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# UNIVERSITY OF MAINE AT ORONO

# AGROFORESTRY OUTREACH RESEARCH PROJECT:

# SEMI-ANNUAL REPORT

# FOR THE PERIOD ENDING JUNE 30, 1985

BY

Marshall D. Ashley
Team Leader
and
AFORP Staff

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# SEMI-ANNUAL HIGHLIGHTS FOR THE UNIVERSITY OF MAINE AGROFORESTRY OUTREACH RESEARCH PROJECT

I. THIS SEMI-ANNUAL REPORT IS IN ESSENCE THIS SECOND QUARTER REPORT, SINCE THE PROJECT WAS INITIATED VERY LATE IN THE FIRST QUARTER.

II. ALL COMPONENTS ARE NOW STAFFED AND WORK IS UNDERWAY.

III. ALL WORK IS ON SCHEDULE AS PLANNED.

IV. PRELIMINARY ANALYSIS INDICATES THAT THERE ARE SIGNIFICANT DIFFERENCES IN SURVIVAL BY DIFFERING CONTAINER TYPES FOR GROWING SEEDLINGS.

V. HOWEVER, FOR MOST COMPONENTS, NOT ENOUGH DATA HAS BEEN COLLECTED AS YET FOR ANALYSIS AND THE REPORTING OF SIGNIFICANT FINDINGS.

# UNIVERSITY OF MAINE AT ORONO

## SEMI-ANNUAL REPORT FOR THE PERIOD ENDING JUNE 30, 1985

### Executive Summary

This report is in essence a Second Quarter summary. The project began with only one month remaining in the first quarter. However, the work accomplished during that time laid the foundation for the work described in the following sections of this report. As in the First Quarter report, I will summarize the work done over the two quarters within each of the project components, problems encountered and plans for the next quarter.

The Traditional Agroforestry Systems study is now well underway. A map defining the Buffum/Campbell ecological zones has been completed and has been used as a basis for selecting some areas for study. These are based upon a modification of the Holdridge Life Zones and are defined by elevation, rainfall and parent soil type groupings. Thus far, 17 farms have been surveyed over 6 ecological zones. Each farm was visited and through researcher measurements and an interview with the farmer, if he was available, information was collected to characterize the environmental, agricultural and tree parameters of the plot. Included in this collection was a tally of tree/crop competition over a 25 point grid located at random on the farm. This data will be used to tell which species will or won't cohabitate under varying agroforestry conditions. Pretested forms have been used to record the data and work was

initiated to set-up the computer programs to analyze this.

Few problems have been encountered to this time. Farmers were not available for some of the site visits and this did preclude getting some verified information. The progression into the dry season over the last month and subsequent harvesting or senesence of some crops is presently making some data collection difficult in some parts of the country as the growing crops have to be present for its complete collection.

Further fieldwork in other zones is already scheduled for early in the next quarter. This will continue as long as field crop conditions permit and will continue in the fall after the autumn rains.

The Nursery and Outplanting Trials component has made significant progress in most of its subcomponents. Some analysis of previous Container/Mix trial plantings data was done. There have been significant differences found in containers and the results of this analysis are given in the first quarterly report. Using these results as a basis, another trial will be outplanted in September or October of this year to verify these results and to investigate some new, potentially successful container/mix combinations. The only major problem to this time has been the delay of further data analysis pending the arrival of an expanded memory board for the UMO IBM PC XT computer. This board is in the mails and should arrive soon.

The Growth Schedule subcomponent is to get underway with outplanting late in the next quarter or early in the last quarter. Survival and height growth will be compared for four species: Casuarina equisetifolia, Azadirachta indica, Prosopis juliflora and Columbrina aborescens. Each will be grown for its usually scheduled time in the nursery, with a second group of the same species grown for twenty five percent longer than the usual schedule. The seed for this work has been planted and the seedlings are now growing under our supervision at the ODH nursery. The only problem encountered was a delay in obtaining the Azadirachta (Neem) seed. This will only allow a sixteen percent extended growth cycle.

Two trials have been outplanted in the Top Pruning subcomponent. The World Bank trials area in Duvalierville (900 mm) was chosen to represent a dry site and Saut d'Eau a wet site (1700 mm MAP). Water catchments were constructed around the trees on the dry site. Each of the seedlings were pruned to two-thirds their full height before outplanting. The three month survival counts will be made during the next quarter.

The Direct Seeding subcomponent was initiated during the last quarter. The three trials are in Ganthier (717 mm MAP), Duvalierville, and Saut d'Eau. These areas are to represent dry flat, dry hilly and wet areas respectively. The dry sites have Leucaena leucocephala, Pithecellobium dulce, Prosopis juliflora and Columbrina aborescens and Saut d'Eau has Leucaena, Cassia siamea, Albezia lebbek,

and Columbrina aborescens. Germination counts have been taken weekly and heights will be measured periodically after the seedlings have reached a ten centimeters in height.

There have been many problems associated with this trial. The early cessation and less than average rainfall for this spring's rainy season has resulted in poor germination and or survival on the two dry sites. The design for this component also included the planting of nursery grown seedlings for comparison with those growing from the direct seeding. None of these were planted because of the early stop of the rains. Further, the trial at Saut d'Eau has had poor survival because of predation by turkeys and chickens. These trials will be followed carefully to find what germination of seed takes place the next rainy season and to see what the height growth of direct seeded seedlings will be.

The Species Trials subcomponent has not been worked on during the first two quarters other than to gather preliminary information on where the existing trials are. This subcomponent will really commence during the next quarter.

The Silvicultural component was initiated in the last quarter with Dr. Marko Ehrlich and student Butch Barberi working on it. The first part of their work has been confined to doing background searches into the three subcomponents of their work, making contacts with the various project grantees, pretesting field techniques and data recording according to CATIE formats. The three subresearch

areas are volume and biomass table compilation, silvicultural treatments and coppice regeneration studies. Species included in these studies will include Azadirachta indica, Cassia siamea, Leucaena leucocephala, Casuarina equisetifolia, Eucalyptus camaldulensis, Columbrina aborescens and Catalpa longissima. Design of computer programs to handle the data collected has also started.

Field work for volume and biomass table construction has just been started. The felling and cutting for one species was completed and the lab measurements of wood moisture and density have yet to be done.

Several problems were anticipated in this subcomponent. It was recognized that the farmers might be reluctant to sell some of their trees at this time because they are treating them as savings for future needs, somewhat as a savings account for emergencies. Another potential problem was the obtaining of cutting permits for the trees. The first problem has been avoided to this point by working with a Church's plantings, rather than an individual farmer's. However, this concern remains for any future work on this and the other subcomponents. The obtaining of a cutting permit has not been any problem to this time. On the one site where harvesting took place the permit was given without any problem whatsoever on the basis that we were a responsible organization.

The other two subcomponents have yet to get underway. Essentially the silvicultural treatments subcomponent will establish

base line data to determine in the future the effects of species, site, age, basal area, d.b.h. and height on yield. The treatments will involve various spacing and pruning regimes. The coppicing subcomponent will relate site and tree characteristics to yield. Some of the baseline data for this has already been collected by Joel Timyan at ODH. Where we are able to follow up on previous measurements such as these, we will derive some preliminary results.

No unusual problems other than those already discussed are expected. The work for this component should be nearly completed by the end of the next quarter.

The Socioeconomic Components are all now in progress. Several new staff working on these components joined the staff over the last quarter. Gerold Grosenick, Project Economist and the only long term staff other than me is heading up the Consumer Preference Study and cost benefit components. Lisa McGowan the Marketing Study, Dr. Fred Conway the Planter Decision Study and Anthony Balzano the Socioeconomic Profile. Dr. Patrice Harou, Senior economist consultant, was also with us for four weeks and his report is attached as Appendix G. He worked on several of the components.

Much time was spent over the first part of the last quarter doing background research and designing and pretesting various questionnaires for these components. All the team members working on these components, me and several grantee staff met several times to discuss the reasoning behind our research, sampling methodology and the integration of the data into the overall scheme of our research.

The Consumer Preference Study was initiated last quarter. Leucaena, Azadirachta, Acacia auriculiformis, Casuarina and Eucalyptus camaldulensis charcoal was produced for us at ODH and tests are now underway with several classes of users (eg., household cooks and distilleries) are now evaluating their preference for each kind. Tests have also been designed for firewood, poles and lumber, but these will be done in the next quarter.

The background work for the Marketing Study has been completed and pretesting of questionnaires done. The work on charcoal marketing for this component will be an expansion and should complement the survey started last year by CARE and PADF. A nationwide pole survey is also planned as is a survey of all wood products coming into Port-au-Prince. This work will all get underway early in the next quarter. Some preliminary interviews have shown that the wood market, particularly the lumber market, is much more sophisticated than earlier reports indicate with prices in some regions of Haiti now being set by species on a board boot basis, rather than as done in the past on a piece basis.

The Cost Benefit component has had an initial survey of the available literature done and some interviews with farmers have been carried out. This component will attempt to quantitatively assess the benefits to all involved in the use of project trees, from the farmer to the ultimate user of any products produced from project trees. Dr. Patrice Harou was particularly helpful in cla-

rifying the relationships between the last three mentioned components. Again field work on this component will be expanded greatly over the next two quarters.

The two project anthropologists have designed and pre-tested their planned research for the Planter Decision Study and the Socioeconomic Profile components. Conway also spent a great deal of time working with other staff in the design of their studies, particularly in the phrasing of questions to be used when interviewing peasant farmers and others. He is presently out of the country on another assignment but will be returning early in the next quarter to commence fieldwork on the Planter Decision Study. The objective of this research will be to identify why farmers choose to integrate trees into their farming systems in the ways they do.

Balzano has progressed well with the Socioeconomic Profile Study. He is now living at his first of two study sites. This first one is in the Fond-des-Blancs area. The objective of this research will be to characterize individual farmers and any community relationships which in some way influence the use of project trees. Balzano's language skills now seem adequate and he has not experienced any serious problems. His only complaints have been from eating rice and beans three meals each day and that he was bitten by a scorpion in his bed. Some preliminary results from the studies by both anthropologists should be forthcoming over the next two quarters.

