concerned, to decide which information is most essential and how it will be obtained, analyzed, and maintained. The timing of this phase of activity as well as the scale and intensity and methodology of the sampling involved must be well established. A balance between getting started without the fundamental background information and the other extreme - paralysis by analysis - must be struck.

As a result of the difficulties with the baseline data sets, the overall PST action approach was more scattered than it should have been and the key indicators for monitoring progress are lacking. Monitoring and evaluation is particularly important in projects based on the participatory approach which requires greater flexibility as project personnel develop their rapport with and trust of the client peoples and delve deeper into the real issues of the area. With a sound monitoring and evaluation system in place, the flexibility can be carefully guided and ad hoc changes difficult to reconstruct later avoided.

2. Preliminary Assessments and Targets

Knowing what is doable in watershed management is fundamental. An important element of the concept of watershed management is the need to make choices and to do so in a logically and sequentially sound manner. It would appear that the "output" orientation of the project spurred efforts to attempt to do too many things, spreading capability, expertise and resources too thinly and thus failing to generate the momentum needed for real incremental gains.

Making choices in watershed management is no simple matter. Professional resource managers assessing the project area -- the topography, climate, soils and land-use conditions -- cannot fail to note a high degree of variable conditions all needing attention. These bio-physical conditions are further compounded by the socio-economic variables such as land tenure, household objectives, and farming practices thereby providing, if the project is indeed an "integrated" approach, a potentially staggering array of intervention possibilities.

These possibilities, and the systems and tools required to choose amongst them, need to be clearly explained to both project counterparts and beneficiaries. Without a grounding in the fundamentals of integrated watershed management concepts, project participants lack a basic understanding of project goals and methods of achieving them. ***Future efforts in this area should concentrate on increasing local awareness and understanding of these concepts prior to actual implementation.***

3. *Selection Criteria*

In general, the choice based on a simple assessment of the bio-physical needs generates a list much too broad for an action program. A thorough assessment of the socio-economic parameters of the watershed can help enormously to filter the basic list. Finally, however, watershed management planners must ***apply a set of widely accepted selection criteria*** based on the larger development goals of the project. While each project may wish to develop its own set of selection criteria, the following example, put forward in the ARD proposal, still seem germane:

The interventions chosen would:

- best meet the needs (see the list of household objectives on page 8 of this report) of the majority of the target population of hillside farmers;
- be most efficient in reversing the trends of watershed degradation in the project area, given the area's socio-economic constraints; and,
- have the highest probability of engendering sustainable, productive farming systems.

Similar projects worldwide have found considerable advantage in an initial and concerted problem, needs and opportunity assessment and planning exercise designed to narrow down the scope of their activities with the aim of building impact and credibility with the local people in an incremental manner. Typically, these planning efforts involve early assessment of the issues, identification of potential interventions to address them, development of selection criteria such as those above to guide the choices and assignment of priorities to the multiple actionable opportunities that present themselves.

Although these criteria may appear subjective, ***discussion among all the players and brokered decision-making*** about the choices will be a development achievement itself. It will allow both project personnel and the farmer community to better track the project, avoid unfulfillable high expectations, and focus the resources where they can do the most good. This dialogue and consensus building must continue as a purposeful activity over the life-of-the-project.

C. Technical Lessons

Contrary to what was perhaps anticipated, technological issues have been proven to be more of a challenge than was originally foreseen. Steep slopes, degraded soils, labor bottlenecks, and poor agricultural and marketing services combined with the relatively complex mixed farming systems typical of the area are significant constraints to those seeking to solve problems and/or find innovative ways to combine production with conservation. The technical dimensions of the project have not, however, been an insurmountable burden and indeed a number of lessons and findings of interest to the future agricultural development of the area have emerged.

1. *Complexities of Research and Experimentation*

Perhaps the greatest challenge to technological achievement with improved farming systems under the hillside conditions of Southwest Haiti will be knowing and proving the effectiveness of new interventions. These complex mixed farming systems involving different crop combinations under different site conditions defy efforts to link cause and effect in research and experimentation. Because the research challenge was underestimated and "on-station" research was resisted early on, it was only towards the end of the first phase that all concerned (USAID, NGOs & ARD) came to recognize how difficult it would be to corroborate the effectiveness of new interventions. Several points arose in this regard which should be considered by any follow-up efforts:

- The inherent heterogeneity of mixed farming systems (soils, slopes, crop mixes, different crop management and harvest patterns) makes it difficult to hold the variables constant so as to define the real impact of a new practice. In order to achieve certainty, in a scientific context, one must increase the number of trials and apply more rigorous and complex statistical designs to detect the significance of the perceived changes. Much can be learned in this field from the various world-wide efforts at farming systems research which has had to deal with these same issues.

- For various reasons, many farmers practice highly varied combinations of the basic cropping patterns thereby complicating the formulation of the extension messages.

- The issue of time and expense in "proving" that a new intervention works and whose role it should be to carry on such a program. PST originally envisaged a combination of "project managed research" (PMR) and "farmer managed experimentation" (FME). The latter was intended to field test promising interventions and provide an opportunity for demonstration and training.

- The need for broad agreement on a prioritized research agenda was hard to achieve because of the wide array of localized interests among the NGO participants. This made it difficult for ARD with its relatively limited personnel to focus its level of effort in the research arena.

In retrospect, ***the question of the institutional home for the research needs of hillside agriculture in Southwest Haiti needs to be carefully examined.*** The somewhat ad hoc project approach to research, undertaken in the absence of a significant governmental research capability in the area, leaves a great deal to be desired. Neither the technical assistance team nor the NGOs had the broad capability or should be expected to undertake the necessarily long-term research effort more properly the realm and responsibility of a government agency.

