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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

HAITI

PROJECT PAPER

Agroforestry Outreach
Amendment # 2

AID/LAC/P-365
CR AID/LAC/P-083
P-083/1

Project Number 521-0122

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: C (A = Add, C = Change, D = Delete) — Amendment Number: 2 — DOCUMENT CODE: 3

2. COUNTRY/ENTITY: Haiti

3. PROJECT NUMBER: 521-0122

4. BUREAU/OFFICE: USAID/Haiti [5]

5. PROJECT TITLE (maximum 40 characters): AGROFORESTRY OUTREACH

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 12 DD 31 YY 89

7. ESTIMATED DATE OF OBLIGATION (Under "B." below, enter 1, 2, 3, or 4): A. Initial FY 81 B. Quarter 4 C. Final FY 89

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 81 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total	535	775	1310	14490	12510	27,000
(Grant)	(535)	(775)	(1310)	(14490)	(12510)	(27,000)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1. CARE				150		150
Other U.S. 2.						
Host Country						
Other Donor(s)	535	775	1310	1833		1833
TOTALS				16,473	12,510	28,983

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) ARDN	210	160		11,400		15,600		27,000	
(2)									
(3)									
(4)									
TOTALS				11,400		15,600		27,000	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 067 | 066 | 096 | 878 | | |

11. SECONDARY PURPOSE CODE: 201

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BS	DEL	ENV	PVOU	PVON	TNG	
B. Amount							

13. PROJECT PURPOSE (maximum 480 characters)

- To motivate Haitian peasants to plant and maintain trees for generation of income, the production of fuelwood and lumber, and for soil conservation.
- To obtain reliable information through an applied research program on the technical, economic and social aspects of agroforestry in Haiti.

14. SCHEDULED EVALUATIONS: Interim MM 12 YY 83 | MM 04 YY 86 — Final MM 04 YY 89

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [X] 941 [X] Local [ ] Other (Specify)

16. AMENDMENTS, NATURE OF CHANGE PROPOSED (This is page 1 of a 45 page PP Amendment)

This amendment No. 2 to the original project paper will allow for an extension and expansion of project activities, and an intensification of the ongoing research program through the provision of $15.6 million and the extension of the PACD through 12/31/89.

I have reviewed and approved the methods of payment for this project.

Charles E Brooks CONT, CBrooks

17. APPROVED BY — Signature: Gerald Zarr — Title: Director, USAID/Haiti — Date Signed: MM 11 DD 06 YY 86

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 01 DD 8 YY 87

IV

PROJECT AUTHORIZATION

AMENDMENT NO. 3

Name of Country	: Haiti
Name of Project	: Agroforestry Outreach
Number of Project	: 521-0122

1. This Amendment No. 3 to the subject Project Authorization, dated September 23, 1981 and subsequently amended, provides as follows:

   A. Paragraph 1 is deleted in its entirety and replaced by the following paragraph:

   "Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Agroforestry Outreach Project in Haiti for the Pan American Development Foundation (PADF) and CARE, involving planned obligations of not to exceed Twenty-Seven Million United States Dollars (US$27,000,000) ("Grant") over a period from the date of the original Authorization through December 31, 1989, subject to the availability of funds in accordance with the AID OYB and allotment process, to help in financing foreign exchange and local currency costs for the project ("Project")."

   B. Paragraph 2 is deleted in its entirety and replaced by the following paragraph:

   "The Project consists of five components: two outreach grants to PADF and CARE, a contract with a Title XII university for research, a contract with another organization for seed and germplasm improvement, and a coordination and technical support team for the Project, including a coordinator, a senior-level forestry advisor, and a bilingual secretary."

2. Except as specifically amended herein, the original Authorization remains in full force and effect.

Gerald Zarr
Director
USAID/Haiti
-6 NOV. 1986
Date

DRE:RByess:rjb:10/28/86:treeauth

ADO, RWilson
ADO, VCusumano
DRE, AFord
CONT, CBrooks
D/DIR, LEMorse

b

AGROFORESTRY OUTREACH PROJECT (521-0122)
Amendment No. 2

Table of Contents

C

I. BACKGROUND AND RATIONALE FOR AMENDMENT

A. PROJECT SUMMARY

The Agroforestry Outreach Project (521-0122) was authorized in September 1981, with a four-year LOP and a budget of US $8.0 million. The project was extended for an additional 15 months in January 1985, and the overall funding level was increased to US $11.5 million. The current PACD is December 31, 1986. The goal of the project is to reduce and ultimately reverse the ongoing degradation of Haiti's natural resources, and thereby maximize the productive potential of its land.

The primary purpose of the project is to motivate Haitian peasants to plant and maintain trees and to achieve the planting and maintenance of a substantial number of trees in Haiti over the life of the project. Its secondary purpose is to obtain reliable information on the technical, economic and social variables of forestation in Haiti.

Trees planted under project auspices are planted with one or more of the following objectives, each of which may be considered a sub-purpose of the project: (1) soil conservation, (2) increased supply of fuelwood, and (3) rural income generation. These project goals, purposes and objectives remained unchanged under the first extension.

The principal strategy of the project is to introduce and to support the idea of planting and harvesting trees as a cash crop. The project seeks to exploit the basic economic rationality of private landholders operating in a cash economy by emphasizing the relatively near-term profitability of planting and maintaining substantial numbers of trees, and to encourage this course of action by providing appropriate plant materials, training, and support services to planters.

The project appeals to the relatively short-term economic self-interest of cooperating farmers. Employing this strategy, the project has achieved a level of participation and a scale of operations heretofore unattained in Haiti, with significant long-term impacts in the areas of soil conservation, afforestation and national wood-resource reserves, as well as peasant income-generation.

The project is an umbrella for five separate components. In 1981, under the original PP, grants were awarded to three private voluntary organizations: CARE, Operation Double Harvest (ODH), and the Pan American Development Foundation (PADF). In addition, a Coordination and Technical Support Unit, staffed by two personal services contractors and a bilingual secretary, was established within the USAID/Haiti Mission. These four original components were all extended under the project amendment and, in early 1985, a fifth component was added when a research contract was awarded to the University of Maine (UMO).

The summary, AID-financed budget for the five components is as follows:

PROJECT COMPONENT	AMOUNT AUTHORIZED (to date)
CARE	$ 2,450,000
ODH	1,200,000
PADF	5,590,000
UMO	1,083,000
COORDINATION AND TECHNICAL SUPPORT	1,177,000
TOTAL	$11,500,000

CARE and PADF (hereinafter referred to collectively as "outreach grantees") work with peasant farmers in the Northwest and throughout the rest of the country, respectively. They were charged with establishing outreach programs that target small farmers with extension services which promote and support the planting of substantial numbers of trees and other environmentally sound land-use practices. The *sine qua non* of both outreach programs is that the trees are actually managed by the participants themselves, who are encouraged to make their own--informed--decisions about such matters as where to plant, when to harvest, etc. The benefits of trees planted accrue directly to the farmers.

CARE operates its own seedling production and extension network in the Northwest, based on two regional teams headed by expatriate foresters and staffed by salaried employees, including Haitian agronomists, agricultural technicians, animators, monitors and nursery workers. PADF, on the other hand, works primarily through local intermediary organizations, assisting them to establish extension programs of their own through a system of sub-projects. Five regional agroforestry teams provide grants, training and technical assistance to field-based NGO's and farmer groups interested in offering agroforestry services to their constituents.

Both outreach grantees have established extensive regional nursery systems to service their outreach programs. In addition to seedling production and extension activities, they are also charged with various project documentation and applied research responsibilities.

ODH, on the other hand, has worked with large private landowners (and on State lands) in the Cul-de-Sac Plain, in an attempt to demonstrate the feasibility of large-scale tree plantations on marginal lands located near Port-au-Prince; the idea being that such plantations, if successful, might ultimately supply a significant portion of the urban demand for fuelwood, charcoal, poles and lumber, thereby reducing pressure on rural forest resources and ameliorating the nation's wood-based energy crisis.

ODH is also responsible for various research-and-development and project support activities, including tree nursery experimentation, seedling production, and quality seed production, storage and distribution.

The project extension made provisions for letting a research contract with a Title XII University, in order to better pursue the project's secondary purpose of information generation. In January of 1985, this contract was awarded to UMO. The contract, which became effective on 1 March 1985 for an eighteen-month period, includes the investigation of a number of specific topics touching on socioeconomic and technical aspects of agroforestry in Haiti, and is being implemented by a multi-disciplinary team of long- and short-term professionals and student interns.

B. PROJECT EVALUATION SUMMARY

In December 1986, the Agroforestry Outreach Project will arrive at a major crossroads in terms of its program design, implementation and funding levels. While AID's Annual Budget Submission for Fiscal Year 1986 and the Mission Action Plan both made mention of continued agroforestry activities, and initially made provisions for additional resources for the project, an evaluation conducted in the second quarter of FY 86 took stock of its accomplishments and shortcomings, appraised its potential role within the Mission's overall strategy, and made recommendations for future implementation and funding requirements.

Overall, the project has been an unprecedented success. It has made a substantial, long-term contribution to the ultimate attainment of its goal--the reduction of natural resource degradation. This contribution is evident not only directly, in the fields of tens of thousands of peasant farmers, but also in terms of (1) the generation of a substantial body of information and practical experience; (2) the elaboration and demonstration of an effective tree-planting extension methodology based on income-generation and self-interest; (3) the stimulation of close to two hundred local organizations to become involved in agroforestry activities; (4) the establishment of a nationwide plant propagation system focussed on fast-growing tropical hardwoods, both local and exotic; and, (5) the training of hundreds of direct and indirect personnel, at all levels, to function effectively in implementing project activities.

The two outreach grantees, who together stand at the focal point of the project, have met or significantly exceeded all of their quantifiable targets. They have made good-to-excellent progress in achieving each of their more *qualitative* specific objectives, as well. Their performance in virtually every domain far exceeds the expectations, either expressed or implied, in the original PP and grant agreements, or their subsequent amendments and extension. Moreover, both of these grantees have registered important accomplishments in areas not explicitly covered in their original grant agreements, including (1) the introduction of fruit-tree propagation and distribution, on a small scale, to complement their primary emphasis on fast-growing tropical hardwoods; (2) the implementation of pilot and demonstration programs for *Leucaena* hedgerows, one of the most promising soil-conserving hillside farming technologies currently available; and, (3) the establishment of regional, containerized-seedling nurseries throughout the country, rather than in the Northwest alone.

Project monitoring, research and reporting are perhaps the weakest areas of performance for these two grantees to date, but these weaknesses have not yet profoundly affected performance in the field. However, if the project is to continue in its *de facto* leadership role within the agroforestry sector in Haiti, and to expand its own efforts in the long-term, then the time has most

definitely come to monitor more closely the technical performance of tree seedlings in the nurseries and in the field, and the performance of project extension agents vis-a-vis farmer acceptance of the recommended technical packages and procedures. If the challenges of new and different ecological and socioeconomic conditions are to be met, then survival, performance and effective extension advice are paramount. These can be enhanced only through a thorough program of practical monitoring, feedback, research and reporting.

ODH's performance has been considerably less consistent than that of the outreach grantees. While its nursery expansion program has been a resounding success, its tree-farm demonstration, technical R&D, and project support programs have been plagued by poor planning, inadequate application of scientific methods and standards, and insufficient documentation and record-keeping. Several key activities, including tree-farm research and demonstration, development of a local potting medium, and seed procurement and production, appear disappointing in achieving their original purposes. On the other hand, several practical technological innovations, including a new containerized-seedling system with wide potential applicability, have come out of ODH's efforts under the project. Their collaboration with the UMO research team has also been valuable.

In any event, it is not apparent that ODH can continue to play an integral role in the AOP as it has developed to date, with its primary emphases on rural outreach and decentralized nursery production. Future support to ODH should be based on a realistic assessment of its current capabilities as an organization, and of resource constraints and priorities within the AOP. Such support, if accorded at all, should probably be limited to (1) follow-up on on-going activities that continue to be of interest under the extension; (2) selected applied research topics; and, (3) a potential pass-through or collaborative role in a seed selection and tree improvement program sub-contracted to a third party.

Finally, the UMO research component was found to be performing well, and making a significant and timely contribution in terms of systematizing and expanding upon what the project has learned thus far. The UMO team has generated a wealth of relevant new data and analyses, through a well-executed research program that responds more than adequately to the terms of its contract and, in many arena, exceeds them. While the responsiveness and flexibility of the UMO research agenda (with respect to the grantees' perceived needs) may have been somewhat constrained by the specificity of their contractual obligations, they have convincingly demonstrated that the presence of an academic research institution within the AOP can only have a salutary effect on project planning, research and implementation.

Some highlights of the project's accomplishments, as recorded in the evaluation, include the following:

(1) By the current PACD, over 27 million fast-growing hardwood seedlings, both local and exotic, will have been produced and distributed for outplanting by peasant farmers. Survival rates have been rising gradually over the past two years (for which there is reliable data), and may now be estimated to range from 44% (PADF) to well over 60% (CARE) at 12 months.

(2) By the PACD, over 110,000 Haitian farmers will have planted substantial numbers of trees (varying between 100 and 500 per participant), and will

have demonstrated the economic potential of "trees-as-a-crop" throughout the country.

(3) 172 different PVOs and local groups have already participated in PADF's sub-project program.

(4) AOP extension networks throughout the country now reach approximately 17,500 participating farmers (including repeat planters) each planting season, and maintain regular contact with those farmers for at least a 12-month period following outplanting.

(5) A national network of 39 regional nurseries, with an annual production capacity approaching 15,000,000 containerized, fast-growing hardwood seedlings, has been established.

(6) More than 40% of the trees planted under the outreach grants have been planted on slopes exceeding 20%, and it is likely that a significantly larger number of participating farmers are, in fact, hillside farmers in one degree or another, regardless of where they chose to plant their first lot of project trees.

(7) Extension packages developed under the project stress the erosion-control potential of trees as well as their income-generating potential. The spatial arrangement of trees within hillside gardens to maximize their soil conservation effects is encouraged, and project participants are instructed in the construction and use of the A-frame.

(8) More than 60,000 linear meters of *Leucaena* hedgerows have been established in close to 500 small, widely-dispersed demonstration plots on farmers' fields.

(9) The two outreach programs operate at a combined internal rate of return of 15.6%, with a benefit-cost ratio of 1.54, discounted at 10%.

(10) The capacity of the ODH Cazeau nursery facility was expanded from 300,000 to 3 million seedlings per year.

(11) The Winstrip containerized-seedling production system was developed.

(12) Significant data on numerous technical and socioeconomic aspects of agroforestry in Haiti has been gathered and analyzed.

Some of the project's projected long-term impacts include:

(1) Rural income-generation, at a rate of $3.95 of net benefits to peasant participants for each dollar invested in the current outreach programs. The $8,719,780 already invested by USAID and other donors in the AOP outreach program (at the time of the evaluation) will generate a total of $34,418,885 of additional net income to project planters over the next twenty years.

(2) In addition, significant benefits in the form of labor income will accrue to those who harvest and transform the wood produced by project trees, since labor costs are charged against the figures above. This amounts to some $12,000,000 more in rural income generated over the same period.

(3) Micro-site changes on literally tens of thousands of marginal and fallow plots planted to woodlots, resulting in reduced rainfall impact intensity on exposed soil, increased rainfall penetration and moisture retention, and the accumulation of significant amounts of organic matter.

(4) Significant reduction in accelerated erosion on hillside plots planted with contour rows of trees or *Leucaena* hedgerows.

(5) Production of additional wood resources that measurably contribute to the national supply of wood products of all kinds, comprising as much as 3.9% of total projected annual consumption needs in subsequent years. (This effect is cumulative. Thus, for example, another ten years of sustained outreach activity, at current levels alone, would ultimately lead to a substantial increase in the proportion of the projected national demand able to be met by project trees.)

C. RATIONALE FOR AMENDMENT

The original Project Paper for this project stated the following:

> *The scope and severity of Haiti's environmental problems are difficult to exaggerate. Environmental conditions and trends in Haiti are the worst in the Western Hemisphere. Haiti ranks among no more than a half-dozen nations in the world whose natural resource endowments are moving toward a point where rehabilitation of the resource base may no longer be possible. Haiti's deteriorating natural resource base is a serious constraint on the country's efforts to increase agricultural production, which makes prospects for a productive and well-nourished life remote for the great majority of Haitians who already live on the margin of subsistence. The social and economic effects of environmental degradation are great, and contribute to the growing outflow of people from rural areas. Thousands of rural Haitians leave their homes each year for Port-au-Prince, other Caribbean islands and the United States in search of employment and better living conditions. The Haitian economy is primarily agricultural and has faltered with the declining productivity of the soil. Drought, flooding, soil depletion, scarcity of building materials and fuelwood, and damage to infrastructure have taken the place of what was once an ecological setting noted for its diversity and productivity. Hunger and malnutrition, even among the producers of the country's food supply, are common.*

But, contrary to the prediction of impending ecological disaster made in the original Project Paper, the country appears to have a somewhat more optimistic prognosis in light of what has happened over the past five years, and the hope that Haitian and donor vigilance on environmental action will be maintained.

Over the past five years, the AOP has demonstrated that it is both technically and economically feasible to limit environmental degradation through appropriate technological interventions that take existing socioeconomic realities into account. Scarcely a reforestation or environmentally oriented project undertaken since the AOP began has been implemented without borrowing one or more of its technical or organizational features.

Public awareness has also developed over this period, to the point where environmental action, even if it is only expressed in terms of tree planting, is now a priority issue. Today, as the country moves toward democratization, this

issue is on the lips of emerging politicians, community groups and, above all, on the *minds* of their rural and urban constituencies. Thus, the most critical step towards the solution of Haiti's environmental problems--that of attitudinal change--is being made.

At the same time, the AOP can continue to stand as a beacon for the implementation of new initiatives in this area. In order to fulfill this role effectively, however, the project must be extended and take up the following responsibilities: (1) the continued demonstration of environmentally-sound perennial tree-crop technologies; (2) the continued provision of material, technical and moral support to local organizations undertaking environmental and agroforestry projects in the field; and, (3) the further development of appropriate technological responses to an ever-widening scope of agroforestry-related problems and their proposed solutions.

While the project cannot hope to satisfy the growing demand for such services on its own, its continued operation at currently established outreach levels, if successfully linked to progressive qualitative improvements in technology and implementation, will ensure continued major impacts in this sector. The project will maintain its leadership role in substantive terms--setting the standard for the successful implementation of seedling production and outreach systems in Haiti--and will continue to leverage significant additional resources, both local and external, for environmental action here. This, then, is the primary rationale for the project amendment and extension proposed in this paper.

Furthermore, many of the AOP's accomplishments to date represent essential pieces of the complex puzzle the Mission is attempting to put together in its long-term hillside strategy. Perennial tree crops--and those human, technical and institutional capacities involved in their production and extension that are already in place under the AOP--are surely some of the most critical elements in the pursuit of this strategy. In terms of progress made so far, and potential future resources, the AOP, in a very real sense, can continue to lay the groundwork for the achievement of current Mission objectives on a national scale.

(1) Hillside farmers throughout the country are reached in significant numbers by the AOP, and are adopting and learning to establish and to manage some of the key elements of environmentally sound hillside farming. In the future, upgrading these practices and acquired skills, as part of integrated hillside farming technical packages, will be much easier than starting from scratch.

(2) The continued demonstration of the returns to trees-as-a-crop farming strategies and, more generally, of the potential value of the introduction of new, perennial plant materials into current farming systems facilitates the adoption of proposed new hillside farming technologies on a national scale.

(3) The national PVO extension network stands ready to disseminate these improved hillside farming technologies as they are developed under more intensive research and extension efforts soon to be mounted by the Mission.

(4) Finally, the AOP's national nursery network constitutes an invaluable potential resource for any realistic program of improved hillside farming which, of necessity, will include a significant component of agroforestry inputs and will require the large-scale propagation of high-quality plant

materials, including hardwoods, fruit trees, forage crops, and grasses. Upgraded under new project initiatives to become regional or local plant propagation centers, the AOP nurseries promise to make what will likely prove to be the project's most concrete and long-lasting contribution to the implementation of sound hillside farming practices around the country.

Implementation of the Targeted Watershed Management Project (TWM, 521-0191) will depend heavily on the AOP nursery and animation network established by PADF in the Cayes area. There alone, PADF is now assisting three major regional nurseries with a combined annual production capacity of 770,000 hardwood seedlings, serving more than 1500 farmers in the targeted watersheds each season, and employing about 75 part-time animators. Moreover, this network is currently operated by precisely those three major PVOs slated to become the key local collaborators under TWM. Increased demand for quality seedlings, as part of the comprehensive, soil-conserving technical packages to be developed and extended under TWM, will necessarily be satisfied by AOP nurseries. At the same time, the AOP animation network will be used and gradually upgraded under TWM, as the new project seeks to offer its much more intensive extension services to more and more area farmers now served under the AOP. This process is currently being programmed into the TWM project by the design team.

Likewise, as the hillside strategy comes to be applied in other targeted watersheds and, over the long term, throughout the country, AOP seedling production and outreach systems will be ready to serve this crucial role in implementation, providing established points of departure and sources of plant material for the dissemination of more complex, improved hillside farming technologies.

Thus, there is a second, quite compelling rationale for the maintenance and further refinement of these systems nationwide under this proposed extension of the AOP--as an investment in the long-term success of AID's entire future agriculture and rural development program.

II. REVISED PROJECT DESCRIPTION

A. INTRODUCTION

Beyond the successes of the project's basic program in its first five years of implementation, the end-of-project evaluation found, and the Mission concurred, that there are a number of areas in which significant improvements must be pursued if the project's accomplishments to date are to be consolidated and its full potential realized. In general, the time has come for the project to complement its earlier emphases on program establishment and expansion with an increased commitment to refinements in the quality of technical, outreach and research performance.

The proposed three-year extension, therefore, includes (1) the addition of much-needed technical backstop personnel to the outreach grantees' staffs, in the areas of training, nursery production systems, and research and documentation; (2) the continuation of an independent research component; and (3) the initiation of a seed and germplasm improvement program. These revisions under the extension will move the project towards state-of-the-art performance in qualitative as well as quantitative terms, and enable the AOP to continue to set the national standard for peasant-based agroforestry initiatives. Improvements in AOP technical and outreach systems over the next three years will also greatly enhance the project's long-term contribution to the success of the entire hillside strategy. In order to proceed with these improvements, while still maintaining current tree production and distribution levels, moderate increases in funding on an annual basis are programmed.

B. GOAL, PURPOSES AND OBJECTIVES

The goal of the project is to reduce and ultimately reverse the ongoing degradation of Haiti's natural resources, and thereby maximize the productive potential of its land.

The purpose of the project is to motivate Haitian peasants to plant and maintain trees and to achieve the planting and maintenance of a substantial number of trees in Haiti over the life of the project. Its secondary purpose is to obtain reliable information on the technical, economic and social variables of forestation in Haiti.

Trees planted under project auspices are planted with one or more of the following objectives, each of which may be considered a sub-purpose of the project: (1) soil conservation, (2) increased supply of fuelwood, and (3) rural income generation.

These project goals, purposes and objectives will remain unchanged under this amendment.

C. IMPLEMENTATION STRATEGY

The principal strategy of the project is to introduce and to support the idea of planting and harvesting trees as a valuable crop, for cash or in-kind income. This strategy seeks to exploit the basic economic rationality of private landholders operating in a cash economy by emphasizing the near-term profitability and utility of planting and maintaining substantial numbers of

trees. It encourages this course of action by providing appropriate plant material, training, and support services to planters. Under this extension, the quality of plant materials, training, and extension services will be further improved, in order to achieve significant increments in the survival and growth rates of project seedlings outplanted by peasant farmers.

The AOP differs markedly from previous efforts in reforestation or conservation *per se*, in that it does not attempt to engage participants on the basis of long-term, abstract, societal goals, but appeals instead to the immediate, economic self-interest of cooperating farmers. Income generation, then, is as much the driving force behind the project as it is one of its sub-purposes or objectives. Conversely, the project's other objectives--soil conservation, afforestation, and increased supply of fuelwood--are, by and large, pursued and achieved only indirectly, both on sites where project trees are actually planted and by relieving pressure on forest stands that might otherwise have been cut. This approach to tree planting, more than any other single feature, is what distinguishes the AOP from any of its predecessors, and will continue under this extension.