The set-up of our computer system was started in late May with the arrival of Douglas Gill. He has been working with our equipment and has it all operating. Several programs are now operational and several desireable software packages have been copied from others having them in Port-au-Prince. Gill has spent considerable time working with the other staff to help them in setting up their data collection so that it can be analyzed using our programs. He has also been meeting with some of the grantees to discuss what must be done to perform computer analysis of data they have been collecting from their various surveys.

There are some potential problems in this area. The delayed arrival of the board to expand the memory of our system has held up some of the data analysis needed by a few of the components. This is in the mails now and will hoepefully arrive undamaged soon. Another problem that won't be resolvable is going to be the demand for computer time beyond that available by all of the components plus that needed for word processing by our secretary. The project should have at least one other system to deal strictly with word processing.

In summary, all components have some activity underway. The details beyond that already given can be read in the complete accounts which follow this. While I won't take the space here to discuss my administrative activities, all seems to be going fairly well as I have become more familiar with the personalities and procedures of the Mission.

Lastly, and most importantly, I and our entire staff would like to thank the CARE, ODH and PADF staffs for their time spent on and thoughtful inputs to our work. Their help in initiating contacts with farmers has also been invaluable.

# APPENDIX A

## A QUARTERLY REPORT

## FOR THE PERIOD ENDING JUNE 30, 1985

## MARSHALL D. ASHLEY, TEAM LEADER

### Traditional Systems

This component has recently gotten underway and is progressing well. A set of forms to record field data has been derived, pretested and revised into the format that is presently being used. This same set is being used to characterize project farms as well. A set is attached to this report as APPENDIX H and consists of six forms. The first is a plan sketch of the farm plot giving its approximate dimensions and the spatial arrangements of the various crops and trees over the plot. The second is a series of vertical profiles which records the average height in meters of each crop and tree species. Form 3 records several physical characteristics of the farm such as elevation, aspect, percent, slopes, soil types, fertility rating, and soil surface character. Each crops and tree species present is also recorded with its percent ground cover and spatial arrangement. The potential of any trees on the farm for making poles, posts or lumber is also noted. The presence or absence of grazing and other animals is recorded along with the types of live or other fencing used on the farm. Form 4 gives a projected crop calendar for the species planted on the farm now and if possible also notes the calendar for the previous two years and that projected for the coming season. The last two forms collect information on

the relative competition of trees and crops. A twenty five point grid having a two meter spacing between points is randomly located on the plot and at each point the species of trees and/or crops is noted. The presence of bare soil or other such as bedrock or weed cover is also tallied. The forms are set up to record multiple events, eg. a Royal Palm tree growing over maize, growing over Congo beans, should these occur at a given point. A Users Manual has been written, but is presently under some revision and will be included in the next quarterly report.

The farms for this component are being selected to represent the range of farming systems over the various ecological zones of the Buffum-Campbell classification. A master mylar map of these zones based upon elevation, rainfall and parent soil type has recently been completed and paper copies will be made soon and distributed as appropriate to the grantees and others. To date 17 farms have been surveyed over 6 ecozones. Some of these have had project trees planted on them, but the trees have only recently been planted and have not really made any difference as yet in the farm management.

Special note should be made here of the excellent cooperation and help given us by the PADF and CARE staffs. Typically, a project coordinator has arranged for me to meet with local animators and we then in turn have gone to the farms to survey them

and when possible to meet with the farmers. The arrangements have been well scheduled and all those we have been set to meet have met us near the appointed time.

Work is also well underway on developing the coding and format for the computer analysis of the data. Doug Gill has already loaded a master set of codes for the tree species based upon the CATIE system and is in the process of finalizing the coding sheets needed to record the data for each farm. These will be filled out from the six basic field forms.

This component may have to be interrupted in some zones until the fall growing season. It is becoming very difficult to judge properly some of the needed data as the crops have been harvested and conditions are getting very droughty. Further, many of the PADF and CARE personnel are going on home leave, making it very difficult to set up the interviews.

Time will cure these problems and some further interviews have been scheduled over the next month. Another future opportunity continues to be the possibility of doing some cooperative, intensive farm output studies with the ADS II project.

For the next quarter, other representative farms will be selected for study. These will probably be limited to some of the more moist areas so that some semblance of the cropping pattern will exist when the farm is studied. And finally, hopefully the entire computing program and analysis procedure will also be tested.

APPENDIX B

A QUARTERLY REPORT

FOR THE PERIOD ENDING JUNE 30, 1985

BY

ROLAND DUPUIS, PROJECT RESEARCH FORESTER

The Quarter began with my attending the Nursery and Outplanting Research Committee meeting held on April 3, 1985 at PADF. During the meeting I described the proposed nursery and outplanting research and gathered input from the other grantees on species selection, site selection and experimental design. Recommendations from the meeting included a half-day technical meeting on seed selection and collection.

At 1:30 p.m. that afternoon, I attended the Silviculture and Species Trial Research Committee meeting held at PADF. During this meeting I described my responsibilities in reviewing the existing information on species trials in Haiti, including the remeasurement and analysis of some of the trials.

On April 25, 1985, I attended a seed selection and tree improvement meeting held at the AFORP office. Technical issues concerning tree improvement genetics were discussed.

I will continue with the format of describing each of the five sub-components within the agroforestry sector of the project for which I am responsible.

Container/Mix Subcomponent

The *Prosopis* was pruned to two and three stems per stump. This system of pruning most resembles how rural Haitians manage

*Prosopis* in dry areas and should improve their growth rate. It will also make remeasurement of these trees easier. The 17 month tree height and survival data which was collected in March 1985 has been transcribed onto a hardcopy and is currently being entered into the computer system at the AFORP office. All previous measurements are also being entered. From the previous work and preliminary analysis of the October 83 container/mix trial another container/mix trial will be outplanted this September/October in Ganthier. The trial will consist of four containers:

| | |
|---|---|
| Winstrip | (1" x 1" x 6") 6 in.$^3$ |
| 'Fives' Rootrainer | (1" x 1" x 4.25") 3.8 in.$^3$ |
| 'Deep-six' Rootrainer | (15/16" x 1 1/8" x 5.5") 5.5 in.$^3$ |
| Plantband | (1.5" x 1.5" x 5") 11.25 in.$^3$ |

Four mix types:

Fafard No. 2

Fafard No. 2 and Terrasorb

Haiti mix with 50% peat moss

Haiti mix with 50% peat moss and terrasorb

Three species:

*Prosopis juliflora*

*Columbrina arborescens*

*Azadirachta indica*

Columbrina may be replaced by Leucaena leucocephala. This decision will be made after further observations of its survival during the current dry season.

The trial will contain four replications of 20 trees per treatment for each species. The spacing will be 2m x 2m and cover 1.536 ha.

At present, the three species have been planted in their respective treatments, and the Leucaena will be planted as an alternate species. Work requirements and the amount of materials needed for each treatment have been recorded. With this, I hope to look at the economics of growing trees in these containers and mixes.

During the next quarter I hope to finish gathering information on all previous work with containers and mixes and compile the data into a sensible base from which to write recommendations for their further use in the Agroforestry project. I also hope to clear and fence the container/mix site, dig 3840 water catchments basins and set up a raingauge at the site.

At present, there is a problem with the analysis of the October 83 container/mix data. It seems that the current AFORP computer program ABSTAT cannot accomodate the large quantity (9.000 observations) of data for this trial. Unfortunately, we are still waiting for the arrival of the SPSS program and a "memory board" which will expand the memory capacity of our computer system: Until this equipment arrives, data analysis for this trial is at a standstill.

Overwatering at our nursery has been a minor problem. Because our young seedlings are in the same nursery house with older ODH trees which need more water, the seedlings are receiving too much water from the automatic sprinkler system. This has slowed the seedlings initial growth, but fortunately the problem has been alleviated.

GROWTH SCHEDULE SUBCOMPONENT

The growth schedule experiment will have a randomized block design within which a control group of trees will be outplanted with the same species of trees that have been grown 25% longer in the nursery. The objective is to see whether trees which have been grown 25% longer in the nursery will exhibit better survival and height growth within the first year and at what added expense to the nursery operations. The four species are:

| | Development time |
|---|---|
| *Casuarina equisetifolia* | 14-17 weeks |
| *Azadirachta indica* | 9-14 weeks |
| *Prosopis juliflora* | 10-12 weeks |
| *Columbrina aborescens* | 10-12 weeks |

The trial will contain four replications of 20 trees per treatment for each species with a spacing of 2m x 2m. The trial will contain 640 trees and cover .256 ha.

The predicted outplanting date is September 20, 1985. *Casuarina* was planted on May 6 (20 weeks) and on June 3 (16 weeks) for a 25% extended growth period. *Columbrina* and *Prosopis* were

planted on June 12 (14 weeks). June 28 (11.5 weeks) will be the control group planting date, thus these will have a 22% extended growth period. Due to the unavailability of Azadirachta seed, they were planted on June 20 (13 weeks) and the control group will be planted on July 3 (11 weeks). This gives a 16% extended growth period.

Top Pruning Subcomponent

Two top pruning trials were outplanted during this quarter in both a dry area (Duvalierville-900 mm) and a wet area (Saut d'Eau-1700 mm). Both trials are randomized block designs containing four replications of 20 trees per treatment for each species.

Before the Duvalierville trial was planted on June 6, 1985, the trees were pruned to two thirds of their average height on May 10. The site was cleared and 480 water catchments were dug for the trees.

The trial contains Casuarina equisetifolia, Columbrina aborescens and Azadirachta indica. The Casuarina and Azadirachta were ODH stock grown in 70% peatmoss/30% Haitian mix and 40% peatmoss/60% Haitian mix respectively using the Winstrip. The Columbrina was CARE stock grown in Pro-mix using the'fives'rootrainer. Special thanks to Marcia McKenna who delivered the trees to the AFORP office. I believe the Agroforestry Project could benefit greatly by this kind of cooperation.

The Saut d'Eau trial was planted on June 7, 1985. All the trees were pruned on May 10 except Catalpa which was pruned the day before outplanting. There was no site preparation involved, however, after the trees were planted, they were ring weeded and small open-faced water catchments were built.

The trial contains Catalpa longissima, Cassia siamea, Casuarina equisetifolia and Eucalyptus camaldulensis. All the trees were ODH stock planted in 40% peatmoss/60% Haitian mix, 70% peatmoss/30% Haitian mix, 60% peatmoss/40% Haitian mix and 40% peatmoss/60% Haitian mix respectively using the Winstrip.