On-farm experimentation and adaptation of new interventions, however, is both an appropriate and useful role for the NGOs. This realization is perhaps best underscored by the exception offered by the ORE case wherein an NGO has proved itself effective in generating improved seeds and plant materials precisely because of its commitment and the in-house capability for these efforts built up over the longer term. ***In short, the challenge of problem-***

solving, research and experimentation needs a carefully thought-out plan and broadly agreed strategy to maximize its effectiveness.

2. *Important Parameters for New Interventions*

Several constants related to the suitability and acceptability of new technical interventions were notably underscored time and time again in the course of the first phase of project experience. As they are likely to remain important for years to come, they are briefly outlined here:

- Given the periodic labor constraints associated with temporary out-migration by farmers to find cash income, ***reducing the labor intensity of proposed interventions*** became a key variable. It is likely to remain an important consideration until such time that there is a major demographic shift in the project area involving a reduction in the number of small farms and a concentration of arable lands in larger holdings.

- The need for ***a more technical approach to soil conservation engineering***; the various prescriptions (contour hedgerows, side hill ditches, Wynne canals, rock walls, etc., etc.) do not all work everywhere and with all soils and slopes. In a number of instances, attempts at various soil conservation engineering techniques on slopes over 60 percent probably contributed to greater erodability because the sites were better suited to perennial crops rather than traditional agriculture.

- Similarly, it is somewhat futile to treat only the mid-slope lands without dealing with the problems higher on the slope where the problems originate. In general, ***a micro-watershed approach concentrating extension and development efforts*** in a particular area with all the farm community working the area is likely to be more effective than the more scattered approach adopted in this first phase of PST.

- Another element of the soil conservation equation which was overlooked in the PST area is an understanding that the ***poorly laid out roads and paths often contribute substantially to the amount of erosion.*** For example, a foot path bordering the Grand Ravine du Sud caused a large landslide into the river thereby considerably raising the debris and siltation load and affecting the maintenance of the Cayes Plain irrigation system.

3. *Great Potential for Livestock Development*

The early project documentation mentioned the potential of livestock development in the project area. Initially, because of reticence to further expand the already wide range of issues to be addressed by PST on the part of the technical assistance contractor and USAID, efforts in this regard were limited. Because of the persistence, however, of the ARD animal husbandry specialist, it became clear in years three and four that this was an area that deserved greater attention.

It also became clear, however, that similar to livestock development efforts elsewhere, the approach required would have to be fairly comprehensive, beginning with the basics of improved animal nutrition and management, providing veterinary services and ensuring market outlets, and also including options for improved stock. While the potential gains to the smallholder farmer are good, providing meat and milk for the family and income from the sale of animals, the loss of an animal because one of the basic elements of animal husbandry is lacking can have a severe financial impact.

Because of the relatively more specialized services required for a comprehensive livestock development program, the issue of the institutional home for such an endeavor should be carefully considered. Are the NGOs capable of mounting such a program, or would this be another area where a rekindled government capability, particularly in the area of veterinary services, be more appropriate? ***In any case, it is an area which should not be overlooked in any future program or project in the area.***

4. Some Technical Achievements

As the section in the earlier chapter specifies, there has been considerable attention to technical achievements within PST, including the introduction of new crop species and well as modifications and improvements in farming techniques. A recounting of the full range of these achievements would be beyond the scope of this report; they can also be found in other reports (see the appendix listing technical reports and papers), both those published by ARD and the other partner organizations.

There have been, however, several breakthroughs largely attributed to the efforts of the ARD technical assistance team and these are detailed here below in order to reiterate the potential of their future application in the area and elsewhere. They include:

- *An understanding of the formula for successful tree and grass contour hedgerows* - Although this technology had been in use in Haiti prior to the establishment of PST, its application in the steep terrain of the project area was more fully explored during this phase. In principal, both extension personnel and selected farmers are now familiar with the establishment and management of contour hedgerows. In order to minimize the establishment costs, a formula involving the sowing of abundant quantities of fresh seed (or grass cuttings) on carefully laid out contour bunds at the beginning of the rainy season, was devised. Following this prescription, farmers have been able to establish thick well-stocked hedgerows with few gaps thereby avoiding the labor intensive requirement of re-sowing or replanting.

  In addition, of particular note was the introduction of the small leguminous tree species - *Calliandra calothyrus* in substitution for the more widely known *Leucaena spp.*. This substitution allowed the project to overcome farmer resistance to *Leucaena* which they saw as a weed species, short-circuited the potential pest and monoculture problems emerging with *Leucaena*, and provided a suitable species for hedgerows higher in the watersheds.

Although management still remains a challenge, given farmer labor constraints, and the tendency to use the pruned cuttings for animal fodder in lieu of green manure predominates, it would be fair to say that this intervention has been well established and should be relatively easy to continue developing with excellent results during any follow-up activities. Those interested must, however, be mindful of the fact that contour hedgerows should not be employed as a soil conservation technology in slopes exceeding 60 percent. A full explanation of the technique may be found in the March 1990, ARD/PST Practical Manual No. 1 - "Guide PST pour L'etablissement et L'amenagement des Haies Vives".

- *Improved Seeds and Plant Materials Propagation* - In parallel with the emphasis placed in this area of endeavor by ORE, the ARD/PST technical assistance team drew continuing attention to the need to have at hand in both quantity and quality, sufficient supplies of the germplasm on which many of the most successful new interventions were based. For example, the importance of establishing seed production areas and plant multiplication sites was a constant theme stressed to the other three NGOs who have all now established production areas of one kind or another.