The basic implementation strategy of the project, then, is based on the profit motive of individual planters. Thus, the project works overwhelmingly with individual farmers on their own land. The benefits of trees planted accrue directly to the farmers.

D. PROJECT COMPONENTS

The AOP is, and will continue to be, implemented entirely through grants and contracts with non-governmental organizations, supported by an in-house Coordination and Technical Support Unit, rather than through a program of bilateral assistance to the Government of Haiti. At the time of its original authorization, this feature of the project also represented a significant departure from current practice. In the interim, a number of other major AID initiatives have followed similar approaches and, indeed, have been greatly influenced in their design by the success of the AOP. Still, the project, and each of its distinct components, currently enjoy cordial and productive working relationships with the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR) and its representatives. Informal collaboration with MARNDR's Direction of Natural Resources and the World Bank-MARNDR National Forestry Project has been particularly fruitful on both sides.

The project amendment will extend the project an additional three years, through December 31, 1989, and provide an additional $15.6 million funding for selected ongoing and additional (complementary) components. The project extension will (1) continue successful grant agreements for small-farmer tree planting with attendant extension and training; (2) continue to provide for a contracted, applied research program on technical and socioeconomic factors related to small-farmer tree planting; and (3) support a contracted program of biological and genetic tree improvement which can be maintained effectively through the non-governmental implementing organizations. The project will continue to require the services of two personal services contractors for the coordination of the various project components and related non-project activities, and the provision of technical assistance and guidance to the various components.

Through these agreements, the project will continue to provide information, training, technical assistance, and material support to Haitian counterpart

institutions and individuals. The outreach grantees will continue to produce and distribute substantial numbers of tree seedlings--an estimated 5 million tree seedlings per year over the next three years, for a total of 15 million. Cumulative project tree distributions will thus reach 40 million seedlings to an estimated 160,000 farmers. The project will also continue to generate important technical and socioeconomic data and will strive to fully document its activities in order to serve as a guide for forestry and agroforestry projects sponsored by Haitian and donor organizations.

The five components of the amended project are those major activities to be implemented by (1) the Pan American Development Foundation (PADF); (2) CARE; (3) a research institution; (4) a seed and germplasm improvement contractor; plus (5) overall coordination to be provided by the Project Coordination and Technical Support Unit.

In summary, PADF and CARE will continue to concentrate on tree seedling production, extension to small farmers, and training of PVO project personnel. CARE will continue to operate in the Northwest, working directly with farmers, and PADF will continue to operate in the Southwest, Southeast, Central Plateau and North regions, working through other PVOs. The research institution will undertake and coordinate research in traditional agroforestry sytems in Haiti, species-site selection, nursery and outplanting technology, socioeconomic issues, and tree product end-uses, with special emphasis on secondary forest products for use as green manure or forage. The seed and germplasm improvement component will concentrate on the establishment and management of tree-seed orchards, select and procure seed, and implement specifically targeted research on the improvement of both exotic and indigenous species. The Project Coordination and Technical Support Unit will ensure complementary efforts between project grantees and contractors, and adherence to AID project objectives. In addition, the Unit will serve as a clearinghouse for technical information, and spearhead the coordination of agroforestry projects and support services throughout the country.

Pan American Development Foundation and CARE. During the first four and one-half years of the AOP, PADF and CARE have worked throughout the country by establishing outreach programs that target small farmers with tree seedlings and extension services, and promote environmentally sound land-use practices, income-generation, and in-kind returns. The benefits of trees distributed accrue directly to the farmers. At current tree production and distribution rates, PADF will have overseen the extension of 20 million tree seedlings to almost 90,000 Haitian farmers by December, 1986. This will have been accomplished through 200 local organizations which have undertaken an average of three seasonal agroforestry sub-projects on their own over the five-year LOP. CARE, which operates solely in the Northwest, will have directly extended 6.5 million seedlings to more than 20,000 farmers.

In support of its program, PADF has fielded five regional agroforestry outreach teams which channel technical, material and financial assistance to local organizations. Twenty-seven of these organizations have established seedling nurseries which supply the extensive PADF program with container-grown seedlings. Training is provided to local organization staff in both basic and applied agroforestry technologies. These staff in turn interact with participant farmers. CARE has established five regional nurseries, on a model similar to that of the PADF nurseries, and some twenty decentralized community-

based plastic-bag nurseries, in the Northwest alone. PADF has obtained the services of two Peace Corps volunteers; and CARE, the service of one, in support of local organizational training and extension.

The combined PADF and CARE program is, by virtue of its nationwide coverage, the largest reforestation and agroforestry effort ever implemented in Haiti. In terms of tree seedlings distributed and farmers served, it is also the most successful. Their technical, organizational, and implementation systems, have become the *de facto* norms for similar efforts on the part of governmental, non-governmental, and international donor programs.

Modification of PADF's original grant goal, purpose and objectives is not called for under this project extension. This component of the project will retain its goal and purpose to "protect the productive potential of Haiti's land and generate income in rural areas by promoting and replicating tree growing and other economically productive and ecologically sound land uses by small farmers".

Specific objectives of the PADF grant extension will be to:

(1) continue to assist the implementation of agroforestry sub-projects through local community organizations;

(2) continue the establishment of demonstration areas and the training of Haitian counterpart personnel;

(3) continue to develop and to improve training programs for all levels of the outreach program and to provide training to personnel from other reforestation programs;

(4) continue to collaborate on an applied research program implemented by an independent research institution;

(5) refine seedling production and distribution systems for improved survival, growth and utility of tree seedlings, including close collaboration with the seed and germplasm improvement program for the identification of "plus" trees and the establishment of regional seed orchards; and,

(6) regularly monitor, analyze and document the findings of its extension program to improve its effectiveness.

These specific objectives will be pursued under a detailed plan, including explicit schedules and scopes for implementation activities, targeted geographic areas and groups, and verifiable indicators of progress and achievement. Progress towards the attainment of these objectives will be monitored and documented in quarterly progress reports.

CARE's original grant goal, purpose and objectives will not be modified for the proposed three-year extension. The goal and purpose will remain "to preserve the productive capacity of agricultural land owned or farmed by the small farmers in Northwest Haiti...by restoring the vegetative cover that protects and conserves the soil from the erosive elements of the climate and topography."

Specific objectives of the CARE extension will be to:

(1) refine the replicable outreach networks for application in the Northwest and other areas where governmental and non-governmental organizational presence is weak or not operational;

(2) identify the replicable and economically viable technical agroforestry models which impact soil conservation efforts;

(3) refine regional seedling production systems, in part through close collaboration with the seed and germplasm improvement component for the identification of "plus" trees and the establishment of regional seed orchards;

(4) continue on-farm research activities and collaborate with the independent research institution supported under the project; and

(5) continue and improve agroforestry training programs for all levels of project personnel.

These specific objectives also will be pursued under a detailed plan, including explicit schedules and scopes for implementation activities, targeted geographic areas and groups, and verifiable indicators of progress and achievement. Progress towards the attainment of these objectives will be monitored and documented in quarterly progress reports.

Sustaining the momentum and improving upon the systems established by PADF and CARE under the original AID grants will be the major emphases of the implementation plan for the next three years. In general, there will be an increased commitment to the quality of technical and outreach performance. This strategy, recommended in the recent evaluation, will require moderate increases in staff and material support, and an overall increase in cost-per- seedling ratios, at least initially. The potential impact in terms of program quality, sustainablility and efficiency amply justify these costs.

With respect to PADF's and CARE's extension and training programs, efforts will be made to modify aspects of the extended technical packages in order to have more direct and broader impact on the rural environment. Additional agroforestry options--which entail low-cost inputs yet continue to motivate farmers with enhanced survival, growth and utility of trees, such as direct-seeded *Leucaena* hedgerows--will be elaborated. Training and extension will receive full backstop support within both organizations, with the addition of training and extension specialists and the designation of local-hire training officers in each geographical region. Peace Corps Volunteers will also be solicited at every opportunity, in order to effectively utilize their services in this connection. Training materials will be developed and systematized as part of comprehensive agroforestry education programs (including curricula, teaching protocols, testing materials, etc.). These educational programs will be flexible enough so as to be able to be applied at both regional and national levels, with region-specific information supplementing standardized national curricula.

With respect to seedling production and other technical considerations, PADF and CARE will undertake to refine seed procurement, nursery systems and procedures, and outplanting techniques. Their implementation plans for grant extensions will explicitly address the task of improving the survival, growth and utility

of tree seedlings in the full range of ecological and socioeconomic settings in which the project operates. Here again, such technical considerations will receive full backstop support under the grant amendments. At least one new technical backstop staff member will advise the regional agroforestry teams and sub-grantee staffs, and interact with the independent research program also to be continued under this project extension. A recently completed analysis of pest management practices (see Annex F) makes specific recommendations for pesticide procurement and pesticide application training. CARE and PADF will make provisions in their follow-on grant proposals to fully comply with these recommendations.

SUMMARY OF AID GRANTS TO PADF and CARE
($000)

		PADF	CARE
Obligations through	FY 86	5,590	2,450
Projected for:	FY 87	2,400	1,400
	FY 88	2,400	1,400
	FY 89	2,400	1,400
Proposed total LOP funding (inc. this amendment)		12,790	6,650

[More detailed financial plans for these grants appear in Section II.E.]

Research. One of the burning issues of the Agroforestry Outreach Project has been how to establish a research arm of the project that is adaptive and responsive to overall project needs, be they gaps in knowledge or operational weaknesses in existing production and outplanting systems established under the project, and to obtain reliable information on technical economic and social variables of agroforestry in Haiti for the general benefit of all groups. In March 1985, an independent research contract was started to address the issue by commencing research in traditional agroforestry systems, nursery and outplanting techniques, silvicultural relationships, cost-benefit analyses, consumer preferences, and wood markets. It is being implemented by a multi-disciplinary team of long- and short-term professionals and student interns engaged through the University of Maine at Orono (UMO).

The AOP evaluation found that the research component was performing well and making a significant and timely contribution in terms of systematizing and expanding upon what the project has learned thus far. Also, the evaluation found that the presence of an academic institution lent credibility to major project efforts, enforced the application of scientific conclusions to ongoing practices and, through the collection and reporting of data, facilitated the transfer of information to a wider range of concerned practitioners than had been done previously.

However, information gaps concerning the field of agroforestry in Haiti, and the continuing need for monitoring and improving project operations, still exist. An attempt will be made in the next phase of the project to fill these gaps, and to improve upon the solid research results already obtained by implementing a flexible program of applied research as described herein.

Research already initiated under the project covers several important areas, including: (1) traditional Haitian agroforestry systems, (2) silvicultural studies, (3) nursery techniques, (4) species trial analysis, (5) marketing studies and consumer preference for selected wood products, (6) cost/benefit analysis of tree-planting under the project, and (7) socioeconomic analyses of farmer participation and decision-making with respect to project-distributed seedlings. In each of these areas, essential basic information has now been gathered and analyzed for the first time in Haiti.

The traditional agroforestry systems study identified and described over 40 distinct agroforesty systems currently practiced by Haitian farmers, with the objective of analyzing current practices in order to appropriately tailor project interventions and extension recommendations. Silvicultural studies have compiled, for the first time under the project, yield tables for some of the major species being distributed. The nursery techniques study looked specifically at various seedling container systems and their effect on survival and growth. Species trial analysis compiled information on the array of species trials throughout the country, and provided preliminary indicators of species performance in varying ecological settings. Marketing and consumer preference studies examined the potential profitability to farmers of raising tree crops, in general, and selected project species, in particular, for specific end-uses, including fuelwood, charcoal, pole and plank production. Also, baseline price, demand and supply information was gathered under this research component, and existing marketing channels were described. Cost/benefit analyses have developed farm-gate and project-wide models, on a regionally specific basis, for the determination of rates of return to peasant tree-cropping and project outreach investments. Lastly, socioeconomic research has broadened the understanding of peasant motivation and response to project interventions and highlighted some areas for both methodological and substantive improvement in the project's extension approach.

In each of the above areas of investigation, successfully completed research has now laid the groundwork for longer term research and development activities. Many additional questions and demands for information have arisen from this initial effort, however; and some wholly new areas of applied research, as recommended in the most recent project evaluation, need to be opened to investigation.

The traditional agroforestry systems report needs to be followed up by a more intensive analysis of technical and social parameters which either limit or facilitate the adoption of new agroforestry technologies. Moreover, the traditional systems research has provided a model for the in-depth study of those *new* systems being devised by farmer/participants' themselves as they attempt to integrate project seedlings with their current farming practices. Information from a follow-on study of this kind will ultimately enable the project to make more detailed extension recommendations to participants on the basis of the actual experience of peasant farmers like themselves and, likewise, to caution against innovations that have already proven *un*successful under similar circumstances elsewhere in the country.

Silvicultural studies can move from the basic yield tables to research aimed at practical management of project-distributed trees grown in association with other crops under actual peasant conditions, in order to maximize productivity in this context. The biomass production of additional project species and recently introduced leguminous hedgerows should also be studied in the context of peasant crop associations.

More extensive study of various aspects of nursery management and production systems was strongly recommended in the recent project evaluation. Moreover, these studies must be conducted against the backdrop of practical concerns that currently may militate against innovation in the project nurseries. Thus, for example, technically successful alternatives to current systems will have to be evaluated in terms of cost efficiencies, time/seasonal constraints and potential adoptability, as well. In addition, the production of vigorous planting stock clearly demands the initiation of research and development activities in the areas of microbial symbiont inoculation, seed selection, fertilization and propagation techniques--all of which were unable to be addressed under the relatively more modest original research contract.

Existing species trials require further analysis in terms of soil characteristics, site-species relationships and long-term performance trends. A soil testing program under the project should also be undertaken, as it will allow for the interpretation of species performance data, and the subsequent development of extension recommendations for site-species matching on a regional and sub-regional basis. This program will be facilitated by the expected establishment (CY 87) of a Canadian-financed soil analysis facility in Port-au-Prince, to be operated by a private company known as Agricultural Services S.A. (ASSA). The project has already entered into discussions with the president of the company and can reasonably expect to be able to avail itself of the new facilities by late 1987.

Wood products marketing studies should continue, in order to track longer term market trends and to identify commercial bottlenecks and opportunities affecting project participants as they harvest project trees for income generation. Again, this information should, ideally, be available on a regionally specific basis.

Cost-benefit analyses, likewise, must further be refined to serve the project's extension network with situationally specific input-output analysis that can be used in working directly with project animators and participants in motivational and planning activities. Given that the profit motive figures so strongly in farmer decision-making, this area of inquiry is crucial if the project is to succeed in its ultimate goal of establishing sustainable, agroforestry-based farming systems in Haiti. On-going cost-benefit analysis on a project-wide basis, moreover, serves the purpose of determining the most advantageous areas for continued development investments and policy initiatives within the general framework of the program.

Building upon the groundwork already laid under the University of Maine contract, sociological research can now proceed to examine the precise relationship between project extension strategies and farmers' adoption of new technologies. The communications aspects of project extension need careful review, based on field research, and farmers' specific responses to project motivational and training efforts, both positive and negative, need to be analyzed in close detail.

In general, an expansion and an intensification of the research effort under this project is called for at this time. Baseline information already available as a result of the original research contract will provide the foundation for this expanded research program. However, as per the recommendations of the recent evaluation, any new and extended research agenda must be designed to be more directly relevant to project operations, to be more responsive to the

specific information needs of the outreach grantees, and to broach research issues in areas not covered in the initial research effort.

By providing for a total of 204 person months of research expertise, it is expected that the project, as well as related USAID-funded and other-donor-funded forestry projects will be better able to provide: (i) sound technical advice and support services to Haitian farmers, nurseries, NGO subgrantees, and the two major outreach grantees; and, (ii) reliable information to development planners and policy makers in the areas of nursery production, reforestation, management of agroforestry associations and extension systems for delivering technology to farmers.

The research contractor will be responsible for providing technical expertise of a long-term nature over a period of thirty-three months (projected start-up, following the appropriate procurement process, is expected by April 1, 1987). The long-term team may be supplemented by additional short-term social, economic and technical specialists as deemed necessary and appropriate for the completion of the established research agenda. The long-term research team will be responsible for identifying, designing and implementing the discrete research activities to be undertaken under the contract, in collaboration with the outreach grantees. Short-term professional expertise may be programmed to advise, modify and evaluate research conducted by the long-term team.

The selected research contractor will implement a program which covers, at a minimum, a research agenda in the following areas:

i) Cost-efficient and appropriate systems for the production of vigorous planting stock in NGO-operated decentralized nurseries;

ii) Establishment and maintenance of trees on Haitian small farms; and,

iii) Economic and social aspects of crop and livestock associations with trees.

In addition to field research, the research contractor will be expected to establish and maintain a functioning agroforestry resource library and literature search service, to provide both basic and detailed documentation, on an as-needed basis, to project grantees and other interested parties. In general, the research contractor will be called upon to promote and facilitate the application of objective and scholarly standards to project implementation, monitoring, documentation, research, etc.

The long-term technical assistance team will include the following members:

	Title	P/Ms	Arrival Date (est)
1.	Nursery Specialist	33	April 1987
2.	Silviculturist	33	April 1987
3.	Microbial Symbiont Specialist	24	June 1987
4.	Soil Scientist	24	June 1987
5.	Agroforester	33	April 1987
6.	Economist	24	June 1987
7.	Social Scientist	33	April 1987

Illustrative scopes-of-work and proposed qualifications for long-term technical assistance team members are as follows. Please note that these constitute suggested and general guidelines only. As noted above, detailed research plans, in each instance, will be elaborated following award of this contract, and on an on-going basis, in collaboration with the two outreach grantees and the Technical Coordination Unit.

1. *Nursery Specialist* (33 P/Ms)

Suggested qualifications: Ph.D. or equivalent, university-trained forester, with specialization in nursery production. At least ten years' professional experience in nursery production, some of which should be in developing countries, including containerized seedling production and selection and development of potting media. Research experience in developing countries preferred. Demonstrated reading and speaking ability in French or Haitian Creole at FSI-approved S-3, R-3 levels required.

Specific duties: Conduct research into, and develop recommendations appropriate to specific AOP regions and species, for effective nursery practices for both centralized regional nurseries and for local community nurseries. Specific areas of inquiry and recommendation development will include:

(a) Seed germination techniques, such as sowing small seeds in germination boxes and transplanting to containers, and direct seeding of larger seeds.

(b) Nursery schedules, to determine how long seedlings should remain in shade houses versus open sun, in order to produce appropriately "hardened-off seedlings.

(c) Relative advantages and disadvantages of different sizes of potting containers.

d) Appropriate potting mixes of local and/or imported materials.

(e) Fertilizer schedules for specific potting mixes, and use of controlled release fertilizer.

(f) Irrigation schedules, especially to produce hardened-off seedlings for outplanting.

(g) Nursery-level inoculation of seedlings with microbial symbionts, in cooperation with the microbial symbiont specialist.

(h) Production of bare-root or stump seedlings in beds, especially in community nurseries.

Lastly, the Nursery Specialist shall disseminate research results through participation in workshops with grantee nursery technicians and other technical staff, and prepare, with the grantees, an illustrated nursery manual in Creole in the third year of the contract.

2. *Silviculturist* (33 P/Ms)

Suggested qualifications: Ph.D. or equivalent, university-trained forester, with specialization in hardwood silviculture. At least ten years' professional experience with fast-growing tropical hardwoods, especially as concerns species-site relationships, some of which should be in developing countries. Considerable knowledge of tropical soils preferred. Research experience in developing countries preferred. Demonstrated reading and speaking ability in French or Haitian Creole at FSI-approved S-3, R-3 levels required.

Specific duties: Conduct research into, and develop recommendations for matching species to specific sites within Haiti, and for managing trees in association with crops. Specific areas of inquiry and recommendation development will include:

(a) Correlation of species growth with site factors such as rainfall, temperature and soil conditions. For species with well-defined varieties, such as *Leucaena*, correlate performance of different varieties with site variables. In cooperation with the soil scientist, determine site factors that are easily identifiable by Haitian extensionists, and well-correlated with growth, to help extensionists determine the best species to plant on specific farms.

(b) Determination of practical techniques for managing trees on farms after outplanting. Work closely with grantee field personnel and the social scientist to develop techniques that not only improve tree growth, but that farmers will adopt. Develop effective pruning and coppicing techniques for adoption by peasant farmers.

(c) Experimentation with different spacing of trees and hedgerows in association with crops. Cooperation with agronomist/agroforester to determine interaction of trees and crops.

Lastly, the Silviculturist will disseminate research results through participation in workshops with grantee extensionists and technical staff, and prepare, with grantees, an illustrated tree management manual in Creole in the third year of the contract.

3. *Microbial Symbiont Specialist* (24 P/Ms)

Suggested qualifications: Ph.D. or Ph.D. candidate, university-trained specialist in the identification and analysis of microbial root symbionts. (The activities of this position could conceivably be carried out as research for a Ph.D. program by a particularly talented graduate student.) Expertise in isolating and culturing mycorrhizal fungi and bacterial root symbionts. Microtechnique capabilities. Experience with legume-*Rhizobium* associations. Research experience in developing countries preferred. Demonstrated reading and speaking ability in French or Haitian Creole at FSI-approved S-3, R-3 levels required.

Specific duties: Conduct research into, and prepare recommendations for, the inoculation of native and introduced species with microbial symbionts in the nursery or field. Specific areas of inquiry and recommendation development will include:

(a) Collection of roots and soil from AOP field sites to determine degree of mycorrhizal infection, and identification of symbiont(s). Develop techniques for obtaining inoculum of effective mycorrhizal fungi for application in nurseries, by culture or by other means.

(b) Inoculation of seed or seedlings with effective microbial symbionts.

(c) Production and/or acquisition procedures for symbiont inoculum. This might involve both importation and development of local production in Haiti.

4. ***Soil Scientist*** (24 P/Ms)

Suggested qualifications: Ph.D. or equivalent, university-trained soils scientist with specialization in either forestry or agronomy. Experience with tropical soil classification, soil survey and mapping, and soil dynamics (soil/plant interactions). Demonstrated reading and speaking ability in French or Haitian Creole at FSI-approved S-3, R-3 levels required.

Specific duties: Research on soil aspects of AOP outreach, in support of silvicultural and tree/crop interaction research. Specific areas of inquiry will include:

(a) Determination of soil characteristics that are easily discernible in the field, and that are correlated with good performance by AOP trees.

The Soils Scientist will also participate in workshops for AOP extensionists and technical staff to train them in field determination of soil characteristics to be used for matching tree species with particular sites; and, cooperate with the team Agroforester to determine nutrient and organic matter inputs to soil of green manure from foliage pruned from associated tree species.

5. *Agroforester* (33 P/Ms)

Suggested qualifications: M.S. in forestry or agronomy with specialization in agroforestry. Knowledge of tropical crop production. At least five years' professional experience, preferably in a developing country. Experience with Haitian agricultural systems preferred. Demonstrated reading and speaking ability in French or Haitian Creole at FSI-approved S-3, R-3 levels required.

Specific duties: The agroforester will conduct research on agroforestry associations. Specific areas of inquiry will include:

(a) Comparison of crop productivity with and without association of project trees, as well as the productivity of crops with different tree spacings and configurations.

(b) Effects of mulching and fertilization with foliage and branches of hedgerow and other associated trees, in cooperation with soils scientist.

(c) Determination of inputs and outputs of agroforestry systems.

6. ***Economist*** (24 P/Ms)

Suggested qualifications: M.S.-level, university-trained economist, with at least five years' professional experience, preferably in a developing country. Research experience in peasant farming systems and agroforestry associations preferred. Demonstrated reading and speaking ability in French or Haitian Creole at FSI-approved S-3, R-3 levels required.

Specific duties: Investigate economic impact of tree-cropping and agroforestry associations on Haitian farms. Specific areas of inquiry will include:

(a) Labor, land, capital and financial inputs in traditional and adopted agroforestry cropping systems, from literature and field studies, as needed.

(b) Financial and economic outputs from traditional and adopted agroforestry cropping systems, in cooperation with Agroforester.

The Economist will disseminate the results of economic studies with policy and project implications to extensionists and grantee technical staff, in cooperation with the team Social Scientist, in order to develop materials and activities to promote economical tree planting and agroforestry associations on peasant farms.