In the next quarter I will take one and three month survival counts on both trials. The water catchments at both trials will be redug before the rainy season to maximize the effectiveness of the rains.

There were no problems associated with this subcomponent during the current quarter.

Direct Seeding Subcomponent

Three direct seeding trials were outplanted during this quarter in Ganthier (dry flat area 717 mm), Duvalierville (dry hilly area 900 mm) and Saut d'Eau (wet area 1700 mm). Weekly germination counts were taken on all the trials.

The Ganthier direct seeding trial was planted on April 25, 1985. Before planting, the site was cleared and rows were dug. The trial was to be a split plot randomized row design in

which seed would be planted in rows and an adjacent row would be planted with seedlings of the same species. Due to the lack of rain, the trees were never planted and so the trial is a randomized row design containing three replications of Leucaena leucocephala, Pithecellobium dulce, Prosopis juliflora and Columbrina aborescens seed planted in 100 foot rows. Leucaena and Pithecellobium were planted every six inches and Prosopis and Columbrina were planted two seeds every six inches. Seed treatments were as follows: Leucaena was soaked in 80ºC water for three minutes. The seed was then placed in cool water and allowed to soak for 36 hours. This treatment gave 56.5% germination after 10 days.

Pithecellobium had no seed treatment and had 94% germination after 10 days.

Prosopis was boiled in water for 5 seconds and immediately placed in cool water to soak for 36 hours. This treatment gave 33% germination after 13 days.

Columbrina was placed in 95ºC water for 5 seconds and immediately placed in cool water to soak for 48 hours. This treatment gave 23% germination after 18 days.

During the third week after planting the trial, severe depressions in the germination counts were observed and later were attributed to goats and sheep. During the next week, the trial was fenced, and in the following week, the germination counts increased. At present, the trial has almost totally

succumbed to the drought. Little rain has fallen since the trial was outplanted and conditions were so severe, that Prosopis and Columbrina never germinated. I do expect however, that these two species will germinate during the September/October rainy season. Soil samples at 0-15 cm and 50-65 cm have been taken at the site.

The Duvalierville trial is a split-plot randomized row design planted on a 25 percent slope with a NE aspect. The trial was fenced and three water diversion canals and five canal contours were constructed on the upper perimeters of the trial site to control excess water entering the trial site. The trial contains three replications of Leucaena, Pithecellobium, Prosopis and Columbrina. Seed treatments for Leucaena and Pithecellobium are the same as the Ganthier trial, but Prosopis was soaked in 80ºC water for 1 1/2 minutes which gave 76% germination after 10 days and Columbrina was boiled for 7 seconds, giving 25% germination after 10 days. The seeds were planted on May 9, 1985 in furrowed rows perpendicular to the slope. The trees were planted on June 5, 1985 in water catchments which had been filled the day before by a 19 mm rain. All the trees except Columbrina were ODH stock and their specifications are the same as the Ganthier trial. The Columbrina was CARE stock as listed in the Ganthier trial.

The Saut d'Eau trial is a randomized row design planted on an eight percent slope with a SE aspect. The trial contains six replications of Leucaena, Cassia siamea, Albezia lebbek and Columbrina aborescens. Leucaena and Columbrina seed treatments were like that in the Ganthier and Duvalierville trials respectively. Albezia was soaked in 80ºC water for one minute, which gave 70% germination after 10 days. Cassia had no seed treatment and had a germination percent of 50 after 10 days. The seeds were planted on May 16, 1985 in 50 foot rows perpendicular to the slope.

During the next quarter I will finish the germination counts for the initial two month period. This data will then be correlated with rain data which is being taken at each trial site. The trials will be measured one month before and one month after the rainy season. Height measurements will be taken on any tree grown from seed if it is more than 10 centimeters.

The biggest problem associated with this subcomponent has been the lack of rain. Mortality at all three sites is severe. At the Ganthier trial, during the third week, goats and sheep ate nearly 35 percent of all germinated Leucaena. This prompted us to fence the trial. At the Duvalierville trial, a 9 mm rain destroyed 54 of the 240 water catchments. These were rebuilt the following day, unfortunately, the soil which was carried down slope covered some of the trees and in doing so

depressed the germination counts. At the Saut d'Eau trial, chickens and turkeys are pecking the trial into stagnation. They are specially fond of Leucaena and Albezia.

Species Trial Subcomponent

Species trial information is currently being collected from the three grantees and the various reports that have been published.

During the next quarter, species trial information will continue to be collected, with the remeasurement of several trials.

The workload on other subcomponents during this quarter has been so great that I have not had time to take action on this subcomponent.

General Observations

The Saut d'Eau trial was planted by myself and 3 local hired persons. After carefully explaining and demonstrating to them how to plant a tree, we planted the 640 trees in this trial. Upon finishing, I reinspected the trial for misplanted trees. I found one tree not planted, 16 plug tops showing and 87 trees not heeled-in.

I added this note to remind all project personnel to reinspect their trials immediately after outplanting. Significant losses could occur from improper planting techniques.

# APPENDIX C

## A QUARTERLY REPORT

## FOR THE PERIOD ENDING JUNE 30, 1985

BY

MARKO EHRLICH, SILVICULTURIST CONSULTANT

The Silvicultural Team composed of Dr. Marko Ehrlich and Mr. Butch Barberi, has just initiated work at the end of May. Objectives and research methods have been clearly defined and formulated. Data collection will begin in June.

The Silvicultural Research Component has three main objectives, each of which will be treated individually. The three research areas are: (1) biomass table compilation, (2) silvicultural treatment and (3) coppice regeneration studies.

Species studied will include: *Azadirachta indica*, *Cassia siamea*, *Leucaena leucocephala*, *Casuarina equisetifolia*, *Eucalyptus camaldulensis*, *Columbrina arborescens* and *Catalpa longissima*.

### Objectives

A. Biomass measurement will define yield curves in terms of:

- polewood volume (mc and kg, dry-weight) (*)
- fuelwood volume (mc and kg-weight) (**)

non-merchantable biomass (kg dry-weight)

as a function of dbh, total height and basal area.

B. The silvicultural treatment component of our work will involve establishing experimental plots to investigate the effects of various silvicultural treatments on the growth and yield of trees and to make recommendations as to the most appropriate arrangements, given specific horticultural and ecological conditions. Variables that will be considered in these experiments include: species, site characteristics, age, basal diameter, dbh and height.

Silvicultural treatments will involve: thinning, pruning and spacings within perimeter plantings. Given that the effects of such treatments will occur in the future, only baseline data will be collected in this first stage of the research.

C. The third objective of our research is to collect data on the effect of coppicing on tree growth and yields as a function of site characteristics, basal area, coppice density and selection procedure. As in the case of the silvicultural treatments studies, the coppicing studies will, in this initial stage, involve the collection of baseline data to be followed up in the future. In one case, however, it might be possible to derive some conclusions from follow-up measurements to baseline data collected by Mr. Timyan at Madsen Farms.

Methodology

Field work will commence in June in the South and Southwest, where *Leucaena leucocephala* and *Cassia siamea* will be studied. Field work will then proceed to the North and Northwest where *Eucalyptus camaldulensis*, *Casuarina equisetifolia* and possibly *Catalpa longissima* will be studied. Finally, *Azadirachta indica* will be studied in a site in the Cul de Sac.

As much as possible biomass measurements will be combined with the application of silvicultural treatments (e.g., thinning and pruning) to reduce the total number of trees that will be cut under the research program. In the case of the biomass tables, approximately 30 trees (3 trees/each diameter class of 20 mm) for each species will have to be cut, weighed in segments and the diameters measured along the merchantable (pole) section of the trees.

The cutting of trees in peasant plantations might however, present some prolbems. If resistance to tree cutting of any kind or coercion will become involved in this part of the experimentation, the volume table will be developed only for the polewood part of the tree by taking diameter measurements along the stem, without cutting it. As much as possible, felling of trees will take place on sites directly owned by church groups, NGO's or individuals for whom the removal of 30 trees will not represent too great of a sacrifice.

Conclusions

The silvicultural team expects to complete field work by the beginning of September. By then, a number of silvicultural treatment experiments and coppicing studies will have been set up, and data collected on five or six tree species for the development of biomass/volume tables.

Procedures might change as a result of working with real-world situations in the field, yet the objectives of collecting valuable information on the technical aspects of tree planting in Haiti will not change. The silvicultural team expects to contribute by means of this effort, towards the better understanding of the technical (i.e. silvicultural) aspects of growing trees and producting wood (i.e., pole, fuel) on the eroded hillside of Haiti.

# APPENDIX D

## A QUARTERLY REPORT

## FOR THE PERIOD ENDING JUNE 30, 1985

BY

GEROLD GROSENICK, PROJECT FOREST ECONOMIST

During the quarter three people joined the UMO research team to work on the various socio-economic studies. On April 15, Lisa McGowan began her twelve-month contract. Anthony Balzano arrived on May 7 to begin his twelve-month contract. Fred Conway also arrived on April 15. He was originally scheduled for the six-month period April 15 - October 15. However, his work responsibilities have been rescheduled to better meet the needs of the project.

Dr. Patrice Harou spent four weeks working with us. Dr. Harou was to spend three weeks here in April and three weeks again in October. Since he would not be able to return in October, it was decided that he would stay here for four weeks from April to May. Specifically, he was to help us with an integration plan and the design and pretesting of the marketing and consumer preference studies.

Lastly, Doug McGill arrived to spend 15 weeks setting up our computer system and assisting each of us in preparation for analysis of research data.

## Activities

### Consumer Preference Study

Charcoal: After discussions with Ron Smith of ODH, we made a choice of species to be tested. The choice was based on the relative importance of each species in current planting programs and the availability of wood with which to make charcoal for the tests. We have chosen the following five species: Leucaena, Neem, Acacia auriculiformis, Casuarina and Eucalyptus. ODH agreed to supply the charcoal of those species they already had on hand and to supervise the charcoaling operations for the other species, using wood they have available. All charcoal has been delivered. In addition to the five species listed above, ODH has provided samples of Hibiscus and Albezia.

The testing procedure has been designed and testing is underway.