- *Leguminous Cover Crops* - Leguminous cover crops have long played a role in the rehabilitation of degraded areas throughout the world. ARD directed introductions and experiments added significantly to the array of such species available and applicable to the needs of the project area. Of particular importance was the combination of creeping legumes to the grass based hedgerow technology. Its advantages included improving the sustainability of intensive cut and carry fodder harvesting and adding a nitrogen rich element to the cut fodder.

5. *Promising Technical Areas for Future Inquiry*

A number of promising technical areas which were either often discussed or further explored but went unrealized for one reason or another, may be of interest in the future. They include:

- *Woodfuel Production Parcels* - In a number of steep or degraded areas, over 60 percent slope or severely eroded, it may prove interesting to explore the possibility of coppice-based woodlots for charcoal production using fast growing leguminous tree species. In order to minimize site disturbance which might provoke more erosion, establishment should be accomplished by direct seeding or vegetative means. These practices will also be considerably cheaper than traditional seedling plantation approaches, an important consideration as the profitability of such undertakings is likely to be marginal. Species of choice include: *Leucaena spp., Calliandra spp., Gliricidia sepium,* and possibly on some of the drier coastal sites, *Prosopis spp.*.

- *Vetiver Strip Cropping* - Vetiver is an income-producing oil crop for the peasant farmers in many parts of the PST watersheds, typically those areas of most

severe climatic restrictions or those in the latter stages of degradation. The potential for slowing down the erosion caused by the harvest of the root systems of Vetiver through a method of cross-slope strips alternating harvest and standing crops needs to be examined. A simple incentive might be all that would be needed to induce the farmers to take up this practice the first year after which it would be part of the scheme. Potentially, the incentive could be married to a localized land use regulation in order to ensure its continuity. Vetiver oil production could also be improved if more energy-efficient means could be found to replace the old wood-fired distilleries currently in use.

- *Perennial Crops* - In many parts of the watershed, the need for perennial crops owing to the slope and soils is evident. There are few alternatives that could be put in place which would continue to generate income for the farmers. One alternative, that of fruit trees on individual small terraces, needs to be explored. As many of these areas often give poor returns to traditional practices because of their vulnerability to rainfall variations, the key to finding a suitable crop would be to examine the micro-economics of traditional cropping patterns and find something that would over time generate more resources for the farmers.

  Coffee, of course, would in many cases be the perennial crop of choice given its presence in the area. Improved management, production and marketing could restore it as a viable alternative land-use in a much larger area of the Southwest of Haiti.

- *Protection* - Again, because of steep sites and poor soils, the only viable alternative may be long-term protection. Revegetating degraded areas with traditional plantation techniques is rarely necessary, technically recommended or economically efficient. In many cases of degraded areas, one can re-establish the vegetative cover, and with it the watershed function, just by protecting the area from fire and grazing for a period (both of which are in any case necessary if tree-planting has taken place on the site) and allowing natural succession and regeneration to do the work.

  If for some reason one feels compelled to replant a degraded area for protection purposes (protection meaning for the soil and/or slope conditions, it should not be cut in the future again), then *one needs to find more effective and efficient ways to do so* than the traditional plastic-bagged nursery raised seedlings employed in Haiti. These techniques are simply too expensive to invest in an area that will only yield indirect returns through the re-establishment of the watershed function. For example, in order to lower costs, one could try direct seeding of some of the fast growing leguminous species (e.g., *Leucaena spp., Calliandra spp.* or *Gliricidia sepium*). There are also other ways to lower reforestation costs such as planting bare root stock or using the stump technology or revegetating in strips along the contour to help arrest erosion and allowing nature to do the rest in between.

D. Institutional Issues

As is well known, institutional considerations were a principal concern of USAID/Haiti during the design phase of this project. Over the life of the project, and in light of the almost complete demise of Government of Haiti services in the project area as a result of political turmoil, it is not surprising that institutional matters were often key development challenges. It was often as well a particularly sensitive area of endeavor because some of the NGOs felt, rightly or wrongly, that their relatively long track record in the area was an explicit demonstration of the soundness of their organizational capabilities. As a result, the institution-building aspect of the project gained increased importance and emphasis, and the ARD team members had to continually shift their focus between providing technical assistance in agronomic areas and assisting the NGOs to operate more efficiently in their areas of relative strength.

1. Institution Building

Institution building needs clear goals and benchmarks. A path to follow, indicating all anticipated achievements and how they will be attained, must be understood and agreed to by all concerned. As has often been the case in development projects, the institution building efforts in PST were relegated to vague notions of reorganization and human resources development for the staffs of the NGOs. Although there were some concerted efforts in the areas of planning, reporting and in particular, financial management (the latter driven by the rather strict accounting regulations imposed by USAID), other important operational topics such as task differentiation, chain of command, and delegation of responsibilities received rather less attention than they merited. In the future, building on the PST experience, ***it is recommended that institution-building or strengthening be further enfranchised as a well-defined and immediate project development objective.***

A number of other "lessons" related to the institutional dimensions of watershed management emerged during the course of the last few years. Here again, they are notional in nature but, it is believed, still worth considering. They include:

2. The NGO Mandate

The four non-governmental organizations engaged in the field implementation of the Proje Sove Te proved themselves to be capable and viable development entities and a sound avenue for the introduction of improved agricultural practices in the area. They did so by demonstrating dedication and commitment to the client peoples they serve and through the important element of altruism implicit in their approach. Like organizations everywhere, success is the best stimulus; dedication and altruism are not enough to sustain those involved over the long haul needed to address the deep-set problems of the area. In examining their role and performance in PST, a number of points arose:

- In most cases, NGOs are primarily humanitarian and religious organizations with a wide mandate and a range of objectives. Their participation in a project of this nature was only a part of their activities, and as such, they were less single-minded or able to focus on the intricacies of the project than say, the T.A. team or USAID itself. Their choices of the areas to work in, the approach to take

and the need to "get on with the job" were often influenced by the long-term relationship with client constituencies and the pressure they felt to provide jobs, "primes" and support.