7. ***Social Scientist*** (33 P/Ms)

Suggested qualifications: Ph.D. or equivalent in rural sociology or social anthropology, with at least five years' of professional experience. Long-term field research experience in one or more developing countries. Strong preference will be given to candidates with previous experience in Haiti, the Caribbean, or other creole-speaking societies. Demonstrated reading and speaking ability in French or Haitian Creole at FSI-approved S-3, R-3 levels required.

Specific duties: Investigate and suggest improvement of AOP extension activities. Areas of inquiry will include:

(a) Determination of reasons that Haitian farmers do or do not plant trees under specific circumstances of farm size, demographic characteristics, land tenure, etc.

(b) Design and implementation of research on current extension and training techniques being used in AOP, analyzing their effectiveness in reaching target audiences.

(c) Development of extension and training techniques in cooperation with grantee field foresters, incorporating results of economic research, to better promote tree planting on Haitian farms.

The Social Scientist will disseminate research results through participation in workshops with grantee exstensionists and technical staff. A proposal for modified extension techniques, with full analytic justification, should be presented within one year of the signing of the contract. Also, the Social Scientist will prepare, with grantees, an illustrated agroforestry extension manual in Creole in the third year of the contract.

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The new research contract to be let under this extension will be set aside for an educational institution or an international research center, and will be solicited and awarded on the basis of technical qualifications and capabilities to both design and implement an agroforestry research program. Particular emphasis will be placed on how bidders propose to apply silvicultural and socioeconomic methods of analysis to the most pressing concerns of the project tree seedling production and extension organizations.

SUMMARY OF AID-FINANCED RESEARCH
($000)

Obligations through	FY 86	1,083
Projected for:	FY 87	900
	FY 88	700
	FY 89	700
Proposed total LOP funding (inc. this amendment)		3,383

[A more detailed financial plan for the research contract appears in Section II.E.]

Seed and Germplasm Improvement Program. There have been a variety of difficulties encountered in acquiring tree seed for seedling production and species trials. The quality of native and exotic tree germplasm being collected in-country for seedling production remains essentially undocumented and beyond the effective control of the outreach programs. Sufficiently detailed information on the provenance of most imported seed is also unavailable. Fortunately, and in spite of these findings, good tree form and growth can be observed for most species, throughout the country. Equally visible, however, is poor tree form and growth.

A program for the genetic improvement of trees--through the institution of adequately documented and controlled seed collection, procurement, selection and propagation procedures--is absolutely essential to the long-term success and progressive improvement of the project, as well as to the planning and implementation of USAID/Haiti's major new agricultural sector initiatives under the hillside strategy. Plant materials used in the AOP, and in these upcoming projects, must be selected and improved for a range of desirable characteristics, determined in accordance with specific project objectives; those characteristics, once achieved, must then be maintained through a systematic, in-country program of plant propagation.

The project evaluation report estimates that 20% to 40% increases in seedling establishment, growth and yield can be achieved in a relatively short time period (three to five years), simply by using seed and plant material of good genetic quality and known, site-specific performance potential. Thus, there is a drastic need for the improvement of seed quality for the production of seedlings distributed and outplanted under the AOP.

This need has been recognized for several years within the project, but budgetary constraints and an inability to identify an appropriate institutional home for the program have prevented its implementation. All three grantees have made some progress in establishing programs for the orderly collection of seeds in-country and for the importation of seeds of known provenance from outside sources. This progress has also been hampered by budgetary constraints and, among the outreach grantees at least, by the absence of any full-time, fully qualified personnel charged with this task. Establishment of seed propagation orchards has been extremely limited, and the ultimate utility of these efforts is undercut by incomplete or inaccurate information concerning the provenance and performance characteristics of the original seed sources.

Some essential information for the implementation of a tree improvement program has been generated under the project, but much of it has not yet been recorded or codified in lasting, useable form. It continues to reside, in whole or in part, only in the personal experiences and day-to-day working knowledge of field personnel. For example, the location of outplanted trees of superior phenotype, in terms of form and growth (so-called "plus" trees), is nowhere mapped or recorded. These trees of demonstrated quality, however, constitute the most important single source of germplasm upon which to base a seed improvement and propagation program. This information must now be gathered by an outsider hired specifically for this task, or reported by the field personnel themselves, in order to be of real utility in the future.

An effective seed improvement program must begin with a careful determination of both the species to be improved and the desired characteristics to be sought from each. The determination of desired characteristics to be selected needs to be based on (1) the project personnel's best assessments of end uses intended by participants (i.e., pole production requires different tree form and growth characteristics than charcoal production; intercropped trees a different crown configuration than border plantings--ideally, several distinct sets of characteristics for the most important species may be selected); and (2) technical grounds (i.e., selecting genotypes for pest resistance or drought-hardiness). Also, generally speaking, genetic diversity is necessary within the overall system, in order to preserve the dynamism of the gene pool in-country. A criterion matrix for making these determinations has not yet been developed, but should be the first step in an effective tree improvement program.

Once these decisions have been made, information containing in-country resources of standing trees exhibiting the desired characteristics under specific site conditions has to be gathered and, preferably, mapped. Next, these "plus" trees are rented from their owners for seed production or vegetative propagation from cuttings; vegetative propagation being the preferred method, where biologically possible, for the establishment of seed production orchards. The seeds or cuttings are then propagated under proper nursery management regimes (e.g., with appropriate inoculation), and outplanted and managed for seed production. Second generation selection and seed orchard establishment may be necessary in some cases, as well. The same procedures must be followed for imported plant materials of superior genotype and known provenance. Finally, accurate, detailed records must be kept at all stages of this process, so that future manipulation of the genetic resource base need not start from scratch. Thus, local counterpart agencies and individuals also must be involved and trained in the long-term management of improved seed sources.

Seed production orchards are slated to be established and managed in each of the outreach regions, sited on land under long-term lease or owned by participating PVO nurseries, which represent the local counterpart implementing agencies of the project.

The program proposed here, probably even expanded to include other kinds of germplasm, such as fruit trees, forage grasses, selected annual crops, etc., is also of capital importance to the successful implementation of each of USAID/Haiti's other currently planned agricultural sector initiatives, intended to extend environmentally sound farming practices to hillside farmers.

By providing a total of 66 person months of long-term seed and germplasm improvement expertise, and additional short-term technical assistance as required for the successful completion of this contract, it is expected that the project, as well as related USAID-funded activities and other-donor-funded forestry projects will: (i) have in-country access to adequate supplies of quality multipurpose tree and forage germplasm and seed of selected species, and (ii) have implemented a system for maintaining records of the source and characteristics of germplasm outplanted on Haitian farms.

The selected contractor will be responsible for providing a two-person team, consisting of a Ph.D.-level forest geneticist or botanist and an M.S.-level forester/silviculturist for a period of thirty-three months, as described below in detail. This long-term team may be supplemented by additional short-term technical assistance, in areas such as botany, forest genetics, computer programming and agrostology, as deemed necessary and appropriate for the completion of the full seed and germplasm improvement agenda to be established by the long-term technical assistance team in conjunction with the outreach grantees.

Each professional member of the contract team will possess: considerable academic and practical field experience in his or her technical discipline; data-base management experience; strong interpersonal and organizational skills; the demonstrated ability to manage and coordinate lower level technicians; fluent French and/or Haitian Creole language skills; and, in the absence of Creole, the demonstrated ability to acquire a working knowledge of local languages rapidly at a level sufficient for the purposes of designing and conducting the seed and germplasm improvement program.

The tree improvement team will be responsible for working with the AOP Technical Coordination Unit, comprising the Project Manager, Project Coordinator and Senior Forestry Advisor, and with the grantees, to finalize the detailed tree and forage improvement program to be undertaken under the contract, including the prioritization of species to be improved and propagated, the selection of specific performance characteristics for each targeted species, and the designation of priority ecological zones for which each targeted species is to be selected. To this end, a detailed workplan will be prepared within three months of the award of the contract. Short-term professional expertise may be required to design and/or oversee the implementation of those supplementary aspects of the established, final program not falling within the specific areas of expertise and experience of the two-member, long-term team, such as forage selection and propagation, for example, and to ensure the flexibility of the contractor in responding to the specific needs of the program as it evolves.

The contractor will be required to design and implement a program which, at a minimum, accomplishes the following:

i) Establishment, in conjunction with the grantees and the Technical Coordination Unit, of a criterion matrix for the evaluation, selection and improvement of targeted tree and forage species (including *at least* six hardwood species, both local and exotic) which takes into account significant variation in both the ecological settings into which project seedlings are being introduced and the intended end-product uses envisioned by farmer participants for each species.

ii) Identification and mapping of superior individual performers for each targeted species and selected characteristic, in designated ecological zones throughout the Haitian countryside.

iii) Propagation of these superior individuals, and establishment of progeny test plots and decentralized seed orchards (*at least* twenty [20]) to ultimately supply AOP nurseries and, potentially, commercial seed marketing demands.

iv) Introduction of new multipurpose tree and forage germplasm of known provenance and performance characteristics into Haiti and establishment of multiplication orchards and progeny tests thereof, as deemed appropriate.

v) Design and institution of a project-wide, computerized, record-keeping and mapping system to track seed and germplasm distribution within the AOP.

vi) Establishment of a framework for longer term species improvement and the maintenance of genetic diversity for reforestation purposes in Haiti.

The seed and germplasm improvement program will be designed and implemented, and the results documented and disseminated, according to the highest professional standards. A thorough review of the results of previous agroforestry research, particularly species trials, species elimination trials and socioeconomic research on potential end-uses of project trees in Haiti, will be undertaken before initiating the specific seed and germplasm improvement activities. Moreover, the locations and results of extant species and species elimination trials, where available, should be mapped and coded as part of the computerized documentation system to be developed under this component.

The two-person long-term technical assistance team will include the following personnel:

	Title	P/Ms	Arrival Date (est)
1.	Tree Improvement Specialist (Forest Geneticist or Botanist)	33	April 1987
2.	Tropical Forester/Silviculturist	33	April 1987

In addition to the above listed technical team, a local agronomist/counterpart and local support staff, including an office manager/bookkeeper, secretarial and support assistance will be required.

Illustrative scopes-of-work and proposed qualifications for long-term technical assistance team members are as follows. Please note that these constitute suggested and general guidelines only. As noted above, a fully detailed plan for the seed and germplasm improvement program can only be elaborated following award of this contract, in close collaboration with the two outreach grantees and the Technical Coordination Unit.

1. ***Tree Improvement Specialist*** (33 P/Ms)

Suggested qualifications: Ph.D. or equivalent, university-trained forest geneticist or botanist with at least ten years' specialization in tree improvement/forest genetics. Experience with fast-growing hardwoods, preferably in the tropics. Solid background in vegetative propagation of tropical hardwoods and forage species, seed selection, collection and storage. Demonstrated reading and speaking ability in French or Haitian Creole at the S-3, R-3 levels required.

Specific duties: Responsibilities of the tree improvement specialist will involve: (i) overall management and design responsibility for the seed and germplasm improvement program contracted hereunder; (ii) selection, identification and propagation of superior phenotypes from the Haitian countryside; (iii) introduction, multiplication and test plot establishment of new germplasm; and, (iv) implementation of a record-keeping system for seed origin. Specific activities will include:

(a) Determination of the most promising species for improvement, and establishment of selection criteria, by performance characteristics and ecological zone, in consultation with grantee field foresters and the project's Technical Coordination Unit. In this determination, consideration will be given to a variety of desired end-products, such as charcoal, building poles and lumber, as well as factors affecting the association of particular species with crops and livestock, such as crown size, propensity to self-seed, forage production and nutritive value, etc.

(b) Organize, supervise and coordinate the field identification and mapping of superior phenotype trees for each species or variety selected for improvement and propagation, in each of the project's ten geographic regions across the country. The first step in accomplishing this task will be the organization of a workshop for grantee field foresters and extensionists to explain the procedure for determining and specifying the locations of superior phenotype trees. Visits to each project region will be required to corroborate the superior status of trees identified by grantee staff, and the accuracy of locational data. The location of each tree will be mapped, and a data sheet will specify topographic map coordinates and the name of the farm owner. Specific performance characteristics will, of course, be noted in each instance. To maintain genetic diversity, seed orchards (see below) will be established from a large number (50-200+) of superior trees for each species in each region.

(c) Plan and supervise the collection of seed -- and plant material for vegetative propagation, where appropriate -- from each superior tree, and supervise its propagation for the establishment of seed orchards and progeny tests. Exploitation rights must be established through lease or other type of remunerative arrangement with farmer/owners, to allow the collection of propagation material. These relationships will be facilitated through existing grantee connections with current project participants in each region.

(d) Plan and supervise the establishment of progeny tests for all selected trees. Test plots should be on secure land typical of conditions on project farms.

(e) Plan and supervise the establishment of seed orchards -- vegetatively, if possible -- to produce seed for project nurseries, maintaining the identification of each parent tree. Central facilities for propagation of superior phenotype trees will be arranged by the contractor with funds awarded under the contract. In each region, seed orchards will be established on NGO-operated (leased or owned) land, preferably near a project nursery, using only material from superior trees of that region, or a climatologically and pedologically similar one. The Contractor hereunder will cover the costs of seed orchard establishment and maintenance. Seed orchards should be designed large enough to provide all of the seed needs in each region. Should local sub-grantees be interested in seed sale, then orchards can be of a larger size.

When the results are available from progeny tests, the inferior trees will be rogued out of the seed orchards. By the end of the contract, a *minimum* of twenty seed orchards and/or seed and germplasm multiplication areas should have been established.

(f) Plan and supervise the importation of new, high-production tree species and varieties, including psyllid-resistant *Leucaena* varieties. Where only small quantitites of seed are available, plantings will be established to multiply reproductive material. Plots will have to be established to evaluate the performance of this introduced material in specific project regions, in cooperation with the grantees and the Title XII research team.

(g) Plan and implement the establishment of facilities for the storage of project tree seed. A high-quality centralized storage facility will be necessary for imported seed and reproductive material brought in from superior trees in the regions for propagation. This facility will be installed with contract funds, at the central nursery established or leased by the contractor. Seed collected from the regional seed orchards will eventually be kept in propane refrigerators within each region. The central facilities can also be used for storing imported or locally- produced microbial symbiont inoculant.

(h) Design and implement an efficient, computerized documentation system to maintain records of the tree improvement project. This documentation system is necessary so that if exceptionally good or bad seedling performance is noted in the greenhouse or in field plantations, it can be related to a particular seed source. This documentation system should be microcomputer-based, and easily learned and utilized by other project implementing agencies. By the end of the contract, it is expected that basic data on the provenance and performance of all species and varieties

worked with by the Contractor will be part of this system, and that plans for its continued use in the procurement, production and monitoring of reliable seed and plant material for the project will be in place. Copies of all disks and hard copies on paper of all information should be stored at USAID headquarters.

(i) Plan (in conjunction with other project implementing agencies and the Technical Coordination Unit) and supervise all short-term technical assistance to be deployed under this contract, as discussed above.

2. *Tropical Forester/Silviculturist* (36 P/Ms)

Suggested qualifications: M.S.-level or equivalent, university-trained tropical forester and silviculturist. Strong background in plant propagation, especially vegetative reproduction. Experience in tree propagation in developing countries. At least five years' field experience in tropical forest development. Aerial photo interpretation training and skills, and demonstrable map-reading ability preferred. Demonstrated reading and speaking ability in French or Haitian Creole at the S-3, R-3 levels required.

Specific duties: The forester will be responsible for implementation, management and organization of all program field operations, under the supervision of the Tree Improvement Specialist, as well as for on-going liaison with the grantee field staffs. In these tasks, he will be assisted and will, in turn, train, a Haitian counterpart at the level of university-trained agronome. Specific duties will include:

(a) Verification of "plus"-tree identifications; mapping of superior phenotype trees in the field. Collection of material in the field for vegetative or seed propagation in the central nursery facility. Also, field-level, practical training of grantee staffs in these activities.

(b) Establishment, management and maintenance/supervision of regional progeny tests *and* seed orchards, in cooperation with grantee foresters and NGO nursery personnel.

(c) Provide technical assistance to grantee organizations in the implementation of computerized databases and systematic data-gathering procedures for maintaining seed source, performance and tree improvement records within their own programs.

***

This program will be supported with funding under a contract with a private entity. Appropriately subsidized at first, such a program may also evolve into a sustainable commercial venture, perhaps involving some of the project's collaborating PVOs, and based on an expanding national market for services and seed through AID's expanding hillside farming portfolio.

SUMMARY OF AID-FINANCED TREE SEED IMPROVEMENT
($000)

Obligations through FY 86	-0-
Projected for FY 87	400
FY 88	300
FY 89	300
Proposed LOP Funding (inc. this amendment)	1,000

[A more detailed financial plan for the tree seed improvement contract appears in Section II.E.]

Project Coordination, Technical Support and Evaluation. The role of the Agroforestry Outreach Project Coordinator came into being primarily because the grantees saw the need for liaison among themselves and between themselves and USAID. The key phrase in the original project paper and in the scopes of work of the three coordinators who have been engaged since the project began is that the coordinator should be "responsive to all three [grantees] and responsible to the USAID Mission".

The first coordinator was quite closely involved in the field activities of the grantees, advising on the hiring of field staff, training field staff, meeting with peasant groups and arranging visits by peasants to project sites. Some of these activities were particularly important at the startup of the project and others were seen as continuing functions. The coordinator was seen as a trouble-shooter who could intervene at any level in the project, from the donor agency to the planter. The USAID liaison role was, at this early stage, one of the least emphasized of the five roles assigned to the coordinator in the original PP.

At the current stage in the evolution of the AOP, however, the recommendation for the relative weighting of each of the coordinator's functions is somewhat different. It is of continuing importance for both AID and the grantees and contractors to be aware of each other's progress, problems and concerns. AID needs to have someone with firsthand experience of the project at all levels, from the grantee project director to the planter. The grantees need to have a project-funded liaison at AID to represent and pursue their sometimes complex interests, concerns and administrative requirements. The importance of communication between USAID and the grantees has become apparent on those occasions when it has broken down.

The liaison function has entailed not only communications but facilitating the management of the project, as well, by providing the project manager with necessary and timely information and advising him on project needs and progress as these develop. An explicit planning function has not been written into the scope of work of the coordinator, but has also proved to be an important one, especially in the development of the current extension.

The importance of each of these functions is likely to increase rather than diminish in the next phase of the AOP, for reasons both internal and external to the project. Internally, there will be greater project complexity with the absorption of several new and complementary activities into the project. During the next phase of the project, the degree to which agroforestry activities at the institutional (PVO) and individual levels can be sustainable will become

clearer, particularly when harvesting and marketing become more widespread and agroforestry packages such as living terraces are adopted on a wider basis. Thus, the next phase is likely to bring the AOP to a point at which crucial decisions will be needed with regard to the future, for example, in the ability of the NGO sector to maintain nurseries and outreach programs.

In addition to developments within the AOP, the need for liaison and project leadership will be as great and possibly even greater than in the past because of the inception of major USAID initiatives in watershed management, continued uncertainties in the levels of foreign assistance funding by the Congress, and political developments in Haiti which are likely to affect the agricultural and non-governmental sectors.

The principal roles of the senior forestry advisor will continue to be (1) to provide an in-house technical review capability for USAID and (2) to provide technical guidance, leadership, oversight and coordination services to the implementing agencies. Basically, the forestry advisor assists the Project Manager in responding to technical inquiries and initiating forestry-related technical activities both within and beyond the project. This role is likely to grow in importance as the AOP increasingly fulfils its promise as a working model for future environmental interventions in the rural sector. Moreover, the SFA stimulates, facilitates and ensures the technical soundness and continual improvement of project operations in constant interaction with the outreach grantees and contractors, standing as *primus inter pares* on all technical matters related to project implementation.

The abovementioned roles and functions of the coordinator and the senior forestry advisor will be supplemented, as deemed appropriate and necessary, by short-term technical consultancies and a bilingual project secretary, as has been the case in the past. Incidental project support costs (documentation, library acquisitions, maps, etc.) are also funded through the coordinator's office. Finally, an external, project-funded evaluation of the entire project is scheduled, following the next three year period of implementation.

SUMMARY OF AID-FINANCED PROJECT COORDINATION
($000)

Obligations through FY 86	1,177[1]
FY 87	500
FY 88	200
FY 89	200[2]
Proposed LOP Total	2,077

[1]Includes obligations to both Project Coordinator and Senior Forestry Advisor personal services contracts for first five years, in addition to short-term consultancy contracts for technical appraisals and evaluations.

[2]Includes Final Evaluation and audit costs. (Funding from previous fiscal years will be used to forward fund the PSC contracts of the Coordinator and Senior Forestry Advisor.

[A more detailed financial plan for Coordination, Technical Support and Evaluation appears in Section II.E.]

E. FINANCIAL PLAN

Table 1 outlines the project's financing from its inception through the three year extension. The additional AID financing required for this three-year amendment--$15.6 million for a cumulative project total of $27.1 million--provides for grant amendments with PADF and CARE for agroforestry outreach operations; $2.3 million for a technical and socioeconomic research component; $1.0 million for a seed and germplasm improvement component; and $0.90 million for coordination, technical backstop support, and evaluation and audit activities. The additional financing will permit an extension of the project timeframe by three years (six planting seasons); maintenance of current outplanting and extension levels at approximately six million seedlings produced and distributed on an annual basis with approximately 20,000 participating farmers; and qualitative enhancements to the project in technical and organizational aspects, as outlined in previous sections of this paper.

Tables 2 through 6 provide the estimated summary financial plans for each of the project components for the three year extension period. The tables depict the source and application of project resources, both financial and in-kind.

Table 1
Agroforestry Outreach Project Budget, AID Financing
(U.S.$000)

Component	Authorized Thru FY86	Projected Obligations FY87	FY88	FY89	Totals
PADF	5590	2400	2400	2400	12790
CARE	2450	1400	1400	1400	6650
Double Harvest	1200	0	0	0	1200
Research	1083	900	700	700	3383
Seed Improvement	0	400	300	300	1000
Coordination/Tech Support	1177	500	200	200	2077
Totals	11500	5600	5000	5000	27100

Table 2
Summary Cost Estimate and Financial Plan for AOP Amendment
PADF Component
(U.S. $000)

USE	SOURCE				
	AID			OTHER[2]	
	FX	LC[1]	TOTAL	FX	LC[1]
Personnel	1900	820	2720		
Vehicles	140	20	160		
Operations	80	710	790		305 500 648
Training	0	70	70		
Home Office	60	0	60		
Overhead	1370	0	1370		
PVO Support	610	1420	2030		
Totals	4160	3040	7200	0	1453
Percentages	58%	42%			

[1]U.S. $1.00 = Haitian Gde. 5.00

[2]Contributions from PADF subgrantees are estimated at 15 percent of PVO costs or $305,000. Farmer contributions are estimated at 10 cents for every planted tree (5,000,000 x .10 = $500,000). Other donors have contributed an additional 9 percent of the first five year grant amount, projected over the next three years at $648,000.

Table 3
Summary Cost Estimate and Financial Plan for AOP Amendment
CARE Component
(U.S. $000)

USE	SOURCE				
	AID			OTHER[2]	
	FX	LC[1]	TOTAL	FX	LC[1]
Material and Equip.	1061	672	1733		
Personnel and Oper.	641	1243	1884	150	380
Training	4	185	189		
Overhead	394	0	394		
Totals	2100	2100	4200	150	380
Percentages	50%	50%			

[1] U.S. $1.00 = Haitian Gde. 5.00

[2] CARE unrestricted funds pay 10 percent of senior mission staff costs and 15 percent of staff and maintenance costs of CARE's P-au-P garage for a total of 150,000. CARE estimates that the communities of the Northwest will provide some $56,000 worth of volunteer labor for community nurseries, road improvements, and materials for community nurseries. In addition, some $324,000 will be contributed in farmer labor in tree planting activities (9000 farmers per season x 2 days x $3.00 x 6 seasons).