Firewood: ODH has agreed to provide the firewood necessary for this test. Species available are the same as for the charcoal test. The wood is currently available and is air-dry. Joel Timyan made contact with the owner of an alcohol distillery. With the owner's cooperation we have begun a series of consumer preference tests on the industrial use of these firewood species. This test, and others like it, will complement our tests of domestic users of firewood.

Poles: Again ODH has agreed to supply the poles needed for this series of tests. Testing will begin in July after an survey of pole users.

Lumber: The search for samples of lumber of our selected species has begun. Such lumber does not seem to exist. In all likelihood we will be forced to find trees from which lumber can be made and have the lumber made ourselves.

Marketing Study

The initial review of marketing literature has been completed. (Naturally, we will continue to search for relevant information throughout the course of the study).

Pretesting has been completed by McGowan.

A survey of charcoal prices in nineteen locations was started in November by PADF and CARE. We are cooperating with them in order to expand the number of survey locations and to survey products other than charcoal, most importantly poles.

Selection of sites for the first round of market structure surveys has been made. Those sites are: Jérémie, Les Cayes, Jacmel, the Miragôane - Port-au-Prince corridor, Bellefontaine, Port-au-Prince, Thomazeau, Hinche, St. Marc, Gonaives-L'Estère, Cap-Haitien, Jean Rabel, Bombardopolis. Follow-up studies, which will be more detailed, will be made on several of these sites.

Arrangements are being made to conduct a survey of deliveries of wood products to the Port-au-Prince market. This seven-

day survey will attempt to quantify deliveries of firewood, charcoal, poles, and lumber to Port-au-Prince. In addition, this survey should give us insight into the market structure for the country as a whole and demonstrate the relative importance of the different supply areas.

Cost-Benefit Analysis

The initial survey of readily available ag-econ data has been completed. It is evident that the information currently available is inadequate for our needs. A great deal of information which is not readily available does exist. This is information which was never widely distributed by the organizations which collected the information. We will continue the search for relevant information. Contacts have been made with several organizations, eg. ADS-II, the Madian-Salagnac work group, the Faculté d'Agronomie.

Dr. Patrice Harou spent four weeks here in April and May. His report and our discussions with him helped to clarify the relationships between the various studies. As the research continues, the understanding of these relationships will help us to maintain a unified or global view of the research.

During the quarter I visited a number of farms throughout the country in order to better understand the variety of farming systems and conditions with which we will be working. I will continue to make such visits as opportunities present themselves.

Coordination

During the first months of our project it has been very important to us to establish and maintain contact with the organisations working on the Agroforestry Outreach Project: CARE, ODH and PADH and the coordinating office. During the quarter, there were three monthly meetings of the Socio-Economic Research Subcommittee. We have used these meetings to insure that each of the groups is aware of what the others are doing and to agree upon future courses of cooperative action. The major effort to date has been in information exchange and coordination of similar effects. We are currently working to make informations exchange even easier. Doug Gill is developing procedures by which each organisation will be able to access the computer stored information of the others via our PC-XT. Not only will the information be accessible to more people but the capability to analyze data will be expanded because a greater range of analytical programs will be available.

We have met with numerous research organizations, study groups, PVO's and individuals on short-term visits to Haiti. (ADS-II, Madian Salagnac, Peace Corps, World Bank agroforestry, FAO/UNDP, and numerous PVO's). We are attempting to contact as many people as we can, over the life of our project. The more we know about what others are doing and the more they know about what we are doing, the better we will be able to cooperate and

coordinate our individual efforts to mutual advantage.

Administration

During the quarter I assisted Dr. Ashley in some of his administrative responsibilities: clearing shipments from customs, making purchases for the project, establishing our office, etc.

Work Plan for the Period July 1 - September 30

During the next three months period, we plan the following activities:

1) Completion of the consumer preference study for charcoal.
2) Survey of pole users.
3) Beginning the consumer preference study for poles.
4) Acquisition of lumber for the consumer preference study.
5) Survey of wood products deliveries to Port-au-Prince.
6) Initial survey of at least eight of the selected market sites.
7) The addition of price survey for poles to the price survey for charcoal.
8) The addition of several market price survey sites.
9) Summary of AFOP data to be used in the Cost-Benefit Analysis. Determination of additional information necessary to complete analysis. Plan for collecting this information.
10) Meet with more organizations to collect data for economic analysis.
11) Continued coordination of our activities with others.
12) Development of a computer information transfer system for PADF, CARE, ODH, and UMO.
13) Administrative duties as assigned.

# APPENDIX E

## A QUARTERLY REPORT

## FOR THE PERIOD ENDING JUNE 30, 1985

BY

LISA MCGOWAN, PROJECT ECONOMICS RESEARCHER

I began working for UMO's Agroforestry Outreach Research Project on April 15, 1985 and spent the first three weeks in-country reading reports, discussing with project members the goals and direction of the project, defining responsibilities, finding housing, and generally becoming reacquainted with Haiti and its ways.

During May, while continuing to research all pertinents aspects of agroforestry (especially as relates to Haiti) long and intensive discussions were held amongst those in the social and economic subcomponents, including our economics consultant Harou, and Marshall D. Ashley. These discussions were mainly concerned with methodology, the scope and depth of our research, and the ways that information for all subcomponents could be collected, analyzed and, most importantly, integrated. Having more or less carved our methodology and relative positions within that methodology out of a nearly infinite set of possibilities, the project in general and myself in particular began to set up the different research components, collecting materials, conducting interviews, pretesting questionnaires forms, getting advice, and meeting with

people interested in what information we would generate and who where willing to share their own.

Primary responsibility for the market study rests with me, and it is on this component that I will report.

Having first established the primary goals for the marketing study research and the type of information it would generate, interviews and meetings with those involved in trees and wood marketing began in earnest. As of July 1st, the following has been accomplished for the wood marketing research component.

1. The market study has been defined in terms of the interrelation of five market characteristics, each of which will be explored, further defined and correlated.

2. Pertinent literature and data sources have been identified. Literature and information searches are of course an ongoing and open ended process that will last the length of the project.

3. Highly cooperative formal and informal ties have been established with the PVO project implementors and the coordinators office.

4. Charcoal price data collected to date has been put on the computer.

5. No less than twenty meetings, interviews, and discussions have been held with Haitian pole, plank and charcoal sellers,

farmers, animators and coordinators. Direct arrangements have been made with project animators and coordinators to enlist their help in the market surveys.

6. Pole and plank price surveys have been drawn up, pretested and distributed to CARE and PADF foresters.

7. Three indepth market sites have been chosen (one urban, one rural, and one regional). In addition to these sites, shorter studies will be conducted at at least four other major wood supply and/or marketing areas.

8. Information and research guidelines have been distributed to AFORP project members as to what kind of market information they will solicit while conducting their own research (i.e. Balzano will include markets in his overall socio-economic profiles, Conway will ask market questions of farmers in the Planter Decision Study, and Grosenick collects market information at all phases of his research).

Planter Decision and Consumer Preference Studies

My responsibility on both of these components has thus far been in their planning. Further work will be conducted at the request and under the direction of Conway and Grosenick, respectively.

Comments

We are finding a great deal of cooperation at every turn, specially from the implementing PVO's, and this not only makes our

research easier and more enjoyable, but it also greatly enhances its quality.

Problems encountered thus far have been minimal and of the sort one expects in Haiti. I see no major obstacles for the future.

# APPENDIX F

## A QUARTERLY REPORT

## FOR THE PERIOD ENDING JUNE 30, 1985

BY

ANTHONY BALZANO, ANTHROPOLOGIST RESEARCH ASSISTANT

Reported here are activities I have been, am now and plan to engage in for the purpose of constructing the Project's Socioeconomic Profile (SEP) and similar concerns as they relate to the Project's Planter Decision Study (PDS) and Consumer Marketing Study (CMS) for which I will be collecting some data.

The PDS is being coordinated by Project Anthropologist Conway and is being reported on by me in his absence at the request of the Project Leader.

Description of my activities in the SEP, PDS and CMS will follow a brief overview of my role in the Project. Following this will be a report on the full scope of activities of the PDS.

I. Overview of Role of Project Anthropologist Research Assistant.

My work for the University of Maine Agroforestry Research Project requires that I establish two Village Study Sites where PADF or CARE Projè Pyebwa tree planting has been active and ongoing for several years. A SEP will be constructed for each Village Study Site. While on-site, I will also carry out task for the PDS as directed by Conway and for the CMS as directed by Project Forest Economist Grosenick.

## II. Socioeconomic Profile

### A. Site Selection for SEP

I arrived in-country on May 7th and promplty commenced, in partnership with Conway, with a series of meetings and site visits for the purpose of identifying the first Village Study Site. Between May 8th and May 17, meetings were held with PADF Foresters Bannister, North and Buffum, PADF Anthropologist and Director Smucker, CARE Foresters Stephens, Wolf and McKenna, and AID Anthropologist Lowenthal in Port-au-Prince. In Bergeau (near Les Cayes), we met with Poupette Maria Bernier and Chavannes Jeune of World Team (Development Rural Institute); in Laborde (near Les Cayes) we met with Père Lebeller and Gilbert Piard of DCCH. In addition, discussions were held and preliminary data was collected during interviews with animateurs at the three following site visits: to Mirebalais with Smucker (10 May), to Les Cayes area with Conway (13-14 May) and to Fond-des-Blancs area with Bannister (19-20 May). At Fond-des-Blancs contact was made with Jean Thomas who is affiliated with PADF and CODEPLA (the development assistance arm of an American evangelical organization).

Some of the criteria for site selection that were discussed during the site selection process were altitude (one site would be above 400 meters, one below), age of project trees, type of PVO implementing tree planting (i.e., religious or secular), effective rainfall and presence of rain shadows, proximity to urban

markets, presence of hillside farming, presence of coffee as a cash crop, and character of implementing PVO and individual animateurs.

The Fond-des-Blancs area was chosen as the first Village Study Site because it represents an area where Proje Piebwa trees are now well into their 3rd growing season, it is below 400 meters, it is an area of rugged hillsides and narrow valleys both of which support agriculture, it is relatively dry and should provide for some telling comparisons with a wetter second site, and because the people at Fond-des-Blancs were found to be receptive and supportive of my work and willing to provide an avenue for a quick and effective entry into the field.