- Donor organizations must recognize that the inherent capabilities and strengths of a non-governmental organization may be diluted or undermined by the addition of large sums of (donor) government funding in a semi-contractual and projectized mode. This type of relationship may not bring out the best in NGOs and the potential for divergent methods and aims is great. In addition, the tendency is to remake NGOs by imposing management and other systems on them that are compatible with donor regulations.

- There can be little doubt about the viability of the role of the NGOs as "outreach" organizations providing the vehicle for communications, extension and training with the farmers. Their suitability for conducting research and experimentation, producing improved plant materials (with the exception of ORE which specialized in that area) or in carrying out the more technical and professional analyses necessary to confirm the worth of the interventions and approach bears more scrutiny. In part, these roles devolved to the NGOs because of the GOH operational vacuum and/or the more transient nature of the project-provided ARD technical assistance team.

- Despite their good intentions, the NGOs need to be a bit more forthright about the necessity of assessing the capacity of their staff and including a concerted training program as a regular part of the annual program. Their objective in doing so, like any organization concerned with meeting a challenge, will be achieving greater effectiveness (impact in working with the client farmers) and efficiency (improving the cost and administrative overheads associated with their work).

3. *ARD's Role as Technical Assistance Contractor*

As mentioned previously, the late change in the basic organizational structure between the so-called "umbrella grant manager" and the NGOs had a profound effect on their working relationship. Logically enough, the decision regarding the choice of USAID sanctioned Cooperative Agreements, as opposed to the original plan to channel the money through the grant manager, had the tendency of shifting the administrative structure away from ARD and focusing it on USAID. Although the reasons for doing so seemed justified at the time, this significant change was not accompanied by a purposeful analysis of its institutional ramifications.

Consequently, issues of authority, chain of communication and command, and lack of clarity about the role of the T.A. contractor were frequent and troublesome. The result was that the NGOs were extremely sensitive to any criticism of their activities by ARD because they saw it as a threat to their funding. The ARD team for its part was frustrated by the confused and delayed start-up which in effect undermined the step by step implementation plan originally laid out for the project. This was exacerbated by USAID's somewhat ambivalent attitudes toward this two-tiered situation and the output orientation of the project.

Future efforts of this kind *must clearly include an adequate period for purposeful mobilization and project inception* during which time the detailed planning and the institutional relationships are thoroughly confirmed.

Several other factors affected the institutional situation of the project:

- The large number of organizational players increased the administrative burden on the ARD Chief-of-Party and limited the time and effort he could devote to planning and leadership and to the review of the economics of watershed management in the project. For example, the COP had to not only advise, review and comment upon the semi-annual work plans produced by the four NGOs, he also had to wait until these plans were produced to articulate the plan for the project. Once the ARD workplan was finalized (in French and English) he then received comments from USAID and the NGOs. Added to this process was the fact that for the first year of the project (1987-88) each NGO was working on a different planning cycle.

- The overall design of the implementation mechanisms for the project including planning, reporting, financial management and general coordination proved to be administratively burdensome for all concerned.

- The ratio of extension personnel to client farmers is an important issue. Building a truly participatory relationship involving two way communication with the farmers takes time and effort. This aspiration can be easily thwarted if extension personnel have to service too many farmers. The tendency then is to revert to the older, top-down approaches of "encadrement" or "vulgarization" which emphasize, at best, getting the message to the farmers rather than working with them to satisfy their needs and opportunities.

- USAID appointed a resident local coordinator whose role was originally foreseen as obtaining agreement on what was working and accelerating the learning curve among the various participants. Because of the difficulties, his role became more of a trouble-shooter and mediator. He was unable to concentrate on either supervisory coordination or on technical assistance, neither of which can substitute for the other.

E. Social/Economic Issues

Local people are and must be the principal actors in watershed management. The participatory approach involves a high level of heterogeneity implicit in the diverse aspirations and motivations of the client farmers. It should, therefore, not be surprising that it is somewhat more difficult to render the PST experience in the socio-economic realm in the form of concrete lessons learned. There are, nevertheless, a series of points that did emerge and are treated below:

- Although Southwest Haiti, and the Cayes Region in particular, is often described as an area of subsistence farming, it became apparent shortly after

project inception that *local people are very enterprise-oriented.* There is high interest in earning cash income, both for short term needs such as school fees, as well as to earn a stake to enable them to escape their destiny in the rugged hillsides.

This more monetized economy and the market orientation make perfect sense given the resource limitations inherent in the area. *Market outlets for cash crops* take on an extraordinary importance in this area but they *must be primary producer-oriented.* Several of the markets for cash crops in Haiti, notably coffee and vetiver, would, if carefully examined, be found to favor the middlemen and so-called speculators.