Table 4
Summary Cost Estimate and Financial Plan for AOP Amendment
Research Component
(U.S. $000)

USE	SOURCE				
	AID			OTHER	
	FX	LC[1]	TOTAL	FX	LC[1]
Salaries, Allow., Fringe Benefits	1000	400	1400		
Travel,Trans.	115		115		
Equip., Materials	345		345		
Logistics	57		57		
Overhead (20%)	383		383		
Totals Percentages	1900 83%	400 17%	2300	0	0

[1]U.S. $1.00 = Haitian Gde. 5.00

Table 5
Summary Cost Estimate and Financial Plan for AOP Amendment
Seed and Germplasm Improvements
(U.S. $000)

USE	SOURCE				
	AID			OTHER	
	FX	LC[1]	TOTAL	FX	LC[1]
Personnel	500	100	600		
Vehicles	40		40		
Equip., Materials	15	30	45		
Germplasm Purchase	5	10	15		
Seed Production		75	75		
Travel	5	20	25		
Overhead (25%)	200		200		
Totals Percentages	765 77%	235 24%	1000	0	0

[1]U.S. $1.00 = Haitian Gde. 5.00

Table 6
Summary Cost Estimate and Financial Plan for AOP Amendment
Coordination, Technical Support, and Evaluation
(U.S. $000)

USE	SOURCE				
	AID			OTHER	
	FX	LC[1]	TOTAL	FX	LC[1]
PSC Coordinator	300		300		
Secretary		50	50		
Office Equip.	20		20		
PSC Forester	300		300		
Short-term TA	150		150		
Eval./Audit	80		80		
Totals	850	50	900	0	0
Percentages	94%	6%			

[1]U.S. $1.00 = Haitian Gde. 5.00

F. PROCUREMENT PLAN

As in the past, a single document, the Project Authorization Amendment, will serve as the umbrella for a number of distinct obligations through separate grant agreements and contracts.

Current specific support grants with the Pan American Development Foundation (PADF) and CARE will be amended to extend the life of the project, provide additional funding, and reflect modifications to project implementation as described above. The original goals, purposes, and objectives of both grants remain unaltered. The technical office, the Agricultural and Rural Development Office of USAID/Haiti, deems PADF and CARE most appropriate to undertake extensions of the outreach components of the project by virtue of their experience, and efficient and effective performance of their responsibilities throughout the first five years of the project. Both PADF and CARE adhere to AID procurement regulations, and will be expected to undertake procurement of goods and services for their respective program needs, obtaining approvals of the Grant Officer when required in the grant standard provisions.

USAID will formally solicit and negotiate a direct, cost-reimbursable contract with an educational institution or an international research center for the research component of the project, a process that was followed in the engagement of the University of Maine at Orono in 1985. Shortly after project authorization, a Request for Technical Proposals will be prepared for educational institutions and international research centers, based on the determination that particular resources, such as multi-disciplinary departments, computer, laboratory and scientific data-base facilities, and ongoing programs in forestry research are necessary for the successful implementation of agroforestry research in Haiti.

For the Seed and Germplasm Improvement component of the project, USAID will formally solicit and negotiate a direct, cost-reimbursable contract. Again, following project authorization, Requests for Proposals, with a clear and complete statement of work and services to be performed, will be prepared by the project technical office.

The Coordination, Technical Support and Evaluation component of the project will comprise two formally or informally solicited Personal Services Contracts. A Project Coordinator and a Forestry Advisor will be engaged immediately following project authorization under renewable one-year contracts. The project evaluation, to be conducted in the third year of the project extension, will be undertaken either under an IQC or through a set of short-term personal services contracts.

PROCUREMENT MATRIX

PROJECT COMPONENT	METHOD OF IMPLEMENTATION	DISBURSEMENT MECHANISM	OBLIGATION PROCEDURE	DATES	$ AMOUNTS
Pan American Development Foundation (PADF)	Specific Support Grant	Letter of Commitment/ Treasury Reimbursement	PIO/T - Grant Authorization Amendment	9/86	-
			PIO/T - Grant Modification	1/87	2,400,000
			PIO/T - Grant Modification	1/88	2,400,000
			PIO/T - Grant Modification	1/89	2,400,000
CARE	Specific Support Grant	Letter of Commitment/ Treasury Reimbursement	PIO/T - Grant Authorization Amendment	9/86	-
			PIO/T - Grant Modification	1/87	1,400,000
			PIO/T - Grant Modification	1/88	1,400,000
			PIO/T - Grant Modification	1/89	1,400,000

PROCUREMENT MATRIX (cont'd)

PROJECT COMPONENT	METHOD OF IMPLEMENTATION	DISBURSEMENT MECHANISM	OBLIGATION PROCEDURE	DATES	$ AMOUNTS
Research	AID Direct Contract with Educational or International Research Institution	Letter of Commitment/ Treasury Reimbursement or Direct Reimbursement with Periodic Advance	PIO/T -	9/86	-
			RFTP -	10/86	-
			Selection -	12/86	-
			Negotiation of Contract	2/87	900,000
			PIO/T - Contract Modification	1/88	700,000
			PIO/T - Contract Modification	1/89	700,000
Seed and Germplasm Improvement	AID Direct Contract	Direct Reimbursement with Periodic Advance	PIO/T -	9/86	-
			RFTP -	10/86	-
			Selection -	12/86	-
			Negotiation of Contract	2/87	400,000
			PIO/T - Contract Modification	1/88	300,000
			PIO/T - Contract Modification	1/89	300,000

PROCUREMENT MATRIX (cont'd)

PROJECT COMPONENT	METHOD OF IMPLEMENTATION	DISBURSEMENT MECHANISM	OBLIGATION PROCEDURE	DATES	$ AMOUNTS
Project Coordination Technical Support and Evaluation					
Project Coordinator Forestry Advisor Project Secretary	AID Direct PSC 2-year renewable for 3rd year	Direct Reimbursement with Mobilization Advance	PIO/Ts - Informal Solicitation Selection Contract Negotiation PIO/T - Contract Modification	9/86 10/86 10/86 11/86 6/88	500,000 200,000
Evaluation	Indefinite Quantity Contract	Direct Reimbursement	PIO/T - Informal Solicitation Selection Contract Negotiation	1/89 2/89 2/89 2/89	80,000

G. IMPLEMENTATION PLAN

As noted above in the discussion of project components, detailed implementation plans will be required of all project contractors and grantees prior to or shortly after agreement signature and obligations. These plans will include explicit schedules and scopes for activities; targeted areas, groups, and objectives; verifiable indicators of progress and achievement; and monitoring, reporting and feedback mechanisms. Given below is an overall schedule of major events over the three-year extension period, rather than specific implementation schedules detailing the specific activities of each separate component.

General Implementation Schedule

FY 86, Fourth Quarter

(1) AID/W approves authorization of amendment in field by Mission; Congressional Notification on project amendment sent and approved by Congress; Mission authorizes project amendment.

(2) Informal solicitation and selection of candidates for Project Coordinator, Senior Forestry Advisor and Project Secretary.

(3) Review of PADF and CARE grant proposals.

(4) Preparation of "request for proposals" documents for research and germplasm improvement components.

(5) Final obligation of FY 86 Agroforestry Outreach Project funds, bridge-financing important elements of the amended project.

FY 87, First Quarter

(1) PIO/Ts for Coordinator, Forestry Advisor and Secretary circulated and cleared; contract negotiations completed and contracts obligated.

(2) Grant proposals with PADF and CARE finalized, grants awarded; grantee disbursements under new agreements proceed upon receipt of acceptable implementation plans.

(3) PIO/Ts for research and germplasm components circulated and cleared; RFTPs issued.

FY 87, Second Quarter

(1) Final reports of original PADF, CARE, ODH and UMO agreements submitted, covering project activities through the current PACD.

(2) Initial FY 87 obligations under new project amendment made. (Subsequent obligations made in second quarter of each fiscal year.)

(3) Research and germplasm improvement contractors selected and engaged; disbursements proceed upon receipt of acceptable implementation plans.

(4) Grantees continue outreach activites under amended project (through first quarter 1990).

(5) Project-wide coordination and implementation meeting (quarterly through first quarter 1990).

(6) Initial quarterly reports of project activities prepared and submitted (quarterly through first quarter of FY 1990).

FY 88, Second Quarter

(1) Provisional budgetary requirements for follow-on agroforestry activities presented through ABS and Action Plan.

(2) Scope of Work for Agroforestry Outreach II PID prepared; PIO/T circulated and cleared.

FY 88, Third Quarter

(1) Agroforestry Outreach II PID team contracted to develop PID.

FY 88, Fourth Quarter

(1) Agroforestry Outreach II PID finalized and reviewed by Mission, then sent to AID/W; DAEC review results and guidance forwarded to Mission.

FY 89, First Quarter

(1) Scope of Work for project-side evaluation/audit and project paper analyses prepared; candidate contractors solicited.

FY 89, Second Quarter

(1) Project-wide evaluation, audit and redesign undertaken.

(2) Budget estimates for Agroforestry Outreach II prepared and submitted through ABS and Action Plan.

FY 89, Third Quarter

(1) Project-wide evaluation and audit completed.

(2) Agroforestry Outreach II Project Paper prepared and reviewed by Mission.

FY 89, Fourth Quarter

(1) Agroforestry Outreach II authorized.

FY 90, First Quarter

(1) Agroforestry Outreach Project close-out and final reporting.

H. REVISED EVALUATION PLAN

Background. The Agroforestry Outreach Project was originally designed as a demonstration project to test three distinct models of project implementation: tree planting with large landholders (ODH); tree planting with small farmers through established NGOs (PADF); and tree planting directly with small farmers (CARE). Within each of the three grants, variations on the implementation models were also identified. Therefore, one of the primary purposes of this project has been to identify the most effective model(s) for continued and expanded tree-planting activities in Haiti.

A mid-term evaluation was conducted as scheduled in November-December 1983, after approximately two years into the implementation phase. This evaluation provided recommendations for mid-course modifications which have already been incorporated into the project implementation models.

A second evaluation was conducted during 1986 to assess project implementation and to provide recommendations for the design of any follow-on activities. This comprehensive, multidisciplinary evaluation, covering the entire LOP, took stock of the project's accomplishments and shortcomings, appraised the project's potential role within the Mission's overall strategy, and recommended extensive implementation modifications and detailed funding requirements for the current three-year extension (see Section I.B. Project Evaluation Summary). This project paper amendment, indeed, has drawn heavily on the results of the LOP evaluation.

In keeping with the success and utility of this most recent evaluation, an end-of-project evaluation is now scheduled to take place during the first quarter of the final year of project implementation under this amendment. This schedule should provide adequate lead time for the design of a distinct second phase of the AOP, if such a follow-on effort is deemed appropriate at that time.

Scope of the End-of-Project Evaluation. The final evaluation will constitute an external, multidisciplinary appraisal of six full years of project implementation, and will be conducted by a team contracted either under an IQC or through a set of short-term personal services contracts.

The evaluation's objectives will be:

(1) To analyze and interpret the accomplishments of the project to date;

(2) To assess these accomplishments in the light of projected outputs; and

(3) To propose appropriate organizational, technical and implementational strategies for the extension and expansion of USAID-financed agroforestry/reforestation initiatives following the completion of the first phase of the Agroforestry Outreach Project.

Each member of the Evaluation Team will assume the following general responsibilities, to be pursued within the context of their specific scopes of work and areas of expertise:

(1) Study background documentation on the project;

(2) Meet with the staffs of project grantees/contractors, project sub-grantees, and other relevant organizations associated with the Project, to discuss

project goals and achievements and to solicit information pertinent to the evaluation;

(3) Visit representative field sites of each grantee in a variety of ecological zones, interviewing field staff and farmers;

(4) Summarize the major project outputs, broken down by grantee or contractor component and by other pertinent criteria;

(5) Assess project accomplishments, by relating them to pre-established verifiable indicators (as described in the project paper, grant agreements, contracts and subsequent amendments);

(6) Recommend modified, alternative or complementary approaches, if necessary, to achieve long-term, sustainable results in the agroforestry/environmental sector.

The Evaluation Team will include members representing the following disciplines, at a minimum: (1) tropical forestry; (2) social forestry/ecology; (3) economics; and, (4) a development-related social science.

Specific evaluation criteria for the final evaluation will include, but probably not be restricted to, the following areas of project performance and impact:

(1) Beneficiaries and benefits received:

(a) numbers, distribution, and sociological characterization (by age, sex, economic status, etc.) of beneficiaries

(b) farmer motives for planting

(c) demand for particular project tree species, and project impact in this respect

(d) overall choice and preference schedule for tree species, considering both those offered by the project and others, including exotics, fruit trees and traditional local species

(e) farmers' own management and planning responses to project trees

(f) cost-benefit analysis

(g) environmental and agronomic impact of agroforestry systems extended

(2) Training and extension education program:

(a) local PVO and community group networks established and/or served by the project

(b) training materials produced

(c) training programs instituted

(d) extension approaches utilized

(e) overall training and extension effectiveness

(3) Technical performance of the project grantees and contractors in the field:

(a) numbers of trees planted under project auspices

(b) survival rates obtained

(c) growth and yield rates achieved, and expected

(d) species types and quality of germplasm made available, evaluated with respect to (1) site-specific conditions and requirements; (2) farmers' own objectives; and, (3) the maximization of economic returns

(e) technical assistance and technological packages extended, and available for dissemination at end-of-project

(4) Nursery and plant propagation network established in support of project outreach activities:

(a) number and geographical distribution

(b) seed and plant material provenances

(c) quantity, quality and timely delivery of planting stock

(d) seedling production systems

(e) nurseryman training programs

(f) future role and potential for self-sufficiency (sustainability) of regional and decentralized nurseries, seed orchards, etc.

(5) Research results and utility

(a) its relevance to project needs

(b) the quality of research to date

(c) the role of grantees in research

(d) information exchange, dissemination, and networking, both within and beyond the project

(e) utility and effective utilization of research results generated by project grantees

(f) utilization of research and information available from outside the project itself (e.g., from other AID-sponsored research efforts, or other donor activities)

(g) future research needs

(6) Assessment of the overall organizational objectives and implementation models of project implementing agencies and and components

(7) Institutional analysis, including assessments of:

(a) the role of continued subsidies (both to individual farmers and to local-level PVO's), in the past, and in future initiatives within the agroforestry sector; is phase-out possible, and how?

(b) current institutional arrangements, in terms of the potential self-sufficiency of both major and sub-grantees

(c) the project's relationship to GOH/MARNDR, and its Direction of Natural Resources; what institutional ties of coordination and collaboration might profitably be enhanced in a follow-on project and for the long-term?

(d) the project's impact and contribution to the realization of AID's Action Plan and Environmental Strategy in the agricultural sector.

III. ANNEXES

A. SOCIAL SOUNDNESS ANALYSIS

The comprehensive social soundness analysis in the 1981 project paper generally remains valid. Moreover, the basic assumptions on which the project was based originally have been borne out, as evidenced by the its success over the past five years. In addition, ongoing research under the project and the end-of-project evaluation have added considerable depth to our understanding of some of the more complex sociological aspects of project implementation, based on analyses of project performance and planter behavior in the critical areas of participation, motivation, extension and training. These analyses have important implications for the future direction of the outreach programs during the extension period, and are summarized here as a supplement to the original Social Soundness Analysis.

Participation. The project has been extremely successful in reaching its intended beneficiaries: over 100,000 peasant farm families will have participated as registered tree planters by December 31, 1986. In addition, an estimated 30,000 "unofficial" planters will have outplanted some smaller number of project seedlings received from friends or relatives participating directly in the project.

Within the general target population of the rural poor, officially registered participants in the current outreach programs appear to be slightly older, and to dispose of relatively greater land resources than non-participants. Also, registered participants are predominantly male. On the other hand, there is no apparent skewing of beneficiaries with respect to religious affiliation, contrary to what might have been expected where many of the PVO sub-grantees are in fact pastoral and missionary organizations with explicitly sectarian agendas in other domains.

The age, gender and resource trends in the planter profile are quite understandable in the context of Haitian rural social organization, under a program that extends goods and services whose effective utilization by potential beneficiaries depends upon secure access to land.

First, landless members of the target population are necessarily excluded, as they are in most agricultural development projects aimed at peasant freeholders. Fortunately, the vast majority of Haiti's rural poor are, in fact, freeholders, rather than actually landless. Within the freeholder group, however, land-poor peasants are generally somewhat less likely to be able to innovate and to take risks on new technologies than their relatively better-off neighbors. After all, the planting of project trees usually implies taking at least some portion of land out of other, more familiar, productive uses, even where a minimally intrusive planting configuration, such as border plantings, is employed. Until definitively proven under local conditions--as is only now starting to be the case at the community level--such new technologies are not likely to appeal to those with minimal land holdings, barely sufficient to meet their current household consumption needs.

Moreover, the sheer number of seedlings distributed per participant under the project, even though it has been reduced significantly in the past few years, still implies a certain minimal holding size to accommodate outplantings. Farmers currently circumvent this problem in a number of ways, including the

informal sharing out of seedlings received, as noted above, and the less salutary practice of simply letting some proportion of the seedlings die without ever being outplanted.

While a significant percentage of project seedlings actually do get given away and are outplanted by "unofficial" participants, these unregistered planters neither appear in the statistics nor, for the most part, do they benefit from other extension services provided by the grantees. It bears noting that these "hidden" participants, if recorded, would probably change the character of the planter profile in interesting ways; there are indications from a limited number of case studies that they are indeed drawn from precisely those groups underrepresented among registered planters, including the land-poor.

The slight age difference between planters and non-planters can be explained as a result of the fact that the extent of individual landholdings in rural Haiti co-varies directly with age, among other sociological variables. More specifically, the purchase of land and the division of inherited land into securely held, individually operated parcels, are also a function of age, increasing in likelihood as people grow older. Thus, older peasants are likely to have access to and control over more land, in general, and to hold it under the most secure tenure statuses, as well. Their security of tenure on particular plots, in turn, is conducive to land improvement and other long-term investments, and is congruous with the outreach programs' explicit policy that project trees only be planted on land unambiguously controlled by the planter.

While it is to be expected on the basis of land tenure dynamics alone, then, that project planters, as a group, will be somewhat older than non-planters, there are some other factors contributing to this phenomonon as well. First, planting trees under the project may be a management strategy employed by farmers whose principal constraint is labor, rather than land, because the cropping of trees represents a relatively less labor-demanding production strategy than planting annual crops. Older peasants, having gained control over land while simultaneously losing effective control over the labor of their grown sons, typically face this management constraint, and have always opted for less labor-intensive systems. The AOP offers just such an option.

Second, older farmers are also at a stage in their own life-cycles where rapid accumulation and expanding production are less important than they are for younger people just starting out, who are seeking spouses and establishing families. Also, older people in Haitian culture are quite explicitly aware of their own mortality and of their obligation to leave behind a viable, landed legacy for their descendants. Consequently, older farmers are somewhat more likely to think in terms of longer-term investments, bearing perennial returns, and to be interested in improving the land resource base that will eventually be passed on to their heirs.

The preponderance of men among project participants is also easily understood within the Haitian context, although it too is multifaceted in its explanation. First, in spite of the fact that men and women inherit land equally under the traditional system of bilateral, partible inheritance, and share in many of the responsibilities of agriculture, a significant majority of peasant farm units are *operated* by men. Second, women are more likely to in-marry than men, in most communities, and their own land will consequently be located farther from their current household than that of their husbands. It is thus somewhat more likely to be sharecropped or rented out or, if worked, to be less easily monitored and controlled with respect to animal trespass, etc. Project research

has shown that this latter is a key selection criterion, applied by planters across the board when choosing sites for outplanting project trees. Finally, even when trees are planted on a wife's plot by her husband, they may not be reported as such for a variety of reasons, and the male head-of- household still gets recorded as the participating planter.

In the less common case of women heads-of-household, operating their own farm units, two points should be noted. First, due to a complex of constraints which need not be detailed here, a single woman head of household is likely to manage a smaller holding than her male counterpart. Therefore, she may be less likely, on the whole, to participate in the project. A countervailing tendency, however, is that where single women *do* dispose of significant land resources, they are more likely to face the kinds of labor constraints noted above in our discussion of older planters. Therefore, one kind of rural woman who probably is benefitting directly and significantly from the project is the somewhat older, single, head-of-household, who does not control extensive labor resources herself, but still manages her own farm.

The preceding discussion indicates that most of the skewing observed in the profile of project beneficiaries is an artifact of the Haitian rural context itself and, within that context, is virtually intrinsic to agricultural development projects stressing relatively long-term, land-extensive innovations. The analysis indicates, quite simply, that those most able and most disposed to take advantage of project services are more likely to do so than others, who are constrained by circumstances essentially beyond the control of the project.

Thus, there is not much that the project can be expected to do to change the planter profile without changing its own character drastically, and this is certainly not advisable. There are, however, two ways in which the outreach programs will strive to serve a somewhat wider, less well-endowed, and younger constituency under this extension.

Lowering the minimum number of trees made available to registered planters (currently, the most common minimums stand between 150 and 300, depending on the region), or instituting a more formal system whereby two or more planters can share a single box of seedlings, will surely enable farmers with smaller holdings an opportunity to benefit fully from the outreach program. Overall survival rates will also probably improve under such a strategy, since some proportion of seedlings currently distributed in excess of what the planter actually can handle are never planted at all, and simply left to die. Under this extension, therefore, lowered minimums will be instituted on a pilot basis in selected subgrantee outreach programs, and their implications for animation, survival and particiation will be followed closely.

Also under the extension, the outreach programs will continue to explore, elaborate, and extend agroforestry options that promise to enhance staple crop production, provide relatively rapid returns, and can be implemented effectively on even the smallest plots. The best example to date is the *Leucaena* hedgerow and alley-cropping system. This system, and others like it, which effectively integrate food- and wood-crop production in an ecologically sound pattern that positively impacts on staple yields, are flexible enough to allow for the participation of virtually any farmer, regardless of the extent of his or her land resources. Moreover, they offer the possiblility of rapid, significant returns with simultaneous benefits in terms of soil erosion control, fertility enhancement, and the production of animal forage.

Farmer Motivation and Extension Emphases. Five years of project experience indicate that the peasants' positive response to the project's concept is far more complex in its explanation than originally assumed. The project began with the assumption that rapid cash returns to market-oriented fuelwood production would be the major driving force behind acceptance of the seedlings. Participants have repeatedly demonstrated, however, that they are oriented to *multi*purpose trees, and are interested in (1) a wide range of end-products; (2) slower growing species that produce higher value timber (i.e., semi-precious hardwoods); (3) fruit trees; (4) construction wood and lumber; (5) production of a variety of end-products for home consumption rather than sale; and (6) the value of standing trees for a number of reasons, including a form of interest-bearing savings, ameliorating soil fertility, demarcating plots, providing shade for other crops, strengthening claims to a particular parcel, or soil conservation. This has proven to be the case even in areas where charcoal production is a traditional local activity--trees are always and everywhere seen in terms of a variety of end-uses and values.

The project has already responded well to this reality, adjusting species mix and extension education programs to match peasant preferences and expectations in this regard, and this flexibility will be maintained during the project extension.

Although the immediate reasons why individual peasants plant project trees vary widely from case to case, the fundamental hypothesis underlying the project has now been demonstrated beyond any reasonable doubt: small farmers can be motivated to plant substantial numbers of trees for cash and in-kind returns.

Fast-growing tropical hardwoods are readily accepted (1) as a viable cash crop; (2) for the production of wood products that would otherwise have to be purchased on the open market; and, (3) for their value as a standing crop, in terms of a store of value, a high-value fallow rotation alternative, a regenerator of soil fertility, etc. Thus, the effective demand for subsidized project seedlings currently far outstrips the project's ability to provide them, and will probably always do so.

It must be noted, of course, that this level of demand is based on a significant subsidy to the planter. Project seedlings are made available to the farmer as a free good, and the investment in their outplanting is minimal. To date, there is no hard data concerning the elasticity of demand with respect to cost. No one knows what the effect on demand would be if the project began charging even a nominal price for the seedlings, although circumstantial evidence suggests that seedlings are desirable enough to cajole or even steal from a neighbor. In certain isolated instances, a price has even been offered for project seedlings, when someone with sufficient resources has wanted trees but has been unable, for one reason or another, to register as a planter under an extension program.

It is still too early, however, to expect most farmers to be willing to invest more than minimal labor inputs in project seedlings, since their potential has yet to be demonstrated convincingly over the long haul. On the other hand, the number of farmers willing to make even that minimal investment is overwhelming, and bodes well for the eventual incorporation of purchased hardwood seedlings as a standard input to peasant farming systems. This issue is taken up again in the discussion of project sustainability in the Institutional Analysis below.