B. First Village Study Site and SEP Research

Research for the SEP in the Fond-des-Blancs area commenced on June 10th with a survey of the various locations on horseback. Name of places, names of farmers and age and planting patterns of Project trees were noted. Mapping of garden plots and their owners was initiated for future surveys.

C. SEP Research Goals

Mapping of research area, identification of interviewees (both planters and non-planters), completion of a social survey of research population (e.g., age, sex, occupation, etc.), and establishment of a working rapport with the research population are goals for the month of July. Other goals for the First Village

Study Site are to identify tenure systems under which trees are planted, and to collect garden plot histories for the purpose of characterizing new kinds of agroforestry systems that may be emerging or for the purpose of identifying, if at all, the ways in which Project trees are being integrated into existing agroforestry systems.

III. Planter Decision Study (PDS)

My own PDS interviews will commence forthwith as noted below in the report of the PDS.

IV. Consumer Marketing Study (CMS)

Data will be collected at Village Study Sites for the CMS. This will include pricing and utilization information on a variety of tree products with an emphasis on charcoal, poles and fuelwood. Refer to Grosenick's report for full details.

V. Coordination and Start-up of Planter Decision Study

Project Anthropologist Conway has devised research instruments for the purpose of implementing the PDS. They include questionnaires, a checklist of tasks for the researcher, and work charts for garden characterization, cropping cycles, planting patterns, horizontal sketches and determination of tree management.

Research instruments were distributed to research

personnel and pretested in the Petit-Goâve area on May 13th. After pretesting, the need for a list of agricultural and silvicultural terms in Creole was identified. Such a list was compiled by Conway before his departure.

PDS data will be collected starting in the upcoming yearly quarter by Project Leader Ashley, Project Economist Research Assistant McGowan, Grosenick, Conway and myself at sites selected in the course of their other research activities throughout the country.

APPENDIX G

A QUARTERLY REPORT

FOR THE PERIOD ENDING JUNE 30, 1985

BY

DOUGLASS GILL, COMPUTER TECHNICIAN

Since late May the primary objective has been to install the IBM PC-XT computer and software packages and to insure proper operation. Minor installation problems have been encountered and are currently being remedied. A computer memory board, to expand the RAM (Random Access Memory), has been ordered. The memory board will increase equipment utilization and will increase our statistical analysis capabilities.

User guides are currently being developed to facilitate more efficient and effective use of the computer and of our personnel's time. The user guides will be designed to supplement the manuals accompanying the software packages, and will provide the information required to perform necessary operations.

A data entry person is being familiarized with the computer system and with on-line software. His responsibilities will include entering data, transferring data files between software packages, performing the analysis techniques desired by researchers, and outputting the results in a form useful to the researchers. The software packages he will be most familiar with include:

SPSS (a statistical analysis package), Lotus 123 (a spreadsheet and data-manager), and Multimate ( a word processor and text editor). By September 1, he should be able to operate the system without supervision, and provide other personnel with assistance.

The progression from start-up to full operation has been smooth. Initial data entry and analysis is continuing without major problems. The efficiency of computer operations will improve as users become more accustomed with the system.

APPENDIX H

# AGROFORESTRY OUTREACH PROJECT

# RESEARCH COMPONENT

# GUIDELINES FOR THE ECONOMIC ANALYSIS

BY

Patrice A. Harou

AID-UMO Project
Port-au-Prince
Haiti
May 10, 1985

45

# AFOP RESEARCH COMPONENT
# GUIDELINES FOR THE ECONOMIC ANALYSIS

The report presents the guidelines to be followed to integrate the research components of the AFOP with special reference to the socio-economic components but incorporating also the technical components on which any credible Benefit-Cost Analysis has to rest. According to the author's terms of reference particular emphasis will be given to the benefit-cost, wood marketing and consumer preference sub-components as stipulated in the USAID Contract No. 521-0122-C-00 and project No. 521-0122.

Literature cited

| | | |
|---|---|---|
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1. An overall framework for the research program.

The population of Haiti was estimated at 5.1 million in 1981 and is expected to reach 7 million by the turn of the century. With a total land area of less than 28,000 square km, Haiti is among the most densely populated in the Caribbean. It also has the lowest GNP in the Western Hemisphere (World Bank, 1983).

The combination of a high population density and a low GNP is usually correlated with very high deforestation rate (Lugo et al. 1981). This is the case of Haiti. Almost three quarters of the population is rural and demographic pressure has resulted in intensive cultivation of even marginal lands on extremely steep slopes. Trees are cut for fuelwood which is mostly auto-consumption or for charcoal production sold to urban areas. Uncontrolled forest fires to accomodate extensive grazing compounds the problem in many areas by inhibiting natural regeneration of second growth forests. The resulting erosion and pseudo-drought make reforestation on the hillside extremely costly and crop-failure most common. The damaged watershed treats directly the useful life of hydroelectric power dams.

The resulting wood scarcity resulting from the above destruction of the vegetal and tree cover, together with the appearance of an urban sector which depends on purchased charcoal for cooking, and poles and planks to build houses and furnitures, has endowed the remaining trees with an increasing economic value.

On the other hand the peasants whose land productivity has declined were found to be in a greater need of cash to supplement or complement their own production. In regard to previous reforestation-conservation project failures, the anthropologist G. Murray (1979) suggested to cease promoting the tree among peasants as a sacred, untouchable legacy for future generations, a message which is ignored at any rate, but to present to the peasants the planting of fast growing hardwood as a privately own cash-crop. The tree plantation can appeal also to the peasants as a savings bank, as livestock does, in case of necessities. Anthropologists and economists agree that most Haitian peasants produce in part for a cash market. The contents of their diet are in part also complemented through purchases from that same cash market throughout much of the year. The foresters, however, don't have enough information yet to sustain the claim that indeed the plantation or intercropping of fast growing hardwood species such as Leucaena leucocephala, Azadirachta indica, Casuarina cristata and equisetifolia, Cassia siamea and Eucalyptus camaldulensis could indeed provide the peasants with extra cash income that they would not have otherwise obtained.

The main trust of the AFOP research component is thus to provide evidence that indeed such tree plantations can generate some marginal net benefits to the peasants that have participated in the project so far. Such findings will have to be based on a

detailed physical input-output accounting of the most promising forestry activities per ecosystems after having identified these most promising activities through research experiments.

The other main trust on which the AFOP is based on, is the institutional arrangement through which the project was to be implemented. The A.I.D. $8 million grant was divided among three Private non-profit Organizations: Operation Double Harvest (ODH), The Pan American Development Foundation (PADF) and CARE. The three grantees were to implement their tree planting activities through some different organizational and delivery mechanisms and with the concourse of local Private Voluntary Organizations (PVO's) responsible of the actual implementation of these activities. It was thought that entrusting the resources to responsible local institutions in that way would be the most effective way to reach the main recipients of the project: the rural population.

Another component of the research could be to study which one of these organizational mechanisms and what characteristics of the PVO's make them more susceptible to use effectively the project inputs. This effectiveness could be measured in terms of resources allocated per trees effectively planted, trees planted and surviving and number of trees harvested for different wood products.

While the latter research focus would be interesting to A.I.D. if they want to extend the duration of the AFOP, it is

clearly outside the UMO's scope of work. It should be obvious however, that the grantees and the PVO's organization and management arrangements are a crucial factor in nursery production, number of trees effectively planted and later managed and harvested. The technical research to be undertaken by UMO will try to establish an optimal (in terms of cash income) tree plantation scheme taking into consideration the peasants needs and past project experiences. To do that, the research team should lay out clear and simple methodologies to collect data that will substantiate all the inputs and outputs of the different tree plantation schemes implemented and/or proposed. Prices of these inputs and outputs will have to be collected also following a methodology to be proposed. Given time and budget constraints, as many data as possible will be collected but the research effort should focus on the methodologies to follow and their illustrations so that, if the project is continued, the research and data collection can be pursued without discontinuity.

2. The financial benefit cost analysis.

If the verification of the central AFOP thesis, that trees can be planted as a cash crop, has to be tested through the project research component effort, the benefit-cost sub-component of the socio-economic research becomes particularly important. It is important not only because this analysis will permit to es-

timate the net-benefit of the peasant's forestry activities induced by the project, but above all because it will guide the other socio-economic, and to some extent the non-socio-economic research as well. The benefit-cost analysis exercise will force an orderly synthesis of the different research components. This analysis should be the last exercise of the research project because it will necessitate the outputs of all the other research. In this sense the benefit cost analysis is more than a mere accounting of the tree plantation cost and benefits, it should also provide a common purpose to report the results of an interdisciplinary team of researchers.

The requirements of the benefit cost analysis will force us to consider with special care all the research activities that help us quantify the inputs and outputs, together with their prices, of all the forestry activities implemented so far by the AFOP. The benefit cost will order and use this information in the below described order.

2.1 Nursery inputs

Most of these inputs are known already and vary slightly between sub-grantees and PVO's often because they work in different ecological zones and with different species. Their budgets may vary also. While all use some kind of peat moss in different proportion, the study of soil mix using local ingredients

may influence substantially the cost of seedlings if in the future the PVO's or the farmers themselves need to produce their seedlings with their own resources. The import of the ingredients in the soil mix may also be an important factor that could cause the discontinuity of the nursery activities once the project funds will end.

2.2 Seedlings transportation and outplanting inputs

Here again most of the inputs required for the outplanting of different species in different ecological zones with different soil types should be readily available. The research will assess the best inputs combination for specific outplanting conditions. These inputs will be used in the cost analysis. The same line of thought will be followed to quantify the transport inputs.

An alternative to the nursery, transport and outplanting inputs, would be those inputs related to direct seedlings. ODH experience in this activity should serve as a research starting point. The impact on the cost of plantation may be substantial.

2.3 Planting outputs

The survival rates of the seedlings effectively planted is the most obvious output resulting from the use of inputs specified above. I say effectively planted because all the factors due to the different sub-grantees'and PVO's organizations

and management should not be taken into consideration here. These survival rates will be recorded by species and ecological zones for the different systems planted. They will serve as a basis to establish the replanting costs.

2.4 Planting inputs prices

Once the inputs of the above activities are clearly established, the farm-gate prices of these inputs should be collected. A cost-price (e.g. cost/1000 seedlings) can then be established for the seedlings produced. The lowest cost-price per seedling combined with the lowest replanting costs for the different species and ecological zones will be used in the farmer's benefit-cost under the assumption that they may have to bear the costs in the future. To calculate their present benefit-cost, however, the seedlings are subsidized, and as such should not be entered in the financial analysis made from the farmers perspective.