- Any practical approach to watershed management in an area like the PST Project area must ensure that there is *a thorough understanding of the economic and financial viability of the individual family farms.* Extension personnel must be able to recognize when a farm situation is too marginal to warrant increased investments because ultimately the farm family will be unable to sustain the level of investment required while still meeting basic needs. This type of information is typically very difficult to obtain because of the traditional reluctance of the small farmer to reveal his/her strengths or weaknesses. In this regard, PST was perhaps too "site-oriented," seeking to treat isolated fields rather than considering the importance of the family production unit.

  Several possible courses of action can be used to address this situation. Extension workers must seek over time to establish a trusting relationship with their clientele which will provide a more realistic understanding of their needs and opportunities. This in turn will feed the planning process and enable staff to both guide the investments of their time and efforts as well as make meaningful recommendations about the viability of the extension package. Realistic information about the economics of smallholder farming will be fundamental to decisions regarding the need for and magnitude of incentives and/or subsidies to meet conservation goals.

- Another important concept is that of *land-use capability.* While it is often possible to "push the envelope" of current practices to meet land-use capability limitations by increasing conservation measures, these efforts typically raise the cost of production substantially. There is a point of diminishing returns in attempting to do so. Additional costs to achieve conservation objectives must either be paid for through the marketplace or must be offset by incentives or subsidies which allow the farmer to continue to sustain a livelihood. In other cases, where small farmers must absorb production tradeoffs in order to achieve conservation objectives of importance to larger segments of society, there must be some means for compensating them for their losses. No nation has ever been able to sustain a conservation program on the backs of those least able to afford it.

- An important corollary to the above is that *prevention,* meaning management and conservation in watershed areas, no matter how costly, *will almost always be*

cheaper than rehabilitation - both of the watershed areas and of the social systems undermined in the process of watershed degradation.

- *Successful watershed management projects must reach a high degree of sustainability based on the production and returns from the application of technologies appropriate to the inherent land-use capabilities.* In Haiti, and particularly in the steep, unstable soils of the watersheds of the Les Cayes Region, the recurrent costs of a watershed management model based or dependent on a social welfare approach (incentives to farmers to survive without cultivating steep areas) would be, at least for the near to medium term, prohibitively expensive. Any analysis of PST which attributes impact to the physical achievements is therefore simply "clutching at straws."

One of the implicit aims of PST as a pilot project was to test the replicability of and improve its approach to watershed management and thus, to lay the foundation for future efforts. The ultimate test of this formula must and will be the economic feasibility of the improved production-cum-conservation packages introduced in the area.

Some Final Remarks

Despite the breadth of what has been examined in this section, a few important points have not been addressed. Frankly speaking, these same issues were not addressed during the implementation period of the first phase of the project - in part because they are somewhat sensitive points. No rendering of the experience of the Proje Sove Te would do justice to the hard work of so many, if they were not treated herein. Whether or not they can be dealt with, ARD believes they should not be lost from the project record because of their very real impact on the project.

Paramount among them is the fact that as the political situation improves in Haiti, ***USAID should reconsider reinstituting funding for a further phase of the project*** and the work of the NGOs. In general, ARD recommends that any follow-on efforts take note of the lessons learned in this section, and focus on providing short-term relief to the small farmers of the area while continuing work toward the larger objective of improved institutional support to watershed management efforts.

It is also clear that the ***NGOs must continue to work on solidifying their animation and extension capabilities.*** They must actively seek to improve their effectiveness (impact at the field level) and their efficiency (minimizing the costs of their operations). In the future, their efforts should focus as a group on defining and concerting an extension package, with the recognition that there is potential for adding additional interventions once they have satisfied themselves that the staff and farmers have succeeded in adopting the accepted ones. Again, replicability is the key to success and ultimately to sustainability.

Despite a number of implementation difficulties, ARD believes that ***all concerned should review the framework outlined in the original technical proposal*** as much of it is still quite valid.

Appendices

ARD LONG-TERM FIELD STAFF

John Craig Chief of Party from 4/88 to 5/90 Medical leave and then return to Haiti from 10/8/90 to 11/90	4/88 to 11/90
Alex C. Cunard Agronomist Chief of Party a.i. from 5/90 to 9/92	9/89 to 9/92
David W. Holmes Administrative Specialist	6/89 to 6/91
B. Dean Treadwell Livestock,/Forage specialis	9/87 to 9/91
Deborah Roy Administrative Specialist	6/91 to 9/91

FORMER ARD STAFF

James Gershin Administrative Specialist	10/87 - 9/88
JoAnn Jaffe, Ph.D Farming Systems Specialist	9/87 - 11/89
Leslie Linn Tropical Agronomist/ Horticulturalist	10/87 - 9/89
Curtis Packett Soils/Watershed Management	12/87 - 9/89
Bert Serna Administrative Specialist	10/88 - 6/89

LIST OF PST/ARD HAITIAN STAFF

Technical

NAME	POST	EMPLOYMENT
Edouarzin, Jean Robert	Markets	9-88 to 1991
Jean-Charles, claudy	Livestock	8-87 to 1991
Jouissance, PR	Agriculture	1-89 to 1991
Lorcy, Marie-Resette	Agriiculture	1-89 to 1991
Villefranche, PR	Agriculture	1-89 to 1991

ADMINISTRATIVE SUPPORT

Aurelian, Antoine	GSO	02-01-88	to	9/91
Barratteau, Chantal	Secretary	02-10-88	to	9/91
Denesle, Regine	Secretary	03-01-90	to	9/91
Durand, Helmongue	Cashier	07-06-89	to	9/91
Jean-Baptiste, Alix	Bookkeeper	01-04-89	to	9/91
Jolicoeur, Anglade	Housekeeper	03-03-88	to	9/91
Marcelot, Louis	Mechanic	03-03-89	to	9/91
Misere, Renel	Accountant	04-17-89	to	9/91
Raymond, Antoine	Driver	05-01-89	to	9/91
Remarais, Raymond	Day guard	04-25-88	to	9/91