In spite of the fact that peasants are readily motivated to plant substantial numbers of project seedlings, they appear to be far less strongly motivated to

maintain them, especially where such maintenance involves significant additional labor inputs beyond those required for outplanting. This finding, based on the first-hand observations and experience of project field personnel, again has to do with the fact that there is as yet no definitive incentive for more than minimal investment in the seedlings by planters, their long-term performance having yet to be demonstrated unequivocally.

The essential points at which planter motivation to invest time and labor in the seedlings is critical to seedling establishment and survival are: (1) the period between seedling delivery and actual outplanting, and (2) the initial period of establishment, lasting at least one year from outplanting.

During the first period, the planter must be sufficiently motivated to (a) pick up the seedlings in a timely fashion, in conjunction with the onset of seasonal rains; (b) to protect them from stress between pick-up and outplanting; (c) to plant them out within a reasonable period, usually not to exceed 36 hours from pick-up; and, (d) to plant them properly, following recommended guidelines for spacing, hole size, placement within the hole, etc. At this time of the year, of course, the seedlings are also competing for attention with other major agricultural activities, since the beginning of the rainy season is the critical time to establish most annual gardens, as well.

During the establishment period, there are a number of procedures that the planter might follow to protect and nurture the seedlings. Foremost among these are simply to protect the seedlings from (a) animal trespass, and (b) damage during the cultivation of garden crops with which they are interplanted. These two sources of damage are probably the primary causes of post-planting mortality, save severe drought.

Protecting the seedlings from animal damage is easiest when they are, in fact, intercropped in a standing garden, which is normally respected by neighbors and under the surveillance of its owner. When planted alone, or on the borders of plots (especially along paths), the seedlings require closer surveillance. As trees become accepted within any particular area as a true crop, in and of themselves, this problem should diminish, as it has already in some places.

Protecting the seedlings from damage when gardens are being cultivated also requires the time and attention of the planter. If the planter himself is working his own garden, the problem is simplified. Often, however, hired labor of one kind or another will be responsible for cultivating standing gardens, and they must be instructed to watch out for the seedlings. In any event, the young seedlings are difficult even to see in the midst of a multicrop garden, and the project recommends that they be clearly marked, usually with a stick or a few rocks placed near each one at the time of outplanting.

Fortunately, these most critical procedures are not excessively demanding in terms of additional labor inputs to the seedlings themselves. They have been accepted and instituted as standard practice in some areas and by many planters already, and are within the range of what must reasonably be expected from participants. An effective motivation and extension program should eventually be able to achieve at least this level of performance from all planters.

On the other hand, a host of other procedures recommended as part of the project's extension packages are extremely labor intensive, including the clean cultivation of individual seedlings, rock or organic mulching, individual catchment basins, and even hand watering. It is safe to assume that most

farmers will never be willing or able to give this kind of attention to their seedlings, particularly when they are distributed in relatively large quantities, as is currently the case. After all, this kind of attention is not given to even the most valuable crops now cultivated.

Even if these more labor-demanding techniques are in some sense learned by farmers through project extension efforts, the motivation to actually carry them out is simply not there, and probably cannot be induced. If overemphasized, these essentially unrealistic recommendations are distracting, at best. At worst, too much attention paid to such techniques in the extension program may even have a daunting effect on the new planter, suggesting that necessary care for the seedlings is so overwhelming that little or no care is the only viable alternative.

Project extension training for new planters over the next three years, therefore, will explicitly strive to maintain an extremely strong emphasis on those critical, low-input procedures for enhancing seedling survival which it is reasonable to expect farmers to implement. New extension strategies will be explored to insure that those inputs crucial to seedling survival are made by a larger percentage of participants than is currently the case. Indeed, pilot programs aimed at this goal are already in place in several subprojects. The more demanding techniques of seedling maintenance will continue to be noted in passing, but will intentionally be downplayed in the interest of achieving this more basic goal. The particular problem of animal trespass also needs to be addressed at a community level, where the social acceptance of the notion of trees-as-a-garden-crop needs to be aggressively pursued.

Another area currently emphasized in the basic project extension package that will be less strongly stressed in the future has to do with land tenure. It has been a policy of the CARE and PADF projects that participants plant their seedlings only on land to which they have absolutely secure title. This policy arose out of early concerns, discussed at length in the original social soundness analysis, that insecure land tenure would ultimately impact upon the security of tree tenure for trees planted under the project. At this point, all indications are that planters indeed find it in their own interest to plant project trees on securely held land, and do so irrespective of any direct guidance in this connection. On the other hand, the definition of what constitutes securely held land varies widely from region to region, between communities, and even from family to family, based on customary usage in the local tenure system. Also, somewhat ironically, some planters explicitly choose to plant project seedlings on insecure land, precisely in order to reinforce their personal claims to it. In fine, the extension program can now confidently relax its prior emphasis on planting only on securely held land, not because this issue is insignificant, but because it is so important that participants are clearly taking care of themselves in this regard--and so complex that they, in fact, are best qualified to make their own decisions in such mattters.

Extension and Training Programs. Both outreach grantees have made significant progress in the development of sociologically appropriate and effective extension materials and training programs for planters, field agents (monitors and animators), nursery personnel and higher level staff, particularly over the last two years. Under this extension, efforts in this area will be intensified through (1) the placement of specially qualified personnel on grantee staffs specifically charged with extension and training; (2) the institution of more

systematic collaboration between the grantees in this connection; and, (3) the ever-increasing availability of detailed technical information and experience to underpin farmer-specific extension recommendations on a case-by-case basis.

Of course, extension and training in a project of this kind is an on-going, cumulative, and reiterative process. New participants are constantly being recruited and, in the case of PADF, new field agents also come into the project on a regular basis, as new sub-grants are implemented. Furthermore, new information and whole new subjects are always being introduced into extension and training curricula. The *Leucaena* hedgerow program, which requires training in the use of A-frames, hedgerow establishment, and management, is a prime example. Finally, for extension and training to remain effective and responsive to project needs as the project and participating individuals and communities evolve, almost constant feedback and the development of new emphases and approaches are necessary.

Of capital importance, too, is the fact that in the near future both grantees will have to take steps to address the question of greatly expanding their extension services to meet the emergent need for guidance concerning the harvesting and continued management of trees planted early in the life of the project. Obviously, the constituency for this kind of service increases geometrically as the project continues to recruit new participants and the trees of earlier planters come to maturity. Already, each of the close to 100,000 project participants stands as a potential client for follow-on services.

Planters also need to be encouraged to find and plant their own seeds, seedlings and cuttings, including volunteer seedlings from trees newly introduced by the project, such as *Leucaena*. The benefits from this kind of extension may be difficult to measure and quantify, but they will surely constitute a very important step in helping participants to maintain tree cultivation in the long term, independent of external inputs.

Clearly, operating, monitoring, maintaining and modifying extension and training programs at the scale now managed by PADF and CARE is a serious, time- consuming undertaking; one likely to increase, rather than diminish, in complexity as time goes on.

Therefore, the materials and approaches already developed under the project will be further tested, systematized, and organized into standard curricula and programs during the extension. Codification of the training curricula, from top to bottom, will provide continuity when those now conducting training at various levels, and on various topics, leave the grantees' projects and move on. An assessment of the burgeoning extension requirements posed by the tens of thousands of "veteran" planters under the project will also be undertaken, and realistic, systematic plans for addressing these planters' needs will be elaborated.

In order to accomplish these tasks effectively, each outreach grantee will engage one full-time training and extension specialist or contract for the technical services of one or more such specialists on a short-term basis, thereby establishing a training and extension unit, or backstop service, within its outreach program. In addition, one local-hire staff member will be designated in each outreach region as responsible for coordinating all field-based training functions for planters, monitors, animators, nursery personnel and supervisors.

B. TECHNICAL ANALYSIS

Tree Seed Improvement. There have been a variety of difficulties encountered in acquiring tree seed for seedling production and species trials. The quality of native and exotic tree germplasm being collected in-country for seedling production remains essentially undocumented and beyond the effective control of the outreach programs. Sufficiently detailed information on the provenance of most imported seed is also unavailable.

Fortunately, in spite of these problems, good tree form and growth can be observed for most species, throughout the country. Equally visible, however, is poor tree form and growth.

A program for the genetic improvement of key tree and forage species, through the institution of adequately documented and controlled seed collection, procurement, selection and propagation procedures, is absolutely essential to the long-term success and progressive improvement of the project, as well as to the planning and implementation of USAID/Haiti's major new agricultural sector initiatives under the hillside strategy. Plant materials used in the AOP and in these upcoming projects must be selected and improved for a range of desirable characteristics, determined in accordance with specific project objectives; those characteristics, once achieved, must then be maintained through a systematic, in-country program of plant propagation and seed production.

The recent evaluation report estimates that 20% to 40% increases in seedling establishment, growth and yield can be achieved in a relatively short time period (three to five years), simply by using seed and plant material of good genetic quality and known, site-specific, performance potential. Thus, there is a drastic need for the improvement of seed quality for the production of seedlings distributed and outplanted under the AOP.

This need has been recognized for several years within the project, but budgetary constraints and an inability to identify an appropriate institutional home for the program have prevented its implementation. All three grantees have made some progress in establishing programs for the orderly collection of seeds in-country, and for the importation of seeds of known provenance from outside sources. This progress has also been hampered by budgetary constraints, however, and by the absence of any full-time, fully qualified personnel charged with this task. Establishment of seed propagation orchards has been extremely limited, and the ultimate utility of these efforts is undercut by incomplete or inaccurate information concerning the provenance and performance characteristics of the original seed sources.

Some essential information for the implementation of a tree improvement program has been generated under the project, but much of it has not yet been recorded or codified in lasting, useable form. It continues to reside, in whole or in part, only in the personal experiences and day-to-day working knowledge of field personnel. For example, the location of outplanted trees of superior phenotype, in terms of form and growth (so-called "plus" trees), is nowhere mapped or recorded. These trees of demonstrated quality, however, constitute the most important single source of germplasm upon which to base a seed improvement and propagation program. This information, then, must finally be gathered by an outsider hired specifically for this task, or reported by the field personnel themselves, in order to be of real utility in the future.

An effective seed improvement program must begin with a careful determination of (1) the species to be improved, and (2) the desired characteristics to be sought for each. The determination of desired characteristics to be selected for needs to be based on (a) project personnel's best assessments of end-uses intended by participants, (i.e., pole production requires different tree form and growth characteristics than charcoal production; intercropped trees a different crown configuration than border plantings -- ideally, several distinct sets of characteristics for the most important species may be selected); and, (b) technical grounds (i.e., selecting genotypes for pest resistance or drought-hardiness). Also, generally speaking, genetic diversity is necessary within the overall system, in order to preserve the dynamism of the gene pool in-country. A criterion matrix for making these determinations has not yet been developed, but should be the first task undertaken under the extension's proposed seed improvement program.

Once these decisions have been made, information containing in-country resources of standing trees exhibiting the desired characteristics under specific site conditions has to be gathered and, preferably, mapped. Next, these "plus" trees are rented from their owners for seed production or cuttings for vegetative propagation (this latter being the preferred method for propagating selected phenotypes for improved seed production, where feasible.) The "plus" genetic material is then propagated under proper nursery management regimens (with inoculation, etc.), and outplanted and managed for seed production in regional orchards on land under long-term lease or owned outright by PVO sub-grantees. Second generation selection and seed orchard establishment may be necessary in some cases. The same procedures must be folowed for imported plant materials of superior genotype and known provenance. Finally, accurate, detailed records must be kept at all stages of this process, so that future manipulation of the genetic resource base need not start from scratch.

This proposed program can be implemented at an estimated cost of $1,000,000 over a three-year period. While no consensus was reached within the evaluation team concerning where such a program should be housed institutionally, no one disagreed about its primary importance to the long-term, sustainable success of the project. Such a program, probably even expanded to include other kinds of germplasm, such as fruit trees, forage grasses, selected annual crops, etc., is also of capital importance to the successful implementation of all of the Mission's currently planned agriculture sector initiatives to extend environmentally sound farming practices to hillside farmers.

Therefore, a comprehensive seed selection and tree improvement program, focusing first on seed for fast-growing tropical hardwoods (both local and exotic), but not necessarily limited to them, will be funded under the project, beginning in FY 87.

Nursery Production Systems. Several features of the current regional nursery production system almost certainly do not represent the optimal approach to raising seedlings for outplanting under the typically adverse conditions found in Haiti. Among the most important are (1) container size, (2) inoculation and fertilization, and (3) the length of time the seedlings of some species are held in the nursery.

(1) The size of the Rootrainer 5 seedling container, which is that currently most common in both outreach programs, is less than optimal for general use in Haiti to produce hardy, vigorous seedlings that maximize the probability

of establishment and survival under harsh site conditions. Gains in survival of up to 10% have been recorded for somewhat larger containers.

Outreach nurseries might profitably switch to a production system employing significantly larger containers, although these should still be within limits allowing for relatively easy and efficient transport of substantial numbers of seedlings to outplanting destinations. This recommended transformation, however organized, should be accomplished with all deliberate speed, but no later than by the end of the proposed extension.

(2) Project seedlings that can benefit from inoculation are not being inoculated with basic fungal and bacterial root symbionts nor fertilized for optimal establishment, survival and growth. The use of inoculants, which vary from species to species, promises dramatic improvement in seedling performance over the entire life of the tree (some 15 - 20 years, in most cases). Inoculant for some leguminous species (*Rhizobium* spp.) is available commercially. Other inoculants will ultimately have to be identified and gathered locally, or cultured either on-site or in laboratory/production facilities.

Systems and procedures for the inoculation of all seedlings of appropriate species for which inoculants are available or obtainable will be developed under the outreach grant extensions, as quickly as possible. Specific target dates for these systems to be fully operational should be set.

Current nursery practice requires soluble fertilizer application at weekly intervals (approximately) at central nurseries. At remote community or decentralized nurseries, the use of soluble fertilizer is more variable, and in many of the nurseries no fertilizer is used except possibly animal manure. The fertilizer is applied in a liquid form and is a 20-20-20 NPK formulation with certain minor nutrients present in trace amounts. This material is expensive to purchase and laborious to apply, but in the absence of a better mechanism it represents a direct means of fertilization.

As a means of reducing fertilizer and labor (application) costs, as well as permitting the extension of fertilizer practices to remote nurseries, the replacement of liquid fertilizer with a timed-release fertilizer is recommended. The fertilizer consists of slow-release forms of potassium and phosphorus and a slow-release form of nitrogen, e.g., isobutylidene diurea (IBDU). This form of fertilizer, particularly nitrogen, is released from either a tablet or small "pebble mix" form only in the presence of water. This mechanism thus provides fertilizer only when adequate water is present for plant growth. When dry seasons occur, soil moisture and plant growth are greatly reduced, and fertilizer release stops. Wasteful leaching of fertilizers such as occurs with liquid formulations is minimized. The nursery mix may be mixed in with the soil mix prior to filling of the Rootrainers to support early seedling growth, while a tablet could be placed near the bottom of each Rootrainer cell to provide some pre-, but also post-, planting fertilization.

This timed-release fertilizer is recommended since its use could (a) easily standardize nursery fertilization practice, (b) reduce labor (application) costs, (c) reduce fertilizer costs (each tablet costs about $0.017, and larger orders could benefit from price discounts), (d) reduce shipping costs and (e) provide a unique method of post-planting fertilization which should significantly enhance growth. The effective life span of the time-release

tablet is 8 to 12 months, which allows for fertilization during a 4-month nursery growing season with 4 to 8 additional months for fertilization in the field (or longer, depending upon frequency and intensity of rainfall).

(3) The annual nursery production schedule is extremely tight, with nurseries striving to maximize their production capacity by sowing and distributing all seedlings within a single season. Thus, virtually all seedlings, regardless of species, are well under 6 months of age when outplanted. In reality, growing times are significantly shorter than 6 months, and the Spring to Fall season transition is sometimes so tight that nurseries must literally be cleared of Spring seedlings at a certain point to make way for those to be outplanted in the Fall. The potential brevity of the Fall rains, in turn, may pressure early outplanting in this season, as well.

Seedlings of a number of species, at this age, are not of optimal size and vigor for outplanting. Moreover, this tight schedule also interferes, at certain times, with the "hardening off" process, whereby seedlings are readied for outplanting by being gradually exposed to harsher and harsher conditions within the nursery, in order to reduce the intensity of transplant shock at outplanting. Finally, the introduction of larger containers recommended above will probably necessitate a more flexible, staggered production schedule, as project foresters have already discovered in experimenting with only slightly larger containers in some nurseries.

New, more flexible nursery production schedules, aimed at lengthening the time that the seedlings of some species remain in the nursery and assuring sufficient time for root-system development and hardening-off, will also be developed under the project extension.

Other areas for investigation and potential improvement within the current nursery production system include (1) the quality of the potting mix employed for seedling production, (2) the length of time that seedlings are kept in shade houses, and (3) the overall system for hardening off seedlings prior to outplanting.

In short, within an extensive, decentralized nursery production network of the kind so successfully established under this project, constant attention must be paid to quality control and the standardization of procedures, regardless of the specific production regimes being practiced. Furthermore, nurseries should be technologically dynamic, rather than static, over the long term. This requires continuous, specialized, and full-time attention to such matters as the preparation and upgrading of nursery manuals and nursery training programs, the monitoring of nursery performance, the introduction of new technologies as they are developed, etc.

Each outreach grantee, therefore, should employ a full-time nursery specialist under the extension, in order to provide on-going technical backstop services to their nursery networks. The rationale behind this is to improve the technologies and operating procedures employed within the existing nationwide nursery system established under this project, and to set and maintain a standard of technical performance that could be considered state-of-the-art. No less should be expected in what may be the most significant and lasting contribution the project makes to the institutional and agricultural development of Haiti.

Site-Species Relationships. During the project 37 species trials were begun. Data from these trials have been used to determine which species are to be planted in which zones. These data are compromised to some extent by the fact that, in most cases, leguminous seedlings were not inoculated prior to outplanting in the trials, and detailed information on the sites (and microsite variations within them) was not gathered. Nonetheless, useful practical information has been derived from them. Furthermore, observations of earlier outplantings have also served as a practical guide in determining species appropriateness for any given site.

Characterization of particular sites has been hampered by the lack of reliable climatic data, and the lack of a reliable in-country soil testing service. The project's ability to make site-specific recommendations concerning appropriate species has been limited by this circumstance, and also by the extensivity of the outreach program.

The proper match of site and species, to ensure adequate performance of outplanted seedlings, presupposes the availability of reliable information of two basic kinds: (1) information on species performance, both actual and potential, under known site conditions; and (2) information accurately characterizing the proposed outplanting site. Adequate information of neither kind is currently available in systematic form, although much practical knowledge concerning both has been developed under the project.

Extensive information on species performance has been developed under the project but, like so much practical information, it either remains solely with the field personnel (and is often not effectively shared, even among them) or has not been adequately documented and synthesized.

The major constraint to information on the sites themselves is basically the fact that the country does not have the capacity, either in the public or private sector, to perform detailed and reliable soil analyses. Sufficiently accurate climatic information is also generally unavailable and of poor quality.

The project has made some inroads in this latter area by establishing simple rain gauges in various parts of the country. Also, a fruitful collaboration between two CARE and PADF foresters resulted in the elaboration of a practical environmental classification system (the Buffum-Campbell system), which divides the entire country into zones on the basis of mean annual precipitation, soil parent material, and elevation. This system has been further elaborated by the University of Maine, and it provides an extremely useful framework into which more detailed information on site characteristics can be programmed.

An intensive and on-going effort needs to be mounted to document the knowledge on species performance (and other practical, field-based information) already generated under the project. To this end, a system for debriefing field personnel and systematizing the accumulated information in a useable format needs to be devised and implemented as soon as possible. Also, strict and standardized end-of-tour reporting requirements for all expatriates should be instituted immediately. Information available on species performance in trials and outplantings should be computerized, so that it can be readily retrieved, updated and reviewed. Finally, an extensive soil testing, site classification and mapping effort should be undertaken under the project extension, in order to improve the project's ability to make site-specific recommendations as to appropriate species and outplanting strategies.

Ultimately, the long-term success of such an effort depends on the establishment of an in-country soil testing capablility of considerably higher quality than is currently available. Such a service can probably be established within the private sector, perhaps with the collaboration of the Ministry of Agriculture. Because of its importance for the successful implementation of the entire agriculture portfolio, with its hillside extension focus, such an effort is most appropriately supported under separate financing, and designed to serve the entire sector.

Survival and Growth. Survival and growth rates are both cited in project documentation, including the grant agreements of the two outreach grantees, as primary indicators of project success. Unfortunately, data available on both of these indicators are sorely inadequate in terms of recording project performance.

Growth rates in the field have not been recorded in most cases, except for species trials and silvicultural research measurements by UMO. Outplantings in participating farmers' fields have not been followed for performance data in any appreciable way beyond impressionistically. Some systematic gathering of data concerning growth rates under peasant outplanting conditions has recently been instituted, however, in order to assess project impact and performance over the long term.

Survival has been monitored throughout the life of the project, but data from the outreach program's first two years is subject to extensive criticism in terms of reliability. The system for gathering survival data was upgraded in 1984, to the point where we can now be reasonably confident of its accuracy. The current system bases survival data on two-week, six-month and twelve-month counts that are independently verified for a 3% random sample of all outreach outplantings. The original system did not include random checks, nor the two-week base count. The checks are designed to control the tendency of lower-level field personnel to inflate or invent survival data. The two-week count is used to establish a base count of seedlings actually outplanted in controlled plots (i.e., seedlings subject to inclusion in later survival counts), since early project experience indicated that upwards of 30% of all outreach seedlings were being planted elsewhere by the participant himself or by others who somehow gained access to a portion of his seedlings, or were never being outplanted at all.

Survival data from the first two years of the project were thus subject to inflation (because of uncontrolled reporting) and deflation (because the standard against which survival was measured was "seedlings distributed," rather than "seedlings outplanted on controlled plots") simultaneously. Therefore, early survival data can be manipulated in a variety of ways, depending on which interpretation best suits the current needs of the interpreter. Thus, for example, when the project was criticized in an IG audit for not achieving adequate survival rates, the issue of base counts was raised to suggest that the survival data for the first two years was actually deflated. Currently, however, when questions are raised concerning progress made in raising survival rates, it may be more strategic to suggest that earlier rates now be set at the lowest possible levels, in order to establish a decisive upward trend over the entire LOP. Since the data are so patently ambiguous, there is obviously little to be gained from such *ex post facto* interpretive exercises. Survival data from the first two years of the project should be discarded as hopelessly invalid, and survival statistics should be discussed only from 1984 on.

Over the past four seasons, for which relatively accurate data are available, there is some statistical evidence that survival rates have, in fact, been increasing for both grantees, in all regions. This is probably attributable to improvements in the extension system, as both grantees suggest. The gains, however, while steady, do not represent significant increments, or breakthroughs, over past performance.

Based on extrapolation from the most recent data available to the evaluation team, for the Spring 1985 planting season, PADF's current, program-wide, twelve-month survival rate stood at approximately 44%, on an assumed base count of about 70% of all seedlings distributed. Average twelve-month survival over the first six planting seasons (Spring 82 thru Fall 84) stood at approximately 30%, based on the assumption that pre-1984 survival rates were as low as the lowest accurately recorded survival rates since 1984.

For CARE, the most recent data available are also for Spring 84, and a program-wide, twelve-month survival rate well in excess of 60% can be projected for that season, again against a base count of about 70%. Average twelve-month survival over CARE's first six planting seasons stood at approximately 57%, under the same assumptions concerning pre-1984 plantings as those applied to the PADF data.

While these survival rates have sometimes been referred to as "disappointing", it bears noting that they do compare favorably with the expectations implicit in the original grantee proposals, falling only slightly short of those arbitrarily established marks (50% and 63.5% for PADF and CARE, respectively). In point of fact, the AOP is still in the process of *setting* standards in Haiti, within the context of particular outreach strategies, for survival rates for containerized seedlings outplanted by peasant farmers. This being said, the essential point is that the project continue to strive to improve survival and growth rates over the course of the next few years.

Of course, there are numerous factors, primarily climatic, that affect survival in any particular season and will always remain beyond the control of this, or any other project. Beyond these acts of God, however, significant increments in survival and growth may be pursued through improvements in two distinct areas of project activity: technology and extension. Elsewhere in this analysis, specific recommendations are made for seeking such improvements in both areas.