2.5 Management inputs and prices

The amount of labour and the scheduling of this labour required for different management practices and tree spacial distributions (block plantation hedgerows, intercropping) will probably be the single most important management inputs to quantify. The labor requirements will have to be differentiated also per species and ecological zones. The timing of the labour used for the management of specific spacial arrangements of trees is particularly important to be able to es-

tablish the correct opportunity cost (wage) of that labor input. A significant variation in wage according to season and crop cycle is frequent in developing countries. In labor intensive tree plantation activity, such changes in wage can affect substantially the outcome of the benefit-cost analysis. The particular management practice that would require labor inputs during the off-season labor demands could show a much greater return to a peasant than a management practice that would compete with peak seasonal labor demand.

### 2.6 Harvesting outputs and prices

The intermediate and final biomass volumes produced during the first rotation and the successive coppices are the ultimate outputs of the tree plantation investment. Total biomass volume, however, is not as important as the repartition of this volume among the most useful final wood products: poles, planks, fuelwood, charcoal and other secondary forest products such as bark, seeds, fodder, etc... Such break downs of the harvested biomass will vary with species and ecological zones for any specific tree spacial arrangement and management practices. Even when the different wood products are specified for a precise situation, the optimal mix of these products will not depend entirely on the physical properties of the different components of that biomass but on the price of these different wood products also. Assuming that the management and harvesting costs stay the same, the greatest part of the biomass has to be transformed to the final end

use that commands the highest price. In terms of autoconsumption, it is the farmer himself who will attribute a certain utility to different products. These relative utilities should guide the percentage of the biomass that should be converted into a specific end product. If the management (different spacing, thinning, pruning, rotation age)and harvesting costs differ depending on the final product desired, it is the marginal net benefit of the different possible end products that will have to be compared. All this points out the importance of correctly quantifying the present and future prices of the different potential products to be derived from the tree plantation. It is not only the present and future price increase that is important but also its price increase relative to the other agriculture products that the peasants could grow on his land. This point will be remembered again later. Note that the output prices should be farm gate prices i.e. the market prices from which the transport and commercialization costs and profits have to be substracted. The value of the autoconsumed wood products will be discussed in the economic B/C analysis.

2.7 Land Cost

So far we have listed all the important variables that should enter the benefit cost analysis, assuming that the farmer owns the land already and that the part of the land where he planted was idle and furthermore that the tree would not affect in anyway the surrounding crops. If that part of the land where

trees were planted was in fact not idle but supporting natural vegetation, some grazing, an agricultural crop, another agro-forestry system or some fruit trees, an opportunity cost for these products foregone should should be entered into the benefit-cost analysis by including a soil rent. This soil rent would represent the annualized value of the other land use alternative foregone.

In addition to the space covered, the trees planted may interfer with the surrounding crops in a favorable or unfavorable manner depending on the biological interactions between the components of the agro-forestry system created by the introduction of the trees in the existing ecosystem. These biological interactions can be complementary (a), supplementary (c) or competitive (b) as illustrated in Figure 1.

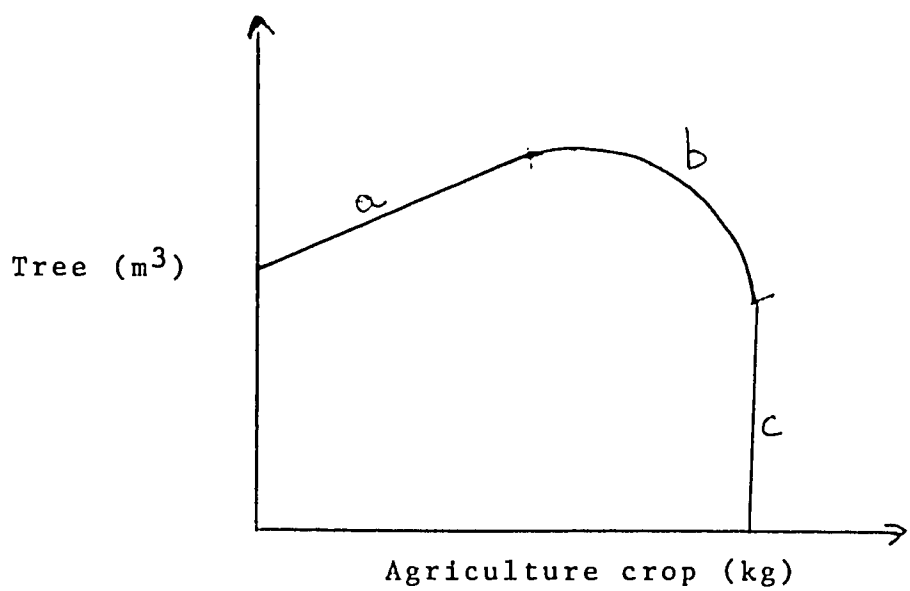


Fig. 1. A complementary, competitive and supplementary production possibility curve between crops and trees.

A complementary relationship could be illustrated by the introduction of a nitrogen fixing tree which increase the agriculture crop by fertilization and add the wood production to the system. A supplementary relationship exists when a palm tree is permitted to grow on the farmer's crop land because the tall tree will barely affect the light reaching the soils and assuming that nutrient and water availability are not limiting factors. Finally, a competitive relationship exists in most of the farmlands on which AFOP planted fast growing hardwoods which is illustrated in Fig. 1 by part b of the production possibility curve. This part of the curve indicates that an increase in the tree volume can only be obtained at the expense of the food crop and vice-versa.

To find the optimal crop-tree mix in this biological relationship one can use the input marginal value approach, the expansion path method, linear programing or simply a comparative benefit-cost comparison (Harou, 1983). Under the conditions found in Haiti, the latter method should be used as only one or two modified version of the traditional agro-forestry system exisiting should be considered. This simplify considerably the problem to a comparison of 2 or 3 mutually exclusive system alternatives. If the tree interfers with the surrounding crops in a competitive way, the marginal net-benefit (or loss) of the best mutually exclusive alternatives to grow that mix of crops has to be accounted for as a benefit (loss) of the tree plantation.

## 2.8 Uncertainty and Risk

Uncertainty is differentiated from risk by the impossibility to put probability values on some estimates of the benefit-cost analysis. The chance for a pest attack, a drought, or a hurricane to destroy a plantation is more difficult to quantify. The best way to handle the uncertainty of input, out, and price estimates is through a deterministic sensivity analysis that will vary systematically the estimates more susceptible of variation. These estimates will be varied over a certain range which will be established by the research in marketing (price range for a certain quality input or output) or in silviculture (biomass growth, labor used). The final measure of project worth B/C, Net present worth (NPW) or Internal Rate of Return (IRR), will be more or less sensitive to the variation in some of the estimates under study. If it is very sensitive, more information should be gathered about this estimate to study to what extent negative variations can be minimized or positive variations enhanced.

If probability values can be obtained for the most important estimates of the benefit cost analysis, a Monte-Carlo simulation could be used to calculate an expected measure of project worth e.g. E(NPW) together with its standard error. To the extent that the physical inputs, outputs, and prices in the benefit cost analysis will be derived from a large number of questionnaires or interviews, these probability values could be obtained easily. In no circumstances should the analyst use a modi-

fied, so called "risk discount rate". Risk and the opportunity cost of capital are two very distinct matters(Harou, 1983). Concerning the discount rate, the opportunity cost of the farmer i.e. its alternative rate of return (ARR) could be derived through very sophisticated questionnaires or interviews or more quickly by reference to studies found in the litterature Smucker (1983). A very reasonable and quick way to approach this value is to consider the peasant alternative rate of return in livestock or poultry, its living bank. The IRR of this alternative could safely be taken as his more likely ARR i.e. his other savings opportunity. If information to find this IRR is difficult to find or if the tree has been planted for autoconsumption, a secure way to present the analysis is a sensitivity analysis of the ARR's used. Note in this case, that poor-hungry farmers in developing countries have usually a very high propensity to consume and consequently their corresponding discount rate can be very high.

To go back to the risk quantification, an important point if the tree is integrated in a new agro-forestry system that would otherwise be a monospecific crop, is the greater dependability of return. A crop mixture is more dynamic biologically than a sole crop and is less likely to succumb to adversities of nature like pest attacks. This new system is protected by the so called "portfolio effect" which in the farmers' language translates "do not put all your eggs in the same basket." This effect

can be quantified by a coefficient of variation of the expected net returns. This coefficient of variation should be lower for the agro-forestry project than for the monoculture. The difference will be particularly marked if the different agroforestry output yields are negatively correlated (e.g. when the agriculture crop fails, the trees have a greater chance to grow well or vice-versa). Alternatively, a risk diversification proxy could be the calculation of a crop diversity index.

### 2.9 Externalities and Intangibles

The benefits and costs perceived by the farmer's will probably be different from the one found in the benefit-cost analysis proposed here. But a farmer will attempt to weigh and compare the advantages and disadvantages following a similar reasoning: what do I get that I would not get if I plant these trees I am given? These advantages and disadvantages of planting trees perceived by the farmers will be provided by surveys and some detailed case studies to be undertaken by the "producer-decision" subcomponent of the socio-economic research. This information may allow to refine the B/C analysis somewhat and should serve to improve the extension-education activities of the AFOP geared toward the farmers. It should also provide some socio-economic variables that characterized the farmers having the greatest chance to be interested in planting trees and at the same time the highest likelihood to insure a good survival and growth rates of the trees planted.

Some of the important considerations that the farmers may have and that are implied in the different steps of the B/C described earlier are:

- need to auto-consume some of the would-be wood products (which ones?) obtained from the tree plantation.
- perception that the proposed tree will provide a wood product (including secondary products) not already available with native trees or a wood product of a better quality.
- availability of idle or low value use land on which he can plant. (If fallow for what period of time? what area of land does he own/rent?). If he rents what is the rent?
- If intercropping occurs to what extent do the farmers perceive complementarity, supplementarity or competition between trees and crops?
- If use in hedgerow occurs, to what extent does the tree hedgeimprove the present fence (e.g. cactus) or bring some extra products with or without interfering with adjoining crops.
- perception of lowering the risk through the diversification of crops (portfolio effect).
- intention and need to sell part or all the plantation wood products (which ones?) on the market (cash income hypothesis).