WATCHMEN

Andre, Raphael	Watchman	06-14-88	to	9/91
Aurelian, Charles	Watchman	04-08-88	to	9/91
Durand, Eval	Watchman	06-14-88	to	9/91
Emmanuel, Sommaire	Watchman	04-08-88	to	9/91
Louis, Sergo	Watchman	04-08-88	to	9/91
Morin, Gracien	Watchman	01-15-89	to	9/91
Thermidor, Antoine	Watchman	04-08-88	to	9/91
Vitalarme, Cherestal	Watchman	03-20-89	to	9/91

SHORT-TERM TECHNICAL ASSISTANCE - PROJE SOVE TE

Name	Approximate Dates	Purpose
Steve Goodwin	March-April 1988	Develop NGO vouchering accounting system, NGO financial management Training ARD/PST staff
Richard Patton	Apr-May 1988 May-June 1988	Computer financial systems, training ARD/ PST staff and ORE staff
Yann Derriennic	July-August 1988	Develop NGO accounting and management systems training IRD, UNICORS and DCCH staff
Rodney Frank	August-Sept. 1988	Livestock health training NGO staff
Carl Heller	March 1989 March 1990	PST/NGO vehicle maintenance/ evaluation and training
Kevin Creyts	April-July 1989 January 1990 August-Sept. 1990	Accounting, finance, and management work with ARD/PST and NGOs
Ted Wittenberger	May-June 1989 March 1990	Postharvest storage and handling, NGO training
Frantz Lohier	August 1989	Study of PST technical interventions
Philippe Mathieu	June-October 1990	Internal evaluation of UNICORS and DCCH
Carl Monde	August-Sept 1990	Internal evaluation of IRD and ORE
Mike Bertleson	May-June 1991	Management planning and budgeting training for NGOs

Overseas Training Arranged by ARD/PST Project

1) November, 1989 : Study tour to Nigeria (IITA - training and visit in alley-cropping and alley farming techniques), Kenya (ICRAF - agroforestry and soil/water conservation) and Rwanda (agroforestry and soil conservation projects) for nine NGO technicians and directors. November 3-23, 1989.

2) June-July 1990: Study tour to the Dominican Republic for 24 NGO staff technicians and extensionists.

3) June-August 1990: Social and Economic Development (SED) course, University of Michigan, CRED for Jean-Marie Robert Chery, DCCH technical director. 20 June -10 August 1990.

4) July, 1990: Francophone Management Course, University of Connecticut for Michel Leonard (DCCH), Joseph Alexis, Oge Danazar (UNICORS). 2-28 July, 1990.

5) November 1990: Study tour to Colombia (CIAT to view work in seed production and small farmer research projects), Costa Rica (CATIE for projects dealing with agroforestry), and Honduras (visit to several World Neighbors projects and ARD Land Use and Productivity Enhancement Project) for 14 NGO directors and technicians. 10-30 November 1990.

In addition to this overseas training, numerous training events, workshops, field days, and on-the-job training etc,. were arranged by project staff and consultants in Haiti.

PRINCIPAL REPORTS AND DOCUMENTS OF PST/ARD

(Livestock and forage documents are listed separately)

PLANNING AND RELATED

- "Proje Sove Te: Proposal for a PST Planning and Evaluation system"

  "Proje Sove Te: Proposition Concernant un Système de Planification et d'Evaluation du PST"

  Joint effort, primarily of JoAnn Jaffe, ARD Farming Systems Advisor and John Craig, ARD Chief of Party.

- "Document à Discuter: Plantules à Distribuer comme Primes" - Policy discussion paper prepared by ARD Farming System Specialist and used by AID as the basis for a policy discussion of this issue.

- PST Semi-Annual work Plans
  January 1988
  July 1988
  January 1989
  July 1989
  January 1990
  July 1990
  January 1991

- PST Semi-Annual Reports
  July 1988
  January 1989
  July 1989
  January 1990
  January 1991

- PST Mid-Term Report
  August 1987 - July 1990

- NGO Management Planning and Budgeting - Report of short-term consultancy by Dr. Michael Bertelson, July 1991.

SOIL RESOURCE INVENTORIES

- Les sols d'interfleuve des rivières de Port-à-Piment et des Coteaux, USAID, Port-au-Prince, 1989, 16pp, 10 tables, 6 figures, 3 appendices and 1 map.

- Les sols d'interfleuve des rivières de Cavaillon, de l'Acul et de la Grande Ravine du Sud, USAID, Port-auPrince, 1989, 13pp, 8 tables, 5 figures, 3 appendices and 2 maps.

- Les sols du mi-bassin versant de la rivi6re Cavaillon, USAID, Port-au-Prince, 1989, 21pp, 14 tables, 8 figures, 2 appendices and 2 maps.

- Les sols d'interfleuve des rivières des Anglais et de Port-à-Piment, USAID, Port-au-Prince, 1988: 21 pp, 12 tables, 8 figures, 2 maps and 2 appendices.

OTHER REPORTS BY SOILS SPECIALIST

- "Soil Conservation Through Improved Resource Management in Haiti" co-authored with Charles-Emile Philoctète, PST Project Coordinator

- "A Feasibility Level Study to Improve the Road to Formond, USAID, Port-au-Prince, 1989: 12pp, 3 tables, 6 figures, 2 appendices." Note: based on this report, AID arranged for funding for this proposed Formond Road improvement.