An economic analysis of the project conducted as part of the most recent evaluation suggests very strongly that incremental gains in survival, even when they have the effect of raising the cost per seedling outplanted, can be cost-effective in terms of trees living at age 12 months. Determining precisely for which specific areas of improvement this is the case must be one of the primary objectives of sustained inquiry on the part of the grantees, as well as of any research and technical support unit attached to the project. It is obviously also a pressing concern in the design and execution of the project extension. So long as the answers to these questions are pursued vigorously, and in an open-minded fashion, the project can be expected to achieve significant improvements in its survival rates over the next several years.

Clearly, the outreach grantees' proposals for extension of their grants, and any bids for research and technical support contracts under the proposed extension should all explicitly address the task of improving survival and enhancing

growth rates in the outreach program. This should include detailed treatment of the technical, ecological, sociological and economic issues involved; feasibility assessments; and specific plans for implementation.

Environmental Impact. As the original PP and grant agreements stipulate, the environmental impacts of the project are extremely difficult to measure accurately in the field, given the absence of site-specific baseline data and the relatively slow pace and long-term nature of local environmental change. Eight years was suggested as the minimum time necessary for these changes to become apparent.

While the quantitative assessment of environmental impacts were well beyond the scope of the recent evaluation, first-hand observations in the field did suggest that tree planting under the project has probably already slowed accelerated soil erosion in many instances, depending on particular site conditions and tree-planting patterns. The potential for project activities to have long-term positive effects in terms of ameliorating the trend to soil degradation and erosion was seen to be quite high.

Two major categories of project interventions can be classified as exhibiting positive impacts on the environment: tree cover establishment and living barriers. Tree cover establishment includes any land treatments whereby a closed canopy is established on a farm plot. Living barriers include any grasses and trees planted on the contour on steep hillsides in some continuous fashion so that the movement of soil downslope is retarded or stopped.

Tree cover is being established on literally tens of thousands of farm plots, by farmers who want to put potentially profitable project trees on marginal or fallow lands. Small woodlots, the end product of this vegetative-cover management strategy, serve to reduce rainfall intensity on exposed soil, such as is the case on recently cleared plots ready for cultivation or just following the harvest of annual crops. Woodlots also allow rainfall to penetrate the soil to a greater depth, rather than careen down a hillside, carrying soil along with it. Finally, leaf litter accumulates beneath this forest cover, adding much needed organic matter to the soil and serving as mulch to prevent soil-water evaporation. These effects further improve soil conditions for both tree and crop growth. While quantitative data on the actual sizes and extent of such mini-woodlots established thus far are unavailable, their sheer number suggests the strength of their aggregate impact, albeit unmeasurable at this time.

Living barriers are being introduced by CARE and PADF primarily through the establishment of the *Leucaena* hedgerows already discussed above, although the contour planting of relatively closely spaced trees is also encouraged under the project. The goal of such treatments is to demonstrate the practical utility of these hedgerows for the production of forage and coppicing wood products, and their effectiveness in controlling soil erosion. Both grantees estimate that the demonstration effects of these living barriers will become apparent in the next year or so, and many additional farmers will adopt such practices if sufficient extension assistance can be offered in hedgerow establishment (including other forage species, where appropriate) and management.

For the time being, the establishment of tree cover is a more widespread phenomenon than the placement of living barriers, but only because the latter is a more recently introduced project technology. In the future, these two simple

land treatments will play key roles in ensuring the project's direct positive impact on the environment, in terms of both soil rehabilitation and stabilization.

Finally, the indirect environmental impact of the project should be noted, in terms of the long-term contribution of project trees to Haiti's rapidly dwindling wood resources reserves. The cost-benefit analysis conducted in conjunction with the end-of-project evaluation demonstrated that, by the current PACD, the project will have already set in motion the production of additional wood resources that will measurably contribute to the national supply of wood products of all kinds over the next twenty years. If the project were to be suspended entirely at that time, this contribution would still comprise as much as 3.9% of total projected annual consumption needs in subsequent years. This is no small accomplishment in the annals of natural resource projects of this kind.

This effect, of course, is cumulative. Trees planted this year, for example, will be harvested at the same time as the first coppice growth of trees planted four years ago and harvested for the first time this year. Thus, it may be assumed that another ten years of sustained outreach activity, at current levels alone, would ultimately lead to an even more significant increase in the proportion of the projected national demand able to be met by project trees.

C. ECONOMIC ANALYSIS

The ultimate goal of this analysis is to determine whether or not a continuation of the project is economically justified. This determination is made by applying standardized procedures of cost-benefit analysis to project activities to date, and estimating the consequences of new and ongoing activities on future cost-benefit variables. First, a general description of AOP plantations and crop associations will be presented. Next, the costs and revenues of cropping practices and project tree plantations will be estimated, including program and opportunity costs. Then, all benefits and costs will be compared over a similar time frame. Lastly, sensitivity analyses will be done on the cost-benefit comparisons with new assumptions about project activities and impacts.

The AOP Plantations and Crop Associations. CARE and PADF report that more than seventy-three thousand farmers have planted project trees since the Spring of 1982, when the AOP began. It is neither possible nor necessary to analyze each of these 73,000 plantings in order to determine whether agroforestry is economically feasible in Haiti. Instead, these 73,000 farmers are divided into twenty representative situations (Table 1). Inferences drawn from the analyses of these representative or typical situations are applicable to the entire 73,000 farmers.

As the first step in the cost-benefit analysis of these twenty representative situations, net incomes have been estimated on the basis of information on the costs of labor, inputs, and market prices of commodities at the local level (Table 2). Net income can be greater or less than the estimated figures due to the degree of error surrounding the information which represent sampling averages.

The interactions between the tree component and the crop component are varied and complex. The two components may show supplementarity, complementarity, or competition. If the association shows supplementarity, the addition of a certain number of trees to the crop system has no effect on the crop output. If the association shows complementarity, the addition of a certain number of trees will increase the crop output. There are numerous examples of these positive interactions. The trees may protect the crops from wind damage. The trees may increase relative humidity, decrease wind velocity, reduce evaporation, and thereby increase production. Trees may bring nutrients from deep in the soil to the surface. The trees may provide shade for crops such as coffee or cocoa which need shade. Finally, if the association shows competition, one or more of the species present suffers from lack of light, water, or nutrients due to the presence of the other. The nature of the effect of the trees on the crop will depend on the density of the trees, as well. It is possible that the association would pass through the different stages from supplementary, to complementary, to competitive, as densities increase and trees are allowed to mature.

It is difficult to estimate the net effects of the interactions between the components, given present knowledge. Complementarity, in particular, has not been documented adequately under Haitian conditions. Therefore, the analysis has simplified the interactions between the components to be analyzed.

For the purposes of the analysis given here, competition is assumed to be minimal for the first two years of each four year rotation. Farmers can continue to raise their crops with no reduction in yield (supplementarity).

This assumption is valid if one considers that, on average, trees have 4.8 m² of growing space at planting and that these trees have a survival rate of approximately thirty-three percent after one year. Thus, the average tree will have 14.4 m² of growing space. With the customary pruning done by the farmers, these trees should not have significant negative effects on the agricultural component during the early years of the association. Beginning in the third year, competition for light, water, and nutrients is so great that crops can no longer be grown under the trees (competition). The trees will eventually be harvested, say for poles and fuelwood. At this point, the stumps will sprout and a four-year coppice rotation begins. As in the first rotation, crops may be grown under the trees for the first two years of the rotation. Succeeding rotations are assumed to be identical to the first.

The Costs and Benefits of AOP Plantings. In this section the costs and benefits of planting AOP seedlings are estimated, based on a comparison between the net benefits of the new investment, in this case, trees and crops, with the net benefits which would have been received had the new investment not been made. This is the "with versus without" approach. For instance, the analysis will assume that erosion in unprotected fields causes a 2% reduction in yield each year. The farmer's "without" income is based on the reduced yields he would have received had he not planted trees.

It is important also to consider changes that the farmer would have made even if he hadn't decided to plant AOP seedlings. Unfortunately, it is at times difficult to determine what a Haitian farmer would have done had he or she not planted trees. It is not necessarily true that he would continue to do what he has done in the past. A farmer who plants AOP trees in a maize and bean field is not necessarily giving up maize and beans as the trees grow and dominate the field. As one observer has noted, farmers sometimes plant their seedlings with the idea of integrating them into their fallow system rather than establishing a system of permanent intercropping. This is an example of the classic *taungya* system of plantation establishment. In this case the "without" net revenues are those derived from an unimproved fallow (which are zero, because the analysis, for simplicity's sake, has not introduced grazing into the model).

During the sixteen-year agroforestry cycle described above, crops are grown in years 1 and 2, 5 and 6, 9 and 10, and years 13 and 14. This is compared to the harvests the farmer would have had without AOP seedlings, noting that he has foregone crop harvests in half the years: years 3 and 4, 7 and 8, 11 and 12, and years 15 and 16. Note that this analysis therefore makes the extremely conservative assumption that, in the "without" situation, the farmer could harvest every year for sixteen years with only slight reductions in yield.

The average size of an AOP parcel is the average number of trees found in the base count in each region times the average space occupied by a tree, 4.8 square meters. Table 3 gives the assumptions used to describe the AOP plantings. For example, in the South region, the average number of trees planted by farmers in the Spring of 1985 was 235. These 235 trees, each occupying 4.8 m², occupy a total of 1128 m² or 0.1128 hectares. The net income from one hectare of, say, maize and beans is $119.01. Multiplying this amount by 0.1128 gives $13.42, the net income derived from 1128 m² of maize and beans in the South region. This is also the annual opportunity cost of not being able to plant this crop association along with the AOP trees. This figure will decrease by 2% each year under the assumption of declining yields on unprotected fields.

The information in Table 3 also was used to determine the benefits of the wood harvested by AOP planters in years 4, 8, 12 and 16, estimated as values in Table 4.

Economic Conclusions from the First Five Project Years. Table 5-1 shows the calculations for the cost-benefit analysis of the PADF component of the project based on an aggregation of all project costs and net benefits obtained by all farmers using the above methodology.

The top portion of the table shows the project expenditures for each year through 1985, plus estimates for 1986. Expenditures in 1986 are assumed to be equal to those in 1985. The net present value of these expenditures is $4,754,750.81 when discounted at 10%.

The middle portion of the table shows the benefits of the PADF component of the AOP. Each line in this portion of the table lists the net benefits ("with" returns minus "without" returns) of the seedlings planted in one season aggregated over all regions. Again, the benefits for 1986 are assumed to be identical to 1985. The net present value of the benefits is $6,746,975.13, also discounted at 10%. The ratio of benefits to costs is then 1.42 to 1. That is, when we use a discount rate of 10%, society realizes $1.42 worth of benefits for every $1.00 spent by PADF.

Note that there are two totals for the NPV. The first is the actual sum of the seasonal NPV's. The second, which is 15% greater, is the total we have used. We have increased the total by 15% to account for the approximately 15% of all project trees which are given by project participants to friends, neighbors, and relatives, and are subsequently outplanted by them. This can be done because the PADF and CARE benefits calculated above use base counts which do not include trees given away. Although these trees are not "official" trees, they are still beneficial to the farmers who plant them, and have, on the other hand, also added to the total cost of the project.

The next portion of the table shows the internal rate of return of the PADF component. The adjusted IRR, which includes the additional 15%, is 14.4%.

The CARE portion of the AOP is shown on Table 5-2. The ratio of costs to benefits is 1.57 to 1 when a 10% discount rate is used. The internal rate of return is 19.1%.

Finally, Table 5-3 shows the benefits and costs of the CARE and PADF components combined. The B/C ratio is 1.34 when discounted at 10% and the IRR is 13.7%.

The present analysis has shown that both PADF and CARE have acceptable internal rates of return. The economic analysis in the Project Paper predicted an IRR of 8.6% and 9.1% for CARE and PADF, respectively. This analysis shows CARE's component to have an IRR of 19.1% and PADF's component to have an IRR of 14.4%. Both components have done much better than had been expected.

One could also evaluate the performance of these two organizations on the basis of the cost per established seedling. The Project Paper states that CARE was to produce 1,940,000 seedlings. Considering the 62.5% survival rate predicted in their grant proposal, CARE would have established 1,212,500 trees for a total of $3,493,000. Thus, the unit cost of establishing and maintaining a seedling for

one year was predicted to be $2.88. Similarly, PADF was to have produced 3,080,000 seedlings with a survival rate of 50% and at a cost of $5,370,000. PADF's unit cost was therefore predicted to be $3.49 per established tree.

Table 6 below shows that both CARE and PADF have establishment costs significantly below those implied in the Project Paper.

Economic Estimates of Next Phase of Project. With respect to future directions of the project, it appears that qualitative rather than quantitative improvements in the production and extension of tree seedlings must be targeted. The evaluation discusses nursery production systems, research, training, and technical assistance as areas that deserve further attention and additional resources if the project's successes are to be maintained and consolidated over the coming years. The evaluation recommends ceilings on the numbers of seedlings, or even reductions, for the sake of improving tree quality, technical backstop support services, and the administrative capacity of the implementing organizations.

All things remaining constant, the effect of maintaining tree seedling production and distribution levels while increasing the level of inputs will be higher unit costs. The bet is that these unit cost increases will translate into better survival, growth, and higher project returns. The evaluation explicitly suggests that the "potential long-term impact [of these investments] in terms of program quality, sustainability and efficiency amply justify [their presumed] costs".

The most important questions facing this analysis, then, are "how will the proposed increases in implementing organization costs effect the positive cost-benefit ratios obtained in the analysis of the first five years of the project?" and "to what extent must benefits under the new implementation arrangements be increased to maintain positive returns to project investments?"

Table 7-1 estimates cost-benefit ratios under a projected $3.8 million annual outreach budget over the period 1/1/87 through 12/31/89. With the assumption of absolutely no increase in benefits (i.e., neither better survival nor enhanced growth), cost-benefit ratios drop from 1.34 in the first five years to 1.11 for the entire eight-year LOP. IRR rates drop from 14.1% to 10%. These measurements are still favorable, however, and they indicate that the project would be economically justified over the next three-year phase even in the absence of significant performance improvements.

Sensitivity analyses of this model of the extended project indicate that approximately twenty percent increases in seedling survival and growth in 1988 and 1989, or commensurate benefits, would be necessary to exceed the positive cost-benefit ratios obtained in the first five years of the project (Table 7-2). While the achievement of increases in benefit streams is a challenge to the technical and extension specialists contributing to the body of project analysis, the economic analysis indicates that the project will continue to demonstrate favorable economic returns even in the event that no additional marginal benefits, or smaller increases, are obtained over the next three years.

Table I Crop associations used in the evaluation of the Agroforestry Outreach Project and their frequency of occurence in a random sample of project farms, by region.

Crop Association	Region							
	South	Southeast	North	Upper Plateau	Lower Plateau	Region I	Region II	Total
Maize, sorghum, pois congo	3	5	0	10	4	1	1	24
Maize, manioc, beans	3	0	5	2	0	1	4	15
Maize, sorghum, manioc	2	2	1	7	2	0	0	14
Maize, beans	1	1	3	1	2	1	0	9
Maize, sorghum	1	0	0	1	6	0	0	8
Maize, sorghum, manioc, patate	2	0	0	1	1	3	1	8
Maize, manioc, patate	4	0	2	0	0	1	0	7
Fallow	2	0	0	0	2	1	0	5
Maize, patate	2	1	1	0	0	0	0	4
Maize, sorghum, pois congo, patate	0	2	2	0	0	0	0	4
Manioc, peanuts	1	0	1	0	0	0	1	3
Maize, sorghum, patate	1	0	0	0	1	0	1	3
Maize, sorghum, peanuts	0	0	1	1	0	0	0	2
Manioc, beans	1	0	1	0	0	0	0	2
Yam, patate	2	0	0	0	0	0	0	2
Manioc	1	0	1	0	0	0	0	2
Maize, potatoes	0	1	0	0	0	0	0	1
Pois congo, patate	0	0	0	0	0	1	0	1
Manioc, patate	0	0	0	0	0	1	0	1
Peanuts	0	1	0	0	0	0	0	1
Sorghum, patate, yam	1	0	0	0	0	0	0	1
Total	27	13	18	23	18	10	8	117

Source: Agroforestry Outreach Project. Case studies, Spring 1985.

Table 2 . Net income of different crop associations, by region. In dollars per hectare.

Crop association	Region . South	Southeast	North	Upper Plateau	Lower Plateau	Region I	Region II
Maize, sorghum, pois congo	231.47	243.17	n.a.	250.97	188.58	227.57	227.57
Maize, manioc, beans	199.94	n.a.	187.46	220.75	n.a.	195.78	195.78
Maize, sorghum, manioc	339.01	350.34	327.68	357.89	297.48	n.a.	n.a.
Maize, beans	119.01	132.43	105.59	141.38	69.81	114.54	n.a.
Maize, sorghum	258.02	n.a.	n.a.	276.11	218.23	n.a.	n.a.
Maize, sorghum, manioc, patate	390.47	n.a.	n.a.	414.97	343.42	386.20	386.20
Maize, manioc, patate	230.21	n.a.	217.77	n.a.	n.a.	226.06	n.a.
Maize, patate	41.00	51.40	30.59	n.a.	n.a.	n.a.	n.a.
Maize, sorghum, pois congo, patate	n.a.	291.24	264.98	n.a.	n.a.	n.a.	n.a.
Manioc, peanuts	376.88	n.a.	365.65	n.a.	n.a.	n.a.	373.14
Maize, sorghum, patate	262.78	n.a.	n.a.	n.a.	219.38	n.a.	258.84
Maize, sorghum, peanuts	n.a.	n.a.	287.37	316.24	n.a.	n.a.	n.a.
Manioc, beans	122.48	n.a.	112.03	n.a.	n.a.	n.a.	n.a.
Yam ,patate	151.23	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Manioc	110.19	n.a.	113.69	n.a.	n.a.	n.a.	n.a.
Maize, potatoes	n.a.	1191.80	n.a.	n.a.	n.a.	n.a.	n.a.
Pois congo, patate	n.a.	n.a.	n.a.	n.a.	n.a.	-3.58	n.a.
Manioc, patate	n.a.	n.a.	n.a.	n.a.	n.a.	194.85	n.a.
Peanuts	n.a.	261.83	n.a.	n.a.	n.a.	n.a.	n.a.
Sorghum, patate, yam	374.56	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Sources: Agroforestry Outreach Project Evaluation, May 1986

Table 3 . Assumptions about AOP plantations.

Region	Number of trees planted	Average survival	Pole price	Charcoal price
South	235	40%	1.00	2.40
Southeast	178	21	1.00	3.60
North	211	31	1.00	2.20
Upper Plateau	134	34	1.00	1.60
Lower Plateau	135	40	1.00	2.00
Region I	285	79	1.00	1.60
Region II	285	40	1.00	1.60

Other Assumptions

Avg original spacing --- 4.8 square meters per tree

Stems usable as poles -- 50%

Weight use as poles ---- 33%

Rate of real price increase - 4%

Growth rate ---------- dbh (cm) = 2 x age (years)

Volume equation --------

dry wt (kg) = 0.817 x BA (cm2) - 2.707 x dbh (cm)

Sources: Agroforestry Outreach Project Evaluation, May 1986

Table 4. Dollar Value of Wood Harvests, by Region.

Region	value in each of four rotations			
	year 4	year 8	year 12	year 16
South	$54.39	$63.62	$74.43	$87.07
Southeast	24.03	28.11	32.89	38.47
North	37.14	43.45	50.83	59.47
Upper Plateau	24.41	28.55	33.44	39.08
Lower Plateau	30.09	35.20	41.17	48.17
Region I	120.61	141.10	165.07	193.10
Region II	61.07	71.44	83.58	97.77

Sources : PADF and CARE survival rate estimates.
UMO price estimates.
UMO volume equation.

Table 5-1. Net present value and internal rate of return for the PADF component of the AOP.

PADF PROJECT COSTS

		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Season		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Spring	2164053.38	335585	472294	561370	802866	802866															
Fall	2590697.43	375055	486689	569863	1088528	1088528															
	4754750.81																				

PADF PROJECT BENEFITS

Planting Season	NPV of benefits	1982 1	1983 2	1984 3	1985 4	1986 5	1987 6	1988 7	1989 8	1990 9	1991 10	1992 11	1993 12	1994 13	1995 14	1996 15	1997 16	1998 17	1999 18	2000 19	2001 20
Spring 1982	126707.72	-8424	0	-20221	75172	2064	2453	-18651	92848	3572	3930	-17203	113164	4962	5293	-15868	136538				
Fall 1982	579046.85	-35670	0	-94573	343175	9654	11471	-87231	424387	16705	18381	-80459	517727	23209	24754	-74213	625097				
Spring 1983	319584.00		-21198	0	-60744	209527	6201	7368	-56029	259826	10730	11806	-51679	317643	14907	15900	-47667	384044			
Fall 1983	753452.22		-53139	0	-138351	493371	14123	16781	-127611	610718	24438	26890	-117705	745549	33953	36214	-108567	900604			
Spring 1984	526067.34			-39874	0	-106595	378643	10881	12929	-98319	468792	18829	20717	-90687	572401	26159	27901	-83647	691500		
Fall 1984	556489.80			-43644	0	-116296	402675	11872	14106	-107267	499266	20542	22603	-98940	610210	28540	30441	-91259	737744		
Spring 1985	521747.61				-45048	0	-110894	411522	11320	13450	-102285	508319	19588	21553	-94345	619610	27215	29027	-87021	747610	
Fall 1985	1052606.73				-93338	0	-229517	833749	23429	27838	-211699	1031046	40542	44608	-195265	1257815	56326	60076	-180106	1518556	
Spring 1986	474316.01					-45048	0	-110894	411522	11320	13450	-102285	508319	19588	-21553	-94345	619610	27215	29027	-87021	747610
Fall 1986	956915.21					-93338	0	-229517	833749	23429	27838	-211699	1031046	40542	44608	-195265	1257815	56326	60076	-180106	1518556
Total NPV	5866933.50																				
Adjusted NPV	6746973.52																				
IRR	0.126	-754734	-1033320	-1329545	-1810528	-1538055	475155	845880	1640650	761272	752841	1205786	2104322	1028027	1038069	1604547	2624709	1282386	1251220	1999039	2266166
Adjusted IRR	0.144	-761348	-1044471	-1359292	-1798398	-1485054	546428	972762	1886748	875463	865767	1386654	2419970	1182231	1193779	1845229	3018415	1474744	1438903	2298895	2606091

Table 5-2 Net present value and internal rate of return for the CARE component of the AOP.

		CARE PROJECT COSTS																			
		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Season		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Spring	794751.69	164351	164457	259908	240801	240801															
Fall	823239.80	251663	259903	185538	184256	184256															
	1617991.49																				

		CARE PROJECT BENEFITS																			
		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Planting Season	NPV of benefits	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Spring 1982	80199.71	-1116	0	-3192	41670	326	387	-2945	49524	564	620	-2716	58651	783	836	-2505	69269				
Fall 1982	141010.19	-3156	0	-10229	75734	1044	1241	-9435	91078	1807	1988	-8702	108841	2510	2677	-8027	129432				
Spring 1983	283513.90		-6557	0	-20988	166623	2143	2546	-19359	200015	3707	4079	-17856	238694	5151	5494	-16470	283553			
Fall 1983	323356.69		-7431	0	-23754	189941	2425	2891	-21910	227964	4196	4617	-20209	272011	5830	6218	-18640	323097			
Spring 1984	361122.42			-8107	0	-25243	231232	2577	3062	-23284	276632	4459	4906	-21476	329279	6195	6508	-19809	390397		
Fall 1984	262387.36			-5890	0	-18338	168009	1872	2224	-16914	200995	3239	3564	-15601	239246	4500	4800	-14390	283653		
Spring 1985	315906.55				-7800	0	-24286	222505	2479	2946	-22401	266191	4290	4720	-20662	316850	5960	6357	-19058	375660	
Fall 1985	332011.18				-8198	0	-25524	233848	2606	3096	-23543	279761	4509	4961	-21715	333002	6264	6681	-20029	394810	
Spring 1986	287187.77					-7800	0	-24286	222505	2479	2946	-22401	266191	4290	4720	-20662	316850	5960	6357	-19058	375660
Fall 1986	301828.34					-8198	0	-25524	233848	2606	3096	-23543	279761	4509	4961	-21715	333002	6264	6681	-20029	394810
Total NPV	2688524.12																				
Adjusted NPV	3091802.74																				
IRR	0.169	-420284	-438553	-472864	-368393	-126702	355627	404039	566057	401279	448236	504984	692648	495401	550323	619350	837075	597713	648001	731383	770478
Adjusted IRR	0.191	-420925	-440651	-476977	-359893	-81949	408971	464645	650966	461471	515471	580732	796545	569711	632871	712253	962636	687370	745201	841090	886041

Table 5-3. Net present value and internal rate of return for the combined PADF and CARE components of the AOP.