- perception of building a savings account (better, same or worst than with livestock or poultry).
- perception of increased land value.
- perception of establishing more firmly his property right.
- perception of diminishing erosion.
- perception of increasing the fertility of the soils through mulching or nutrients fixation.
- other reasons.

If precise and definite answers could be given to most of the questions relating to the perceived advantages and disadvantages just listed, a precise benefit-cost analysis could be made for this particular farmer. Such analysis could not be made for all the farmers involved in the project but for group of farmers sharing the same perceived benefits and costs for a particular agro-forestry system in a given ecological zone in which a new species of tree has been introduced. The different groups of farmers should be differentiated only to the extent that their B/C would change substantially.

Note that the B/C based strictly on the research findings and market prices may end up quite different from the profitability analysis based on the farmers perceived benefits and

costs. Both analyses are useful. The objective B/C analysis is the technical profitability that a perfectly well informed peasant could make but in reality never does. This B/C however should help confirm the hypothesis supposed to be tested by the socio-economic research namely that trees can be planted for cash crops i.e. to generate some extra income to the rural poor. If the farmer perceived B/C is not profitable some education-extension efforts or incentives may be provided to the extent that the economic B/C (not the financial B/C we have been dealing so far which is the B/C from a private individual point of view) which will be discussed in the next section, shows a profitable investment from the societal point of view. If it is not a profitable investment from the society's standpoint, then no incentives should be provided and the trees should not be planted on this farmer's property. This is so if a strict efficiency criterion should be followed. On an income redistribution ground the subsidizing of tree seedlings could be defended but it would probably be a very ineffective way to redistribute wealth. On environmental grounds the project could still be defended. However the environmental benefits should have been included in a thorough with-without long term analysis.

2.10 External Factors

Some factors completely outside of the technical or perceived B/C for the tree planting activities may explain the

(momentaneous) interest of the farmer in planting trees. At the beginning of the projects CARE distributed Food for Work which in itself is enough of a reason to plant trees whatever the B/C happens to be. PADF gave some cash payments for trees surviving after 6 months and one year. This also is a good reason to plant trees no matter what. Even if these 2 types of incentives have been stopped today a great number of project salaried, animators, coordinators, chef coordinators, etc. have an immediate interest in forcing the hands of some peasants to plant or to plant more trees that the farmers is interested in. Other factors like pertaining to a PVO's church involved in the project planting activities, to follow a community leader strong suggestions to plant, etc., are factor that may be found through the social component of the research but is of no particular value for the financial analysis made from the farmer's point of view. This information could only be of some use in the framework of the overall B/C of the AID-AFOP to quantify the long term benefits of this project.

Let's conclude now on the financial benefit cost analysis by saying that several by-products of this research sub-component exist. First, as we said earlier, the B/C analysis provide a convenient framework to organize the different research components of the UMO project. In addition, the technical benefit cost analysis should help provide answers to important economic issues

in the management of the tree plantation, especially the optimal spacing between trees under different ecological and economic conditions, the optimal thinning and pruning regimes and last but not least the best rotation age for different species, in different ecological zones and agroforestry systems. The value of the land once planted and its rent can also be evaluated through this benefit cost analysis. These analyses may be a little too refined for the actual level of management in Haiti, nevertheless these questions could, if the B/C analysis is complete, be answered through this sub-components of the socio-economic research.

3. The Economic B/C analysis

It was made allusion to the economic analysis of an investment earlier when some form of incentives were considered to foster tree plantations on peasant's land. The economic analysis by opposition to the financial analysis would consider the benefits and costs of the tree plantation not from the farmer but from society's point of view.

There are a number of points that will differ from the financial analysis most importantly the duration of the investment period considered, the exchange rate and prices used, the transfer payments, the discount rate, the externalities and the way risk is taken into consideration. All the rest of the methodology used in the financial analysis stays exactly the same

for the economic analysis. The scheduling of the plantation inputs and outputs is the same than in the financial analysis.

3.1 Period of time considered

The time period for the financial analysis has not been discussed but it is usually the shortest period of time that can be considered while still including all the outputs of the initial investment. In the case of fast growing and coppicing hardwoods, the period of time should include the first rotation and successive coppices until exhaustion of the stumps (15 years?) In fact some farmers may only take in consideration the first rotation as they intended to let the land fallow for no more than 3 or 4 years. Depending on their experience, they may shorten or increase this duration, as they see fit.

The economic analysis is taking a longer period of time into consideration and may even consider the maintenance forever of the newly planted and intercropped trees. The final goal of the project being to halt the degradation and loss of the top soils in Haiti, it is indeed wise to hope for the sustainability of these productions of trees and crops over time. The major benefits of agroforestry projects is to insure the sustainability of agriculture at the current level of production through time and eventually to increase that productivity over time.

In order to catch this long term benefit,

the economic analysis has to consider the difference in long term productivity between the present and new systems through a with-without analysis extending in the indefinite future. How long is the indefinite future? Two or three production cycles (rotation + 3 or 4 coppicings) should probably capt most of the new long term marginal net benefit. The net benefits accruing 30 or 45 years or more from now will not have a marked difference on the overall profitability once these net benefits are discounted. Yet foresters deal regularly with infinite horizon to analyze their investments by using the soil expectation value (also called Austmann Formula) which could also be used in calculating the NPW of the agroforestry investment over an infinite time period.

The long term marginal benefit can be depicted in figure 2 depending on 3 possible situations:

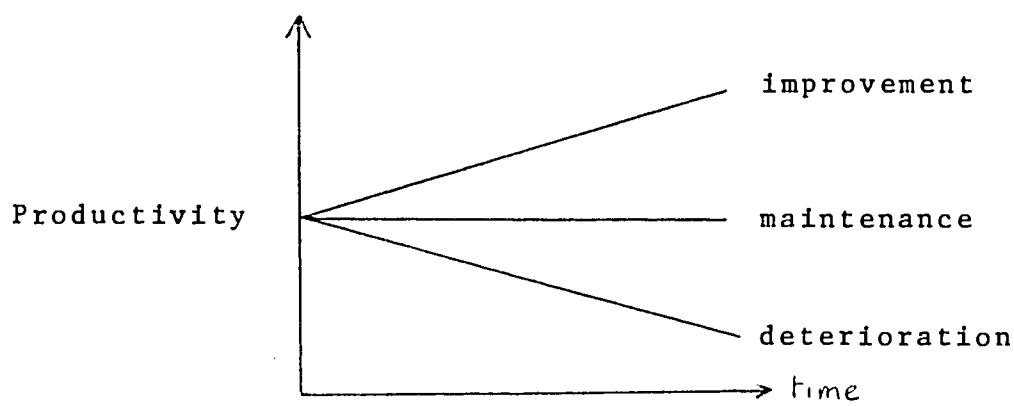


Fig. 2 - With and without tree productivity scenarios

1) The agroforestry project improves a site productivity which would have deteriorated otherwise.
2) The agroforestry project maintains a site productivity that would have deteriorated otherwise.
3) The agroforestry project improves a site productivity for which the productivity would have been maintained without the agroforestry project.

It is important for the economic analysis to be able to conjecture about the future state of the environment with and without the particular forestry activities implemented by the AFOP.

A word of caution here. If in the financial or the economic analysis different management practices or different agro-forestry systems have to be compared, it is extremely important to use a similar duration for each of the alternatives to be compared. In other words you cannot compare a 10 year agroforestry alternative with a 15 year one. But, you could compare three - 10 year agroforestry systems with two - 15 year ones for instance.

### 3.2 The shadow exchange rate

At first sight, the exchange rate may seems totally irrelevant to study a B/C of a tree plantation whose products are consumed internally. Yet after looking more carefully not only would the analyst find some important inputs which are

imported such as seeds, peat moss, electrical fences, trucks etc... but also some very important imported fuel substitutes in the output side.

The farm gate prices of the imported inputs have to be derived from their border prices. These border prices are the CIF prices converted in local currency plus any unloading cost. From the border prices, the transport, handling and commercialization costs sould be deduced to obtain the farm gate price. To convert the CIF prices in local currency requires an exchange rate reflecting the real purchasing power of the local currency. The fluctuation in the exchange rate reflects the corresponding demand for foreign currencies (here dollars) in terms of the local currency (here gourdes). As the exchange rate is officially fixed at five gourdes per dollar, this fluctuation is not possible. If the foreign currency becomes a rare commodity and its price is fixed, its real value will increase like in any classical price setting environment. A consequent black market flourishes that would reflect a more appropriate exchange rate but that we cannot take as exactly corresponding to the shadow exchange rate even if it is probably close to it. The black market for dollar would slightly overvalue the dollar value because of the risk of getting involved in illegal transactions. If the Ministère du Plan does not have a calculated shadow exchange rate, the unofficial 10% higher exchange rate should be used. The shadow

exchange rate to be used is then 5.5 gourdes per dollar.

### 3.3 Shadow Prices

In a society where all the markets are perfectly competitive (an utopy), the market and shadow prices are identical and reflect the best values for society as a whole (Harou 1984). A shadow price is supposed to reflect the real opportunity cost of an input or the willingness to pay for an output. The potential candidate for shadow pricing in the AFOP project are the material, labor and land inputs, and most of the outputs.

#### 3.3/1 Material inputs

Most of the imported inputs: seeds, peat moss, barbed wires will be shadow priced. Their CIF price is converted in local currency using the shadow exchange rate and subsequently all other transport and handling costs expressed in local currency are substracted from that price to find the farm gate shadow price. All the other material inputs can be priced at their market prices.

#### 3.3/2 Land

Ideally the economic project appraisal will use the with-without analysis explained in 3.1. The cash flow of the "without" the project represents the present alternative use of the land and as such is the real opportunity cost to society of using that land i.e. its shadow price. In the financial analysis the soil rent of the alternative land was used because the time horizon was not infinite. Here the net benefit

of the present use of the land (without) is substracted yearly from the net benefit of the "with" project cash flows.