- Operational guidelines of Soils Specialist:

  Installation et utilisation du pluviomètre: PST, Camp-Perrin, 5pp.

  Evaluation de l'érosion: PST, Camp-Perrin, 9pp.

  Echantillonnage et analyses des caractéristiques chimiques et physiques du sol: PST, Camp-Perrin, 5pp.

HEDGEROW MANUAL AND RELATED ITEMS

- Guidelines for the Establishment and Management of Hedgerows.

  Proje Sove Te: Guide PST pour l'Etablissement et l'Aménagement des Haies Vives.

  These guidelines were prepared by the PST/ARD Technical Assistance Team.

- "Haiti Targeted Watersheds Project - PST -11 by Tom Catterson, Agroforestry/Alleycropping consultant.

  "Rapport du Consultant en Agro-Sylviculture et Cultures en Couloir."

  Par Thomas M. Catterson
  21 Pages Report - 19-26 aout 1988

- Systéme de Suivi de Plantation d'Arbres et de Haies Vives de PADF

  Edited by John Craig, based on conversations with PADF's Mike Bannister and Gaspard Brice.

AGRONOMY DOCUMENTS

- Cunard, A.C. (3), 1991: Measurement of Biomass Production by Living Hedges Species at the Perrin Site. ARD/PST/USAID.

- Cunard, A.C.(4), 1991: Height Growth Measurements on Living Hedgerows Species Established on Slopes of Four Soil Types. ARD/PST/USAID.

- Cunard., A.C.(6) 1991: The Resolution of Constraints to Intensified Economic Development of the Rural Environment in Haiti. (Working Paper). ARD/PST/USAID.

- Cunard, A.C.(7), 1991: The Establishment of Sustainable Agricultural Systems on Hill-Slope Farms in the Les Cayes Zone, Haiti, ARD/PST/USAID.

- Cunard (8), 1990: Market Prices for Selected Commodities in Les Cayes and Ducis, Feb. through June, 1990. ARD/PST/USAID.

- "Farming Systems Technology Development Paper"

  sent to Catherine McIntyre, PST Project Manager, by Alex Cunard, PST/ARD Agronomist. March 29, 1990.

- "Interventions Techniques dans l'Aire du Proje Sove Te"

  Rapport Technique par Frantz Michel Lohier, Agr.- MS,
  ARD consultant - Octobre 1989

- "PST Interventions" by Leslie Linn, 21 August, 1989

FARMING SYSTEMS

- Sondeo questionnaire - Prepared by JoAnn Jaffe in collaboration with the rest of the ARD Technical Team.

- "Sondeo Report/ Land Use, Soil Degradation, and Farmer Decision-Making: Cavalier, Despa, Kols, Saut-Mathurinell By JoAnn Jaffe, Ph.D., ARD Farming Systems Specialist

- "Proje sove Te: Pwogram Jaden Lakou - Fiche teknik - Kilti Legim"

  Jean Peres Paul - JoAnn Jaffe, Ph.D, October 1989

- "Results of Weekly Surveys of Prices in the Les Cayes, Haiti, Market June 1988 - June 1989"

  JoAnn Jaffe, Ph.D

- "Results of Weekly Surveys of Prices in the Ducis, Haiti Market June 1988 - June 1989"

  "Résultats des Enquetes sur le Marché de Ducis, Haiti, de juin 1988 à juin 1989"

  By JoAnn Jaffe, Ph.D - Farming Systems Specialist
  Spécialiste en Systèmes de Production.

FINANCIAL ITEMS

- "Financial Review and Training Provided for Proje Sove Te - April 23 - July 31, 1989"

  By Kevin B. Creyts
  ARD Financial Management Consultant

- "Accounting Review for Proje Sove Te - Haiti January 1990"

  Kevin B. Creyts
  ARD Financial Management Consultant

- Preparation du Budget

  By David W. Holmes
  ARD Specialiste en Gestion
  4 décembre 1989

ADMINISTRATIVE

- "Vehicle Maintenance and Evaluation Project"
  Phase I, March 23, 1989

- "Vehicle Maintenance and Evaluation Project"
  Phase II, March 15, 1990
  Carl T. Heller, Consultant.

POST-HARVEST

- A report in English and French on the postharvest situation in the PST area. There were lengthy attachments to the report which provided practical advice (written in French and/or Creole) on a number of storage questions.

  By Ted Wittenberger, ARD consultant.

LIVESTOCK/FORAGE

No. 1
Bibliographic References. B.D. & W.J. Treadwell. Sept. 1988. [Presents over 300 cross-referenced, annotated citations concerning livestock feed and nutrition, disease, general subjects (e.g., milk, hides, fencing, etc.) and six separate sections for each class of animal.

No. 2
Forage Plant Species - List of Initial Selections. B.D. Treadwell. Original distribution: Apr. 1988; revised: Jan. 1989. [Working list of tree, grass and annual and perennial herbaceous leguminous species selected for PST applications.]

No. 3
Intevensyon Teknik pou Komanse Pwoje Sove Te. B.D. Treadwell & L. Linn. 3 May 1988. Creole. ("Technical Interventions to Begin Pwoje Sove Te.")

No. 4
Report of Veterinary Clinics held for UNICORS - July 25-28, 1988. Michael D. Storer and C. Jean Charles. Sept. 1988. [Report of first organized veterinary clinics conducted by PST; text prepared by B.D. Treadwell based on notes and data provided by Storer and Jean-Charles.]