COMBINED PADF AND CARE PROJECT COSTS

		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Season		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Spring	2958805.07	499936	636951	821278	1043667	1043667															
Fall	3413937.23	626718	746597	755401	1272784	1272784															
	6372742.38																				

COMBINED PADF AND CARE PROJECT BENEFITS

Planting Season	NPV of benefits	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Spring 1982	206907.43	-9538	0	-23413	116842	2390	2840	-21596	142372	4136	4550	-19919	171815	5745	6129	-18373	205807				
Fall 1982	720057.04	-38826	0	-104802	418909	10698	12712	-96666	515465	18512	20369	-89161	626568	25719	27431	-82240	754529				
Spring 1983	603097.90		-27755	0	-81732	376150	8344	9914	-75388	459841	14437	15885	-69535	556337	20058	21394	-64137	667597			
Fall 1983	1076808.92		-60570	0	-162105	683312	16548	19662	-149521	838682	28634	31507	-137914	1017560	39783	42432	-127207	1223701			
Spring 1984	887189.76			-47981	0	-131838	609875	13458	15991	-121603	745424	23288	25623	-112163	901680	32354	34509	-103456	1081897		
Fall 1984	818877.16			-49534	0	-134634	570684	13744	16330	-124181	700261	23781	26167	-114541	849456	33040	35241	-105649	1021397		
Spring 1985	837654.16				-52848	0	-135180	634027	13799	16396	-124686	774510	23878	26273	-115007	936460	33175	35384	-106079	1123270	
Fall 1985	1384617.91				-101536	0	-255041	1067597	26035	30934	-235242	1310807	45051	49569	-216980	1590817	62590	66757	-200135	1913366	
Spring 1986	761503.78					-52848	0	-135180	634027	13799	16396	-124686	774510	23878	26273	-115007	936460	33175	35384	-106079	1123270
Fall 1986	1258743.55					-101536	0	-255041	1067597	26035	30934	-235242	1310807	45051	49569	-216980	1590817	62590	66757	-200135	1913366
Total NPV	8555457.62																				
Adjusted NPV	9830776.26																				

IRR	0.137	-1175818	-1471873	-1802409	-2178921	-1664757	830782	1249919	2206707	1162551	1201077	1710770	2796978	1523428	1588392	2223897	3461784	1880099	1899221	2730422	3036636
Adjusted IRR	0.156	-1182273	-1485122	-1836269	-2158292	-1567003	955399	1437407	2537713	1336934	1381239	1967386	3216516	1751942	1826651	2557482	3981052	2162114	2184104	3139985	3492131

Table 6 . Predicted and actual unit costs of seedlings produced and of surviving trees, for CARE and PADF.

	Predicted in Project Paper	
	CARE	PADF
Seedlings to be produced	1940000	3080000
Total cost, in dollars	$3493000	$5370000
Cost per seedling produced	$1.80	$1.74
Survival rate, in percent	62.5	50
Surviving trees	1212500	1540000
Cost per surviving tree	$2.88	$3.49

	Actual production	
	CARE	PADF
Seedlings produced	4554472	15343017
Total cost, in dollars	$1711082	$4625250
Cost per seedling produced	$0.38	$0.30
Survival rate, in percent	60	40
Surviving trees	2732683	6137207
Cost per surviving tree	$0.63	$0.75

Source: Agroforestry Outreach Project Evaluation, May 1986

Table 7-1 Cost Benefit Analysis of Agroforestry Outreach Project. a/

PROJECT COSTS

	NPV of Costs	1982 1	1983 2	1984 3	1985 4	1986 5	1987 6	1988 7	1989 8	1990 9	1991 10	1992 11	1993 12	1994 13	1995 14	1996 15	1997 16	1998 17	1999 18	2000 19	2001 20	2002 21	2003 22	2004 23	2005 24
	12240472	1126454	1383548	1576679	2316451	2316451	3800000	3800000	3800000																

PROJECT BENEFITS

Year	NPV of Benefits																								
1982	926964.4	-48384	0	-126215	535751	13088	15552	-118262	657837	22648	24919	-109050	798383	31464	33560	-100613	960306								
1983	1679716.	0	-88325	0	-243837	1059477	24892	29576	-224939	1298523	43371	47352	-207449	1573697	59841	63826	-191344	1891298							
1984	1706066.	0	0	-97515	0	-266472	1180559	27202	32321	-245784	1445585	47069	51750	-226704	1751136	65394	69750	-209105	2103294						
1985	2222272.	0	0	0	-154384	0	-390221	1701624	39834	47330	-359928	2085317	68929	75842	-331987	2527277	95765	102141	-306214	3036636					
1986	2020247.	0	0	0	0	-154384	0	-390221	1701624	39834	47330	-359928	2085317	68929	75842	-331987	2527277	95765	102141	-306214	3036636				
1987	1836588.	0	0	0	0	0	-154384	0	-390221	1701624	39834	47330	-359928	2085317	68929	75842	-331987	2527277	95765	102141	-306214	3036636			
1988	1669825.	0	0	0	0	0	0	-154384	0	-390221	1701624	39834	47330	-359928	2085317	68929	75842	-331987	2527277	95765	102141	-306214	3036636		
1989	1517841.	0	0	0	0	0	0	0	-154384	0	-390221	1701624	39834	47330	-359928	2085317	68929	75842	-331987	2527277	95765	102141	-306214	3036636	
TOTAL NPV BENEFITS	13579523																								
B/C RATIO	1.109395																								
IRR	0.103159	-1175018	-1471873	-1802409	-2178921	-1664742	-3123602	-2704465	-2137898	2473954	2552314	3499558	2524206	3296147	3382710	4453955	3274568	4151231	4190276	5455665	2928328	2832563	2730422	3036636	

a/ In this case, the project is assumed to continue for three additional years at increased levels of funding for TA, supervision, and monitoring of quality controls. No marginal increases in benefits, except those obtained from additional tree outplantings, are projected.

Table 7-2 Cost Benefit Analysis of Agroforestry Outreach Project. a/

		PROJECT COSTS																								
	NPV of Costs	1982 1	1983 2	1984 3	1985 4	1986 5	1987 6	1988 7	1989 8	1990 9	1991 10	1992 11	1993 12	1994 13	1995 14	1996 15	1997 16	1998 17	1999 18	2000 19	2001 20	2002 21	2003 22	2004 23	2005 24
	12240472	1126656	1383548	1576679	2316451	2316451	3800000	3800000	3800000																
		PROJECT BENEFITS																								
Year	NPV of Benefits																									
1982	926964.6	-48364	0	-128215	535751	13088	15552	-118262	457837	22648	24919	-1[illegible]	798383	31464	33560	-100613	960336									
1983	1679916.	0	-88325	0	-243837	1056477	24692	29576	-224909	1296523	43071	47392	-207449	1573897	59841	63826	-191344	1891298								
1984	1706086.	0	0	-97515	0	-266472	1180559	27202	32321	-245784	1445885	47069	51760	-226704	1751136	65394	69750	-209105	2103294							
1985	2222272.	0	0	0	-154384	0	-390221	1701624	39834	47330	-359928	2085217	68929	75842	-331987	2527277	95765	102141	-306214	3036836						
1986	2220247.	0	0	0	0	-154384	0	-390221	1701624	39834	47330	-359928	2085217	68929	75842	-331987	2527277	95765	102141	-306214	3036836					
1987	1672583.	0	0	0	0	0	-154384	0	-390221	1701624	39834	47330	-359928	2085217	68929	75842	-331987	2527277	95765	102141	-306214	3036836				
1988	2581539.	0	0	0	0	0	0	-154384	0	-589233.	2589452.	60149.14	71468.3	-543491.	3148828.	104082.7	114521.4	-501300.	3816166.	144605.1	154232.9	-462263.	4585320.			
1989	3144907.	0	0	0	0	0	0	0	-154384	0	-769573.	3443068.	80600.11	95767.52	-726278.	4219430.	135470.9	153458.7	-671742.	5113692.	193770.9	206672.0	-619593.	6144329.		
TOTAL NPV BENEFITS	16098501																									
B/C RATIO	1.315186																									
IRR	0.123769	-1175018	-1471873	-1802409	-2176921	-1668742	-3123652	-2704465	-2137898	2276941.	3020790.	5261315.	2569110.	3161021.	4077871.	6823252.	3383789.	4059534.	5139431.	6090860.	3078425.	2780924.	3565726.	6144329.		

a/ In this case, the project is assumed to continue for three additional years at increased levels of funding for TA, supervision, and monitoring of quality controls. Marginal increases in benefits obtained from additional tree outplantings and 20% increases in survival for 1988 and 1989 are projected.

D. ADMINISTRATIVE ANALYSIS

The point of departure for this section is not a discussion of the roles of the Project Coordination and Technical Support Unit and other components of the project, but rather a discussion of some of the different functions that have been, or might in the future be, important in the coordination and technical support of the AOP. Once the functions are defined, the institutional means by which they should be administered can be determined in an implementation plan.

USAID Liaison, Administration and Planning. It is important for both USAID and the grantees and contractors to be aware of each other's progress, problems and concerns. USAID needs to have someone with firsthand experience of the project at all levels, from the grantee project director to the planter. The grantees need to have a "representative" at USAID to explain their interests in the project. The importance of communication between USAID and the grantees has become apparent on the occasions when it has broken down.

The liaison function has entailed not only communication but facilitating the management of the project, as well, by helping the project manager in some of his administrative tasks and advising him on budgeting for the project and other matters. The planning function has not been written specifically into the scope of work of the project coordinator (PC), but it also has been an important one, especially in the development of this extension of the project and in the preparation of its second phase in the relatively near future.

Although USAID liaison was given low priority in the PC's scope of work, and administrative duties were minimized in the original PP, these functions have consistently been the most important ones played by the PC. Personnel from all of the components of the project agree that these are among the most important support functions which have been provided to date and that they should continue.

The importance of these functions is likely to increase rather than diminish in the next phase of the AOP, for reasons both internal and external to the project. Internally, there may be greater project complexity with the absorption of several new and complementary activities into the project. During the next phase of the project, the degree to which agroforestry activities at the institutional (PVO) and individual levels can be sustainable will become clearer, particularly when harvesting and marketing become more widespread and agroforestry packages such as living terraces are adopted on a wider basis. The next phase also is likely to bring the AOP to a position where crucial decisions will be needed with regard to the future, for example, in the ability of the NGO sector to maintain nurseries and outreach programs.

In addition to developments within the AOP, the need for liaison and project leadership will be as great and possibly even greater than in the past because of the beginning of major USAID initiatives in watershed management, continued uncertainties in the levels of foreign assistance funding by the Congress, and political developments in Haiti which are likely to affect the agricultural and non-governmental sectors.

Coordination of Project Activities. This is a distinct function from the activities discussed above in that the emphasis is on grantee relations with each other rather than with USAID. It is not a function which need take place within AID.

The original PP saw the PC as a "full-time broker" among the grantees, but much of their brokering relations (such as provision of seedlings) are now best handled by the grantees themselves. Nevertheless, coordination of grantees is especially needed for the standardization of monitoring and reporting procedures, and the sharing of experiences and discussion of problems and progress.

Documentation of the project has been a problem, with none of the grantees able to document fully its activities and to efficiently feed the lessons learned from its documentation back into its field operations during the first four years of the project. Most of the problems of documentation have been internal to the grantees, but coordination of what is documented by the grantees, and how, has also been a problem. It took a great deal of time to establish standards for monitoring and data collection procedures. Committees were established in 1983 and reconstituted in 1985 when the UMO research team began its work. These kinds of committees are needed, and the Socio-Economic Committee in particular has been successful in finally producing analyses of CARE and PADF outplanting case studies.

By their very nature, committees tend to get bogged down unless they are continually reinforced, directed and prodded. Ensuring that committee members follow up on decisions and that momentum is maintained is an important coordinating function for which a clear mandate is needed.

Project staff reported that they have not had sufficient interaction with each other to discuss problems and means of overcoming them, species performance, and common issues such as extension agent training. Lack of time and opportunities for communication was reported to be a problem for exchanges both between CARE and PADF staff and among PADF regional teams. This has meant that the technical personnel of the best agroforestry projects in the country have been dealing in relative isolation with problems of nursery management, seedling survival, and extension. The development of training standards and materials in the project as a whole has been slow, and this is due in part to lack of communication among project (PADF and CARE) staff on these topics. Lack of personnel specifically charged with training has been the major problem.

Improving communication and coordination among the project components can be done from within the grantees themselves and from support personnel. PADF and CARE plan to propose staff positions for documenting their projects and organizing research, including liaison with other grantees and the research unit. Furthermore, the technicians, particularly the expatriates, are slowly being freed from their administrative responsibilities as those are taken over by Haitian administrators. For example, one of PADF's foresters has turned over the administration of the southern region to a Haitian agronomist, and is himself focusing specifically on technical and research questions. This encouraging trend should make technicians more free from time constraints to have exchanges with their colleagues.

The preparation of an AOP newsletter by the PC in 1985 received high marks as a means of distributing information to technical staff in digestible form. It was viewed as one of the best mechanisms of providing technical feedback to the

regional teams. The newsletter can function not only to inform AOP (and other) personnel about AOP issues, but also about other work in Haiti (e.g. the farming systems research of ADS II) and elsewhere. The newsletter, technical seminars and committees should all be continued and strengthened in the proposed second phase of the project.

Technical Assistance. There will be greater need for technical assistance in the second phase of the AOP, especially in nursery management, fruit trees and tree improvement. Therefore, this support function in the project needs to be strengthened. This could be done either through budgeting funds for the grantees for this purpose, or by adding technical assistance to the functions of a central support component. Finding technical assistance through an AOP grant or contract would relieve the Mission of the burden of writing and managing a series of small consultant contracts and would ensure that the funds would be used for technical assistance to the AOP. If this function were funded through a contract, the contractor would need to be given the flexibility to respond to the needs of the project as they arose. The grantees are concerned that they have at least the right to concur in the selection of consultants so that they can be sure of receiving practical, field-oriented recommendations from them.

Research. The grantees are concerned that research in the project be directly related to their field activities; that it be specifically designed to help improve extension work and tree survival. It is primarily for this reason that the grantees are concerned that they have some input into the content of the research and where it is located. For example, CARE is concerned that field research take place in the Northwest and that field researchers have an intimate acquaintance with the distinctive environment and problems of that region.

Related to this issue, it is interesting to note that the technicians in the project are concerned that the planter be the focus of research. They are wary of a research package that concentrates on technical solutions such as species- soil matching or improved nursery mix, which do not take into account what they believe to be the crucial element: farmer acceptance of tree planting and maintenance, based on the perception that cultivating trees can be profitable. Given the fact that much work needs to be done in developing agroforestry and soil conservation packages that are both technically viable and attractive to planters, it should not be difficult to develop a research agenda that is both technically sound and oriented towards extension.

AID certainly shares these concerns, but may have additional research agendas as well. AID may be more interested than the grantees in research which is more oriented towards policy decisions than extension. This might include national-level data collection of biomass production and wood marketing data, cost-benefit analyses of the project, and independent evaluations of the project.

AID should first decide on the research priorities for the proposed extension of the AOP, and the kinds of institutional arrangements which are proposed should follow from those priorities. It is recommended that AID meet with all the components of the AOP to discuss how their research needs and priorities can be met and to determine how closely they fit with AID's priorities.

Three kinds of relationships have been proposed and are commented on briefly here. One possibility is that the grantees conduct all of the research and most of the technical support themselves. This would be administratively simple for AID, but in terms of CARE and PADF it might lead to duplication of effort unless carefully coordinated. Another drawback to this alternative is that responsibilities for research and technical support can burden the grantees' outreach programs. Another possibility is that the grantees control the funding of research themselves, but contract with an organization (most likely a university) to conduct it. There is certainly precedent for research teams working with funding from different sources, but this mechanism might entail certain contractual complexities, such as the sharing of overhead and different policies with regard to salary levels for CARE and PADF. A third option is for the Mission to contract with a separate component, as in the current case, but to meet with all the project components at certain intervals (for example, quarterly) to discuss the research agenda for the coming year. Such a contract would require a flexible scope of work which would allow for responses to changes in project needs.

One additional comment: There has been some discussion of a need for a research nursery which could experiment with soil mixes, inoculants, and other aspects of nursery management. If such a nursery were developed, it is essential that it be attached to an existing project nursery to ensure that researchers understood the realities of nursery management in Haiti and received immediate feedback on the applicability of their findings.

Tree Improvement and Seed Procurement. There are many issues in the design of a tree improvement and seed procurement system, and some of them will be commented on here. Seed procurement has been a problem for the grantees, both for indigenous and exotic species. The quality and timeliness of shipments of seed to the grantees has, at least on occasion, been a problem. The shipment of inoculants has been an even greater problem. It is possible that exotic seed and inoculant procurement could be improved if orders were made jointly. Not only would the orders be larger, but one person could be responsible for following up on them, which can be a time-consuming task. This function could be performed by one of the grantees, or by separate technical support component.

Procurement of seed from indigenous species is more complicated. Seed sources need to be identified, a network of collectors needs to be trained and systematic collection needs to be supervised. Beyond this initial system, the development of seed orchards from superior specimens would ensure long-term supplies. The proposed second phase of the project should include a system for indigenous seed procurement and the establishment of seed orchards for indigenous (and exotic) species. The initial system could be developed by one of the grantees or by a technical support component. Seed orchards could then be established by the grantees and other interested and capable NGOs. Perhaps NGO seed orchards could be developed along the same lines as PADF-supported regional nurseries, with capital and technical assistance at first, followed by a guaranteed market.

Other developments in tree improvement, such as the development of tissue culture facilities and the establishment of gene pools for species such as *Pinus occidentalis*, would necessitate more complicated institutional arrangements, as they are beyond the capacity of most NGOs in the country.

E. INSTITUTIONAL, PROGRAM, AND DESIGN ISSUES

Institutionalization. Recently, PADF undertook an informal assessment of its subproject portfolio by tabulating the regional foresters' subjective evaluations of the relative viability of the various PVO's with which they work. The term "viability" here refers to the likelihood that the particular PVO would continue its programs in tree production and outreach--in one form or another--if PADF support were withdrawn. The foresters' assessments were based on three elements: management skills, motivation and potential access to alternative funding sources.

Thirty of the PVOs assessed, representing 45 percent of the program in terms of numbers of trees distributed, were deemed to be "viable" by the foresters at this time. These PVOs also represent an eventual nursery production capacity of approximately 6 million seedlings per year, although they currently produce considerably less than that number because of constraints in resources and absorptive capacity. Another 23 organizations, distributing an additional 31 percent of the project trees, were characterized as "may be viable," having a "reasonable possibility of continuing, but on a somewhat more contingent basis" than the "viable" PVOs.

Of course, the potential viability of subprojects undertaken by such a large number of organizations, particularly when assessed on the basis of what are admittedly wholly subjective grounds, proves very little in terms of actual project accomplishments.

First, there is wide variability among PVOs to begin with, and this variability is grounded precisely in their differing abilities to manage complex programs and procure funding for them, and in their various motivations for being in Haiti and engaging in particular kinds of activities in the first place. PADF has been quite successful in engaging a number of very capable PVOs as collaborators, and in introducing them to a particular system for producing and distributing seedlings to peasants. Whether it has made a substantial contribution to their overall development as institutions, however, is quite another matter. Thus, the viability of particular subprojects may simply vary with the *a priori* viability of the PVO itself, rather than as a function of PADF's efforts.

Moreover, potential viability means little until it is actualized, and programs actually undertaken without PADF support can themselves be assessed. While there are a number of PADF-created programs now relatively independent of PADF, all appear to continue to depend, in some measure, on continued PADF assistance of one kind or another. This is in some ways a very positive finding, of course, since it reinforces the conclusion that PADF is currently providing certain critical services not available through any other source, as indeed it is. On the other hand, only when considerably more of the most viable PVO subprojects are, in fact, wholly weaned from PADF support--as the PP amendment suggested they might be during the extension period, but were not--will anyone be in a position to assess the lasting institution-building effects of the project.

While a definitive determination in this matter may be a long way off, it behooves PADF to refine their concept of institution-building, particularly over the long term, and to elaborate an explicit, phased program for the diminution,

withdrawal, or substitution of its support, in whole or in part, from a significant number of its collaborators. Resources freed up in this manner could then be applied to improving the depth and range of services PADF would continue to provide.

During the extension of its grant, PADF should elaborate and begin executing a phased program for disengaging itself, either wholly or partially, from a significant number of collaborating PVOs in its current portfolio. This disengagement should probably be two-pronged: involving the definitive establishment of the most viable subprojects as independently financed and managed programs, on the one hand, and the *triage* of currently ineffective subprojects, on the other.

Implementation of this recommendation over the next three years should pave the way for a long term reorientation of the PADF portfolio, with PADF applying its limited resources to providing a greater depth and range of quality technical and training services to as wide a constituency as possible, while offering direct financial and managerial support only on a time-limited basis to those PVOs who cannot do without it.

Sustainability. Basically, the issue of the sustainability of this project as it is currently constituted, in the absence of continued major funding inputs, is moot. This is a high-cost, high-impact program, operating cost-effectively and addressing some of the most critical issues facing Haiti today with a degree of success heretofore unimagined. It deserves, and will likely continue to receive, significant support from AID and other major donors for the foreseeable future.

More specifically, the project provides numerous higher-order services, including (1) procurement at an efficient scale and under franchise, (2) provision of technical support, (3) extension services, (4) training, and (5) research, most of which are subsidized activities virtually everywhere in the world, and will have to be subsidized by external donors here in Haiti until they can be effectively taken over by the public sector.

For example, the project's primary emphasis--the production and distribution of substantial numbers of trees to peasant farmers--depends for its implementation on new technologies, relatively high-level technical supervision and support, and imported materials, all coordinated at a level well beyond that of the individuals, communities or groups which are its beneficiaries. While the technologies can be learned, and the technicians replaced by local personnel, some portion of the materials will probably have to be continued to be imported for a long time to come. Their costs would double, approximately, in the absence of franchise privileges, and rise even further if not ordered in bulk. Replacement of these materials with local resources is a laudable long-term objective, and one that has been pursued with varying degrees of success over the course of the project. On the other hand, their importation remains the most efficient means currently available for continuing to implement the project on anything like the scale at which it is now operating. This scale of operation, at least in its approximate order of magnitude, with its current and potential impact, clearly should not be compromised at this point in the pursuit of what is ultimately an idealistic abstraction.

On the other hand, there are some features of the project that are extremely promising in this connection, in terms of the dual possibilities that (1) some portion of the costs of the production and outreach system can ultimately be underwritten by the "consumer"; and (2) some of the attitudes and practices currently being advanced by the project will be permanently incorporated into peasant farming systems and communities.

The "seedling purchase agreement" system employed by PADF, based on the production of seedlings for profit by PVO-operated nurseries, is currently fully subsidized, either by PADF or other donors who purchase seedlings. With an assured market, at a fixed price, for their seedlings, these PADF-supported nurseries are operating at a profit, and are able to pay off their initial capitalization costs within one or two years. Profits are turned back into their agroforestry programs, and help underwrite nursery expansion and some outreach expenses. Eventually, the peasant consumer, rather than donor organizations such as PADF and CARE, should be bearing these costs and supporting at least the local production system itself.

This development, however, presupposes both the peasant's willingness to pay anything at all for the seedlings, and his ability to pay their fair market value. The recent evaluation team agreed with the grantees that it was still too early to expect the first of these conditions to be met. Not until significant numbers of project trees have been harvested, used or marketed, and coppiced will the actual economic value of the seedlings become apparent to the participants and their neighbors, and justify a cash investment. This process can be facilitated, as well, by continuing to improve the quality and performance potential of project seedlings. It should also be noted that because the returns to that investment are relatively longer-term than those to other comparable investments, it may still not be possible for all potentially interested participants to pay the real costs involved. On the other hand, the question cannot be begged indefinitely, and some realistic planning for phasing-in at least nominal cash payments for seedlings must begin under this project extension.