No. 5
Sigjesyon pou Plantasyon Zeb Elefon oubyen Zeb Napye. B.D. Treadwell. Sept. 1988. [A creole extension note on planting techiques for elephant grass.] ("How to Plant Elephant or Napier Grass.")

No. 6
Fiche pou Etabli Barye Vivant. B.D. Treadwell, L. Linn and J. Jaffe. Aug. 1988. [Field record form in creole recommended for data collection pertaining to the establishment of living conservation barriers.]

No. 7
Elvaj Bef. R. Frank and M. Birmingham, Dvms. Aug. 1988. [First of six creole manuals for the veterinary technician training program.]

No. 8
Report of Veterinary Technician Training Seminars conducted by R.K. Frank, DVM. - Aug. 15 - Sept. 9, 1989. [Report prepared by B.D. Treadwell.]

No. 9
Forage Plant Seed Sources. W.J. and B.D. Treadwell. Feb. 1989. 15 pp. [Report compiled based on replies received from a mailing to over 100 companies or organizations worldwide engaged in seed production/sales. Information is provided separately for tree (9 spp.), grass (13 spp.) and herbaceous legume seeds (12 spp.) and includes price per kilo, whether or not provenance and percent germination certifications can be provided, and whether the supply can be contacted by telephone or telex. Complete addresses are provided for 23 suppliers.]

No. 10
Assessment and Recommendations for Livestock Feeding Trials as an Activity for Pwoje Sove Te. B.D. Treadwell. Draft circulated Sept. 1989; revised version June 1990. 30 pp. + 10 appendices. [Presents the concept of feeding trials, why they are important for PST and proposed a joint ARD/IRD venture approach. Includes details on methods and operational procedures (e.g., facilities, staffing, sources of animals, etc.) and summary of recommended trials.]

No. 14
Perennial Herbaceous Leguminous Plants as Permanent Contour Land Improvements for Haitian Hillisde Farms: Results and Observations from a 2-Year Field Study. B.D. Treadwell and A.C. Cunard. Sept. 1991. [A collaborative study which reports study biological and socioeconomic objectives; methodology; biomass production from the PHL species; and yields from the associated intercrops. Statistical parameters are included.]

No. 15
Forage and Selected Hedgerow Species Suitable for High Elevation Sites in Haiti. B.D. Treadwell. Draft circulated for review Oct. 1990; final revision completed Sept. 1991. [Includes descriptive and behavorial information, varieties, planting and management considerations and sources of planting material for nine species of grass, eight species of annual and perennial herbaceous legumes and five species of trees. Additional varieties/cultivars are discussed for most species presented.]

No. 16
Summary of Potential Benefits and Market Opportunities from Livestock Related Activities under the Auspices of Pwoje Sove Te. B.D. Treadwell. Draft for review circulated in Mar. 1991; final revision Sept. 1991.

No. 17
Biomass Production from Elephant Grass (Pennisetum purpureum) from Two Sites in Camp Perrin, Haiti. B.D. Treadwell with statistical analyses by A.C. Cunard. Sept. 1991.

No. 18
Final Report of work Performed by the Forage/ Livestock Specialist under the auspices of Pwoje Sove Te. B.D. Treadwell. November 1992.

PST Non-Expendable Equipment List

Description	Qty.	Price
GE Freezer	1	521.25
GE Walkie-Talkie	1	566.00
GE Walkie-Talkie	1	566.00
Shelving at Treadwell's	1	620.75
Olivetti typewriter Linea 25	1	625.50
GE Base radio PSX 200	1	627.00
GE Base radio PSX 200	1	627.00
Olivetti typewriter Linea 98	1	670.50
Shelving container #2	1	793.10
Shelving container #1	1	793.10
Generator installation	1	1,079.90
Metal cage	1	1,383.51
Base antenna & installation	1	1,965.00
Xerox 1012 copier	1	2,500.00
Xerox 1012 copier	1	2,500.00
Panasonic monitor CT-2010	1	549.00
Wicker sofa with cushions	1	580.35
Diplomat safe	1	720.00
ST4 Mirror Stereo	1	725.00
HP 2Mb memory board	1	745.00
SPSS/PC+V20	1	795.00
3X Ocular (1 pair)	1	830.00
IBM Wheelwriter typewriter	1	945.00
20 foot aluminum container	1	950.00
IBM Wheelwriter typewriter	1	950.00
20 foot aluminum container	1	950.00
UPS 1200 VX	1	995.00
Kilobeam scale 500B	1	995.00
Panasonic Camcorder	1	1,295.00
Panasonic Editor/Recorder	1	1,495.00
Panasonic VCR AG6300	1	1,649.00
Zenith Z-181 Laptop computer	1	1,659.00
Zenith Z-181 Laptop computer	1	1,695.00
NEC Multispeed Laptop computer	1	1,695.00

PST Non-Expendable Equipment List (cont.)		
HP LaserJet II printer	1	1,729.00
Zenith SuperSport Laptop computer	1	2,250.00
Honda CT200 motorcycle	1	2,500.00
Dell System 200 computer	1	2,999.00
Panasonic editing controller A750	1	2,999.00
Canon Fax 730	1	3,140.00
Compaq 20 computer	1	3,750.00
Compaq 20 computer	1	3,750.00
Onan generator	1	4,025.11
Toyota pick-up, blue	1	15,000.00
Toyota pick-up, gray	1	15,000.00
Toyota pick-up, white	1	15,000.00
Ford pick-up, green w/winch	1	17,000.00
Ford pick-up, beige	1	16,150.00
Jeep Cherokee, beige	1	16,980.00