Both outreach grantees should develop, over the course of the proposed extension, realistic pilot programs for the phase-in of some level of cash payments for seedlings by participating farmers. By the last year of the extension, at least nominal cash payments should be being made in some outreach areas.

In the realm of attitudes and practices, it is clear that the project has not only stimulated peasants to plant substantial numbers of seedlings, but has introduced or reinforced the basic idea that trees should be planted and managed in large numbers as a perennial crop, with the potential for producing significant cash or in-kind income for the peasant household. Since, as Conway points out in a recent report for UMO, "[t]here is [already] considerable traditional peasant experience in practice in planting tree seeds, transplanting volunteer seedlings, [and] managing seedlings and trees," planters who come to adopt the core project idea of planting *substantial* numbers of trees-as-a-crop are likely to seek seedlings beyond the project as well, including collecting their own seeds and transplanting volunteers from local or project trees. In this way, the project sets in motion a relatively self-sustaining process at the community level that can be maintained even without continued direct support from the regional nurseries. This process needs to be explicitly encouraged in future extension efforts.

The *Leucaena* hedgerow programs instituted by both grantees also hold the prospect of being sustainable, in this sense of introducing a concept whose repeated execution does not depend upon the continued presence of external inputs. Hedgerows are established through direct seeding. Once a sufficient number have been established in a given area, therefore, they can be self-sustaining, with seed coming from local stands of *Leucaena* or from the hedgerows themselves.

Furthermore, both outreach grantees have begun to explore ways in which seedling production itself can be transferred, at least in part, to community and individual nurseries, operating almost exclusively with local materials and, eventually, under minimal supervision. These nurseries produce seedlings for home-use or sale in the immediate area, using production systems that are already basically familiar in rural Haiti (plastic sacks, natural shade, soil-based potting medium, etc.). While both PADF's backyard nurseries and CARE's decentralized nurseries are still nascent programs, and it is much too early to judge their long-term potential, they do represent another strategy for ensuring that even some significant levels of improved plant propagation would be maintained in the absence of the project.

This being said, it must be added that neither these local nurseries, nor traditional peasant tree propagation practices will ever replace the regional production nurseries, nor is it necessarily desirable that they do so. Higher-order services such as quality control, supervision, maintenance of germplasm quality, and the continued introduction of improved technologies and techniques, after all, all depend upon the regional and national system. Again, for the foreseeable future, the project's long-term, large-scale impact will have to be predicated on the regional nursery and outreach system now in place, which must be maintained by major donor financing (perhaps diminishing as some operating costs begin to be borne by the market), until such time as it can be taken over by an efficient public sector.

The project should continue to pursue ways in which to diminish (1) regional nursery dependence on imported and manufactured materials; and (2) local dependence on regional nursery production. This should be done with the clear understanding, however, that such dependence probably cannot be eliminated entirely, and should decidedly not be eliminated at the expense of the quality and impact of the current program.

Relations with MARNDR, GOH and Other Donors. In spite of some earlier problems reported in this area, the project and each of its separate components currently enjoy cordial and productive working relationships with MARNDR and its representatives. Informal collaboration with the Direction of Natural Resources and the World Bank-MARNDR National Forestry Project has been particularly fruitful on both sides.

The AOP has made a lasting contribution to the national dialogue on environmental rehabilitation and resource management, stimulating interest, disseminating information, and sharing its methodology and philosophy in a variety of public fora, including most notably last year's ministerial workshop on watershed management.

In more concrete terms, MARNDR has availed itself of services provided by the AOP, including ODH's nursery production system, which sells a good portion of its annual seedling output to the Ministry to extend under its watershed

protection, forestry and irrigation rehabilitation projects, in part financed through AID Title III; and PADF's procurement system, which has on occasion assisted the Ministry in obtaining nursery materials and supplies. MARNDR field personnel have also been assisted by PADF's regional outreach programs, the most well-known instance being the provision of seedlings to Agronome Monosier's soil conservation effort in Petit-Bois (Chaine des Matheux).

Information and feedback are mutually solicited and shared freely, on an informal basis, through the Coordinator's office and directly with the individual grantees at all levels of staff. The flow of information from the project to MARNDR should probably be somewhat more routinized, with the Direction of Natural Resources regularly sent copies of all substantive documentation from the project by the Coordinator's office.

The evaluation team found no compelling reason for the AOP to pursue a more formal, institutionalized relationship with MARNDR at this time, but does advise that current informal, collaborative relationships be maintained and reinforced where appropriate.

One area that falls beyond the scope of this analysis should, nonetheless, be noted in closing this discussion. There are significant national policies, embodied in the Rural Code, that seriously abridge project participants' rights to harvest the trees they plant under the project. Existing statutes also open the door to the exploitation of tree harvesters, charcoal producers and wood marketers by local petty officials, most notably the so-called "Gardes Forestiers." Finally, even legitimate tax disincentives to tree cutting currently apply to all harvesters, irrespective of whether they have planted trees expressly for cropping or have simply cut natural stands.

The Ministry of Agriculture, Direction of Natural Resources, in conjunction with the World Bank, is currently drafting new forestry legislation. While the AOP has commented informally on an early version of this proposed legislation, the AID Mission should engage in direct policy dialogue with MARNDR over these issues. The current director of PADF, Dr. Glenn Smucker, appears to be the most knowledgeable proponent of legislative reform within the project. He should probably be asked by the Mission to prepare a detailed briefing paper as background to this dialogue.

As in the case of the GOH and its Ministry of Agriculture, the AOP currently enjoys productive working relationships with other donors concerned with Haiti's environmental degradation. This has resulted in several donors channelling small amounts of money into the project, presumably for reasons of the project's existing organization and donor interest in using funds efficiently. In the first four-and-a-half years of the project, AID financial inputs have been supplemented by funds contributed by the Shell Corporation ($34,500), the Canadian Embassy ($77,250 Canadian), and the Swiss Association for Technical Assistance ($373,202). The PADF affiliation with the Organization of American States also has resulted in in-kind contributions to the project. This leverage that the project has been able to muster in small grants could be capitalized upon in the future; and it should continue with the ongoing demonstration of project capability and success, and efforts at coordination of donor activities.

The leverage that the project is able to effect on the relevant multi- and bi-lateral projects in the forestry and environmental sectors also needs to be developed. This ostensibly should be pursued through a demonstration of the project's successful production and extension organization, and arguments for

supporting services and complementary interventions. AID and the project have assumed a *de facto* leadership role in this respect, and the continued improvements to the project, as have been suggested in other analytical sections and programmed under this extension, can help convince others considering project interventions of the strategy's soundness and worthiness of support. The initial effort along these lines has already been made with World Bank and UNDP missions to Haiti, which are currently considering agroforestry- related projects. It appears to have been somewhat worthwhile in that both organizations now are contemplating major outreach components, modeled after the AOP, in their initial proposals. In addition, complementary interventions in policy reform, human resources, and research are being proposed by these institutions to bolster development in the sector.

Relationship to the Hillside Strategy and the TWM Project. The AOP can serve as a cornerstone, both operationally and conceptually, for the Mission's new agricultural thrust on the hillsides, in the following ways:

(1) The AOP outreach grantees operate extension networks throughout the country that reach approximately 17,500 participating farmers (including repeat planters) each planting season, and maintain regular, quarterly contact with those farmers for at least a 12-month period following outplanting.

(2) By the current PACD, the extension network will have assisted over 110,000 Haitian farmers to plant substantial numbers of trees (varying between 100 and 500 per participant), and will have demonstrated the economic potential of "trees-as-a-crop" throughout the country.

(3) More than 40% of the trees planted under the project have been planted on slopes exceeding 20%, and it is likely that a significantly larger number of participating farmers are, in fact, "hillside farmers," in one degree or another, regardless of where they chose to plant their first lot of trees.

(4) Extension packages developed under the project stress the erosion-control potential of trees, and encourage the spatial arrangement of trees within hillside gardens to maximize their soil conservation effects.

(a) In the past two years, under a pilot program, the project has assisted in the establishment of more than 60,000 linear meters of *Leucaena* hedgerows in close to 500 small, widely-dispersed, demonstration plots on farmers' fields.

(b) In conjunction with this program, and in keeping with its encouragement of the planting of trees on the contour of hillside plots, the project has instructed thousands of participants and outreach personnel in the construction and use of the A-frame, a basic tool in the implementation of any soil conservation program.

(c) A national network of 39 regional nurseries, with an annual production capacity approaching 15,000,000 containerized, fast-growing hardwood seedlings, has been established. While certain technological improvements in the production system have been recommended, it currently functions on a scale, and with a degree of efficiency, previously unheard of in Haiti.

95

Each of these fundamental accomplishments represents an essential piece of the complex puzzle that the Mission is currently attempting to put together in its long-term hillside strategy. In terms of progress made to date, and potential future resources, the AOP has, in a very real sense, laid the groundwork for the ultimate achievement of the Mission's agricultural sector objectives on a national scale.

(1) The national extension network stands ready to disseminate more complex, improved hillside farming techniques as they are developed in the more intensive research/extension efforts soon to be mounted by the Mission.

(2) The progressive, and increasingly convincing, demonstration of the returns to trees-as-a-crop farming strategies and, more generally, of the potential value of the introduction of new, perennial plant materials into current farming systems, will itself facilitate the adoption of proposed new hillside farming technologies and vegetative barriers, again on a national scale.

(3) Hillside farmers throughout the country are, of course, already being reached in significant numbers by the AOP, and are adopting and learning to establish and to manage at least some of the key elements of environmentally sound hillside farming, including not only trees, but hedgerows as well. In the future, upgrading these practices and acquired skills--as part of integrated packages as they are developed will be much easier than starting from scratch.

(4) The *Leucaena* hedgerows recently put in place constitute an important source of research data and farmer feedback, allowing project planners and implementors involved in the new watershed management and hillside farming projects a unique opportunity to preview some proposed interventions *in situ*, and follow their progress in more advanced stages than would be possible otherwise.

(5) Finally, the national nursery network already in place is a literally invaluable potential resource for any realistic program of improved hillside farming which, of necessity, will include a significant component of agroforestry inputs, requiring the large-scale propagation of high-quality plant materials, including hardwoods, fruit trees, forage crops, and grasses. Upgraded under new project initiatives to become regional/local plant propagation centers, the AOP nurseries promise to make what will likely prove to be the project's most concrete and long-lasting contribution to the implementation of sound hillside farming practices around the country.

Needless to say, what holds true nationally for the AOP is also true in the Les Cayes area, where PADF has an active regional office serving the entire southwest peninsula.

In the watersheds specifically targeted under the Targeted Watershed Management Project (TWM, 521-0191), PADF is now assisting three major regional nurseries, with combined annual production capacities of 770,000 hardwood seedlings. These nurseries are operated by precisely those three major PVOs cited as essential local collaborators in the TWM PID -- DCCH/Laborde, DRI and UNICORS. Their associated outreach programs alone serve more than 1,500 farmers in the targeted watersheds each season, and employ approximately 75 animators. Also, of course, PADF enjoys a privileged relationship, through its regional forestry team, with

each of these organizations. These relationships are based on hard-earned respect and cooperation developed through years of consistent, reasonable collaboration and the provision of meaningful--and manageable--support and services.

Clearly, it is incumbent on TWM project designers, managers and implementors to pay more than passing notice to these aspects of the institutional, developmental and technical context into which their new initiative will attempt to insert itself. An adequate project design should formulate detailed, mutually acceptable procedures for the integration of the new project into this context, rather than its imposition upon it. Such procedures-- perhaps including some form of "buy-in" option through the PVOs themselves or through PADF/Haiti, but going well beyond simple financial matters in their scope--should not only provide a framework for long-term collaboration between the two projects in the targeted areas, but must also establish a precedent for wider interaction and cooperation as new hillside farming projects come on board around the country in the future.

Finally, it bears noting that CARE is expected to propose an expansion of its operations into the currently underserved Trois Rivieres area, which is one of AID's targeted watershed areas under the current Action Plan. This proposal should definitely be given careful consideration and some priority by the Mission, as it will set the stage for new initiatives under the planned Hillside Farming Outreach Project.

Costs and Standards of Project Accomplishment. The costs of implementing the full package of recommendations proposed in the evaluation, while still maintaining the two outreach programs at levels approximating those achieved to date, simply cannot be borne by projected funding levels for the proposed three-year extension. Ideally, between three and five million dollars of additional financing will be necessary over that period in order to fully and satisfactorily implement all the suggested improvements in the program, including higher-level staff increases for the outreach grantees, capital investments in improved nursery production systems, continuation of an independent research/technical assistance contract, establishment of full-blown seed selection/tree improvement and soil-testing/site classification programs, etc. A significant portion of this increment, moreover, would have to be available in FY 87, in order to fund start-up costs for many of these operations.

As suggested in some of the recommendations, however, not all of these costs need be borne by the project *per se*, but might better be handled as separate Mission activities designed to service a number of projects within the agricultural portfolio simultaneously. Alternatively, lower cost programs, based on the recruitment of qualified technical backstop staff members, might be set up within the grantee structure (particularly in the areas of tree improvement and site-species relationships), to carry out significantly less intensive, project-specific efforts in these domains. Even these more streamlined programs, however, will mean the assumption of significant unanticipated expenditures by the grantees themselves, thereby threatening correspondingly significant cuts in outreach levels.

Another alternative is to seek supplemental funding for the outreach programs from other sources, particularly those within the Mission and other donors. PADF's sub-grantee system would seem to be particularly amenable to this strategy, with particular PVO programs able to seek independent financing under an expanded ESF program, should it materialize.

In confronting this design/funding issue now, and in the future, the Mission will necessarily have to re-assess its long-term commitment to the AOP, and to quality, state-of-the-art performance in agroforestry. In so doing, it should explicitly recognize the fact that a number of the programs and improvements recommended here have relatively high initial costs, but then can be maintained on a much lower level in terms of recurrent costs. Private sector soil testing and seed improvement and propagation services might even prove entirely self-sustaining at some point. Also, investments made now in better quality seedlings, through better nursery production techniques and improved germplasm can be amortized not only over the life of the project, but over the lifetime of all trees planted under the project. If the nursery system ultimately becomes self-supporting, these improved systems will literally be bearing returns for decades after they are instituted. Thus, if AID is fully serious about this project's potential to make a lasting and, indeed, permanent contribution to rural development in Haiti, then it is incumbent upon the Mission to make the necessary investments in improving the quality of that contribution now, based on truly long-term projections of returns.

A corollary of this argument is that the Mission should vigorously resist any future tendency to reduce this project to a set of simple ratios, such as cost per seedling or cost per established tree, grossly determined by dividing total project or grant financing by numbers of seedlings or established trees delivered. If the recent evaluation has demonstrated anything, it is that this project, both in its past performance and future potential, is anything but a "simple" tree planting effort. Both its non-quantifiable outputs and its long-term impacts must be considered when assessing its success. Investments made now in research, for example, or in systematizing training curricula, or in enhancing the growth potential of trees that will still be yielding wood resources two decades from now, can hardly reasonably be charged against this year's seedling distribution levels. The outreach grantees, then, and the project as a whole, must be accorded an unambiguous mandate under the proposed extension to complement their earlier focus on expanding tree levels and declining cost/seedling ratios with greater attention to long-term technical and qualitative improvements in their products and programs.

F. PESTICIDE RISK-BENEFIT ANALYSIS

ASSESSMENT OF THE NEED FOR PESTICIDE USE IN THE AGROFORESTY OUTREACH PROJECT.

Introduction

Prior to the initiation of the AOP in 1981, an IEE prepared by Mr. William Sugrue, indicated that the use of pesticides in CARE and PADF nurseries would not be necessary. Therefore, AID funding of the AOP was approved with the special condition that pesticides would not be used during the LOP. However, several pest problems have since then emerged which require the use of pesticides in order to avoid substantial losses due to diseases and insect pests.

Technicians in CARE and PVO nurseries of PADF have taken upon themselves to initiate pesticide treatments in view of the evergrowing pest problems. The purpose of this report is to analyse pesticide use and pest management practices in CARE and PVO nurseries of PADF involved in the AOP.

This report is based on a meeting with Steeve Goodwin, project coordinator for PADF in PAP, visits of two of the PVO nurseries of PADF (DCCH and DRI), and a meeting with Rick Scott, project coordinateur for CARE in PAP. Because of a lack of time, none of the five CARE nurseries, which are located in the NW of Haiti, were visited.

1. List of pesticides proposed for use in the AOP.

Common name	Commercial name	Users		Authorization
		CARE	PADF	
Benomyl	Benlate		X	YES
Captan		X	X	YES
Carbaryl	Sevin	X	X	YES
Chlordane			X	NO
Malathion		X	X	YES
Mancozeb	Dithane M45		X	YES
Maneb + Methyl-thiophanate	Peltar		X	YES
Trichlorfon	Dipterex		X	YES

The reader should refer to the EA/TWAMP for a detailed analysis of these pesticides. Chlordane, the only pesticide not authorized for use in the AOP because of its Cancelled EPA status, is normally used for ant control in tree nurseries. Carbaryl and Trichlorfon are two adequate substitutes.

2. Use of IPM principles by PADF and CARE.

PADF produces a nursery manual titled: The Small Container Nursery Manual for Rootrainer Fives. This document, printed in both creole and english, gives control recommendations based on crude classification of pests: damping-off, fungus, crickets, caterpillars, aphids, and ants. Pesticides recommended are all broad-spectrum. The only non-chemical methods recommended are for: 1) crickets: hand weeding around the nursery, and 2) damping-off: reduced watering and increased ventillation. However, at the two PVO nurseries visited, the technicians did not appear to be using the manual and, when asked on whether they were using non-chemical methods for pest control, they did not mentioned the two above methods. At DCCH, however, they do use neem seed extract for the protection of tree seedlings against insect attack (see EA/TWAMP for complete discussion).

With regard to CARE nurseries, Rick Scott claims that pest problems are not too important at the present time and that all pest problems are controlled with three broad-spectrum pesticides which are relatively safe to use (see table). No non-chemical methods are presently being used. (The reader should consult the EA/TWAMP for more details on potential alternative control methods as some of them also apply for the AOP).

3. Need for training of pesticide applicators.

Based on visits at the DCCH and DRI nurseries, the level of training of PADF pesticide applicators appears somewhat low (see EA/TWAMP for more details). It Has already been recommended that two technicians in each of DCCH and DRI attend one of the two 1-day pesticide application trainning courses which will be offered shortly by AID/Haiti Cooperative Agreement for Fruit Tree Production in Camp Perrin (see EA/TWAMP). PADF includes several other PVO nurseries, however, and pesticide application training should be provided for at least one technician in each of those nurseries. The pest management specialist hired for the training course offered by AID/Haiti Cooperative Agreement for Fruit Tree Production, should be rehired for a one-day training session in PAP.

With regard to CARE, Rick Scott informed me that only nursery technicians apply pesticides in the five CARE nurseries and that those technicians are trained by CARE's senior forester.However, since I cannot assess the quality of that training, I suggest that the five CARE nursery technicians attend the one-day course offered in PAP for PADF nursery technicians, as mentionned above.

4. Final recommendation

With the condition that: 1) Chlordane is not used by PADF or CARE during the remaining part of the LOP, and 2) proper pesticide application training is provided for PADF and CARE nursery technicians, the authorized pesticides are recommended for use in the AOP.

Illustrative budget

One-day pesticide training course for PADF and CARE nursery technicians:	$2000.00
Purchase of protective devices for all PADF and CARE nursery technicians:	$2000.00
Total:	$4000.00

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G. LOGICAL FRAMEWORK

AGROFORESTRY OUTREACH PROJECT 521-0122 | PROJECT DESIGN SUMMARY | Life of Project: From FY 81 to FY 89
LOGICAL FRAMEWORK | Total U.S. Funding: $27.1 million
Date Prepared: August 1985

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To reduce and ultimately reverse the ongoing degradation of Haiti's natural resources, and thereby maximize the productive potential of its land.	Measures of Goal Achievement: 1. A slowing and reversal of the existing negative rate of growth re average annual agricultural productivity 2. Increased supply of wood for fuel and other uses, without a reduction of remaining forest reserves.	1. Data generated by GOH (Haitian Institute of Statistics, Ministries of Agriculture and Plan, ADS II Project (CRIES system)). 2. Data and trend information generated by donor agencies (World Bank, IICA, etc.). 3. Field surveys and research.	Assumptions for achieving goal targets: 1. Agroforestry activities will have a salutary effect on soil erosion, wood production and rural incomes. 2. Increased supply of wood will reduce pressure on remaining forested areas and marginal lands. 3. Peasant agroforestry is an economically viable and technically feasible enterprise.
Project Purpose: 1. To motivate Haitian peasants to plant and maintain trees. 2. To plant and maintain substantial numbers of trees during the LOP. 3. To obtain and analyze information on the technical, economic and social variables of forestation in Haiti, and on the basis of this analysis, to guide future and ongoing reforestation projects in Haiti.	Conditions that will indicate purpose has been achieved: End-of-Project status. 1. Substantial numbers of Haitian peasants undertaking agroforestry activities. 2. The majority of project trees surviving or utilized at project termination. 3. Existence of analyzed and interpreted data on technical and socioeconomic factors, and other agroforestry-related topics.	1. Reports received from implementing agencies. 2. Field surveys and observations of Project Coordinator and Senior Forestry Advisor. 3. Project evaluations. 4. Reports on controlled experiments carried out by project technicians. 5. Research reports.	Assumptions for achieving purpose: 1. PADF and CARE will be able to carry out extension and technical assistance activities. 2. Local PVOs will retain current interest in agroforestry and will carry out sponsored outreach and research activities.
Outputs: 1. Small farmer agroforestry subprojects continued with local PVOs and community groups. 2. Strengthened PVO capability in seedling production and extension, through: a) the practice of appropriate standards of nursery management; b) the propagation of superior plant materials; c) the appropriate matching of sites and species, with respect to technical and socioeconomic conditions; d) the utilization of standardized technical curricula for all levels of project staff and participants; and, e) the adoption of recommendations forthcoming from extended research studies, and intensified project monitoring systems. 3. Baseline and operational research studies conducted on the project's technical and socioeconomic aspects, with recommendations for future project implementation. 4. Orchards of genetically superior and economically advantageous tree and forage species established at decentralized nurseries.	Magnitude of Outputs: 1. No less than 150 agroforestry outreach subprojects implemented on a yearly basis with local PVOs and community groups. Yearly outplantings will not exceed 6 million trees. Participant level approaching 30,000 annually. Trend analysis will demonstrate yearly increases in seedling survival @ 12 mos. 2. All project nurseries (35) practicing state-of-the-art inoculation, fertilization, irrigation, shade management and plant propagation techniques. Each with their own improved germplasm orchard. 3. Training curricula with teaching protocols developed for all levels of project staff and participants by CARE and PADF personnel. 4. Research reports generated and recommendations adopted for site-species selections; improved nursery practices; costs and benefits of survival and growth enhancement techniques.	1. Reports received from implementing agencies. 2. Field surveys and observations of Project Coordinator and Senior Forestry Advisor. 3. Project records and evaluations. 4. Reports generated by project technicians, Coordinator and Senior Forestry Advisor. 5. Project records and reports. 6. Grantee records and financial reports. 7. Agency records.	Assumptions for achieving outputs: 1. PVO interest will remain high, as will their ability to motivate farmer participants. 2. GOH will continue expanding its own operations in this sector. 3. Sufficient land area will be available to carry out subprojects; and sufficient supplies of seedlings and other inputs will be available. 4. Training programs will be successful. 5. Research grantee can effectively implement relevant research program.
Project Inputs: ($000) PADF 7,200 CARE 4,200 Research 2,300 Seed Improvement 1,000 Coordination, Tech. Support, Evaluation & Audit 900 TOTAL (this amendment) 15,600	Implementation Target (Type and Quantity) (See Procurement and Financing Matrix)	1. Project records and reports. 2. AID records. 3. Project Implementation Status Reports (PISRs)	Assumptions for providing inputs: Continued availability of AID funding.