3.3/3 Labor

Because of the seasonal manpower requirements of the agricultural crops, the shadow wage, like for the financial analysis, will fluctuate during the year. In the rural areas a minimum wage does not exist, the market wage may be a good approximation of the shadow wage. However, the market wage that is unduly low (e.g. just a meal) in order to repay a debt or other favors does not reflect the true societal value of the work foregone, and as such should not be considered to be the correct shadow price. For the farmer foregoing to work elsewhere on his piece of land because of the tree plantation, his shadow price or opportunity cost will equal his marginal value product in this other crop. If the person working in the plantation would not have been doing anything at that particular time his shadow wage would be nhil.

3.3/4 Outputs

For the purpose of valuing the AFOP from the societal standpoint, the energy outputs (fuelwood-charcoal), the wood products (poles and boards) and the secondary forest products (fodder, mulch, seeds...) may have to be shadow priced. If energy production is the goal of the planting farmer, or at least for part of the trees, the analyst should know if that pro-

duction is intended for its own consumption or for the market and in this latter case what market (local, regional, Port-au-Prince). Obviously the distinction has to be made between charcoal and fuelwood as the intended markets are different (urban or rural) and more or less close to its farm (the main advantage of charcoal being that it is transportable over longer distances).

We delayed the discussion of the autoconsumed wood products valuation in the financial analysis because both prices may be identical in that case. The basic concept behind valuing any auto-consumed farm products is: what does the farmer forego by letting his family consuming these products. If he did not produce that product before, what was the price he would have had to pay for it at the local market or in terms of labour to acquire it. If possible and realistic, the easiest way to value that wood product consumption is probably to take its market price minus (or plus in the case he would have to purchase it) the transport cost. However, that market price may sometimes have to be shadow priced in the economic analysis.

Let's go back to the energy outputs. For fuelwood, the farm gate price derived from the local market price can be used if the farmer had to purchase it before from that market or if he decided to increase his own consumption (by cooking a second

meal per day for instance) that would have been available only from the market in the absence of the plantation. If in the absence of the tree plantation, he was collecting his fuelwood from a neighboring forest, his shadow price is zero. However, if he had to walk a very long way to get that fuelwood, the labour saved represents the fuelwood value for him and for society also. Note that in this case the fuelwood shadow price may increase rapidly over time as he would have to walk further and further away from his home. In the driest part of north east Haiti another possible alternative for him in the absence of the tree plantation could be to burn cattle dung. In this case the energy of dry dung (BTU) has to be compared with the fuelwood energy content The opportunity cost of using the BTU equivalent amount of cattle dung is the corresponding loss in fertility (manure) converted in terms of a decrease in crop harvested.

For charcoal which is usually sold for urban markets and not autoconsumed, the charcoal price in the closest market could be used for both the financial and economic analysis. However, the shadow price may be different if the analyst has good reason to believe that in the absence of the charcoal made from the tree plantation, kerozene should have been imported to satisfy the consumption of cooking fuel. Here again the energy content of the alternative fuel (kerosene) as well as its price or alternative use has to be known. Let's illustrate this with an hypothetical example:

| | |
|---|---|
| - Neem calorific charcoal value | 1 kg = 8000 kcal |
| - Kerosene calorific value | 1 liter = 9000 Kcal |
| - Burning efficiency of charcoal cooking | 25% |
| - Burning efficiency of kerosene stove cooking | 50% |
| - Average charcoal weight per $m^3$ is | 170 kg |
| - Cost of kerosene delivered in P.au P. | $0.90/liter |
| + stove depreciation | $0.10/liter |
| Total kerosene cost | $1.00/liter |

- Equivalent number of kerosene liter in effective calories for one $m^3$ of wood:

$$\frac{8000 \text{ Kcal} \times 170 \text{ kg} \times 25\%}{9000 \text{ Kcal} \times 50\%} = 75 \text{ liters}$$

- The value of one $m^3$ of wood changed in charcoal and substituting for imported kerosene is thus $75/$m^3$.

Note that this value of $75/$m^3$ represents only the real shadow price if the official exchange rate reflects the true value of foreign currencies, here the dollar. We recognized earlier the existence of a more appropriate shadow exchange rate of 55.5/1$ so that the real value of the cubic meter of wood substituting for imported kerosene is in local currency equivalent to 412 gourdes.

The shadow price for a pole can probably be best approximated by its market price as the import of poles are minimal. It is important however to assess the different quality of the

low density poles attained from the tree plantation compared to the high density slow growth of the native species.

The shadow price of boards can be estimated by the price of the lowest quality of imported lumber converted in local currency using the shadow exchange rate. If the boards substitute for the hand sawn boards of native species, their market price corrected for quality difference may be used as the appropriate shadow price.

The different secondary forest products from the tree plantations can best be estimated by their market price unless it can be shown that they substituted for imports like fertilizer (mulch) animal feed (fodder) coffee (leucaena seeds!)...

3.4 Transfer payments

Transfer payments within a society are not taken into consideration in a benefit cost analysis made from a societal point of view. Only the real uses of resources have to be taken into consideration (Harou, 1984).

For the project we are concerned with, any taxes that are included in the price of the inputs or that have to be paid at the time the outputs are sold should be disregarded in the economic analysis. They are transfer payments.

On the other hand, the price of the subsidized seedlings, that may not be included in the financial analysis of the farmer will have to be included in the economic analysis because it represents a real use of resources by society.

### 3.5 Social Discount Rate

The social discount rate to be used for forestry public projects is a complicated and controversial matter that has been reviewed and discussed recently in details (Harou, 1985) Suffice it to say here that the opportunity cost of capital to use in calculating a shadow price of investment would be difficult to assess in Haiti. The consumption rate of interest could be circumvent by calculating the IRR. If a NPW criterion need to be used, the discount rate for society should be much lower than one used for a poor Haitian peasant taken individually. This is so because society invests in a lot of different investments (not just tree or agricultural crop) and has a much longer time frame to take into consideration than a farmer producing at the subsistence level. A sensitivity analysis of the discount rate can be used also.

### 3.6 Externalities

If the with-without analysis explained in 3.1 includes all the details that the technical analysis is able to provide, there is no need to include any other externalities. Indeed if the avoided erosion because of the tree plantation can be calculated and converted into agriculture productivity avoided loss or improved productivity, the with-without analysis will say it all. Often, however, such quantification of erosion control and impact on the productivity of different agriculture

systems may be difficult if not outright impossible to make. In such a case a good environmental impact statement of the tree plantation activities should be produced. Such EIA will refer to experiments made in similar conditions and litterature on the subject. This part is particularly important to substantiate as some will argue that the most important benefits of the tree plantations undertaken by AFOP stem from environmental restauration.

### 3.7 Risk

An investment made by society will not carry the same risk as if it was undertaken by a private individual that invest only in that project as a farmer who decided to invest in a tree plantation on part of his property. The risk component of a public project is more related with the possible organizational failure in its implementation. In any case a deterministic sensibility analysis of the most sensitive costs or benefits or the most audacious shadow prices may help put the public investment in perspective. Such an analysis could be carried out here.

## 4. Wood Products Marketing Study

The overall objective of the wood products marketing research is to establish the price (or value) of the AFOP tree plantation outputs.

This socio-economic research sub-component is closely related to the consumer preference research to the extent that prices reflected the consumer preference for a certain amount of a traded forest product in a particular market. As part of the tree products will be consumed on farm, the marketing study is linked with the producer decision research sub-component also. In this case the consumer and the producer are the same person. The analyst will have to find the relative value of the different wood products autoconsumed by the farmer based on an opportunity cost approach (see shadow price discussion). The price of the forest products traded in the markets will have to be obtained through a survey.

### 4.1 The Haitian markets

Moral (1961) has well described the importance of the market places in the rural and urban economic life of Haiti. The presence and dynamics of the markets confirm the hypothesis on which the AFOP is based i.e. the existence of a cash economy. The Haitian peasant is not strictly organized on a subsistence type of farming but exchanges his surplus indispensable to insure survival or a certain level of consumption throughout the year. The idea of planting tree as a cash crop

is consequently possible. It has the definitive advantage to permit the sale of this cash crop at any time during the year as a need of cash arises or when the market price is advantageous. The sale can also be postponed for several years waiting for an important occasion (building a house, marriage, funerals, etc.)

The Haitian markets have been categorized and described well by La Gra et al. (1975) in a IICA document (No. 16) of the OEA project "Analysis and Diagnosis of the Internal Marketing System for Agriculture product in Haiti." Note that other working documents of that project should be useful for this marketing study such as document No.8 giving some wood products monthly prices in 10 different markets and document No. 14 giving the structural characteristics of these markets. The Haitian markets are classified by Le Gra et al. after literature search and field surveys in three main types: urban, regional and rural. This differentiation was based on the deserving road network and its quality, the market infrastructure, the number of persons selling, the type of transport used, the number of days of activity and other factors.

4.1/1 Urban markets

These markets are not numerous and most of them are concentrated in the Port-au-Prince area. You find one or two markets for the important urban center or chefs-lieux de

département only. These markets are characterized by the fact that the final consumers usually buy from an intermediary who may have received the products through several other intermediaries: "Madame Sara" who bought from the producers and resale to a wholesaler (marché en gros) before selling it to a urban transporter (marchand ambulants) who may sell the product directly to the market retailers or to another urban wholesaler. Different level of retailers may exist for more or less small amounts of the marketed product.

4.1/2 Regional markets

As the name implies, these markets deserve a particular region and sell products typically produced in that region given the environmental setting and the traditional agriculture productions (e.g. sisal in the north). These markets are thus characterized by the trading of important quantities of few agriculture products at a lower price than in other markets. Here the producers are usually selling to the first intermediaries (Madame Sara). Sometimes final consumers may buy bulk quantity in these markets to benefit from "wholesale prices." Some of these regional markets exist only at certain period of the year i.e. at the harvest time of the crop typifying this market.

4.1/3 The rural market

This includes all the markets not classified as urban or regional. Note that some rural markets are more

important than others. Some "Madame Sara" may be found in some markets that could be called semi-rural. Prices are usually lower in the semi-rural market than in the regional or urban markets. The truly rural market will find in presence only the local producers and consumers.

4.2 Market study sites

A certain number of sites will have to be picked in the 3 types of markets just described. These sites will also have to be chosen in function of where the previous AFOP activities have been concentrated. The markets deserving the farmers who will be chosen for the in depth case studies will have to be studied also. Within these constraints the markets should be chosen at random from the list of 512 markets recensed in 1978 and included in Appendix I. These market places are located on the road network and urban centers mapped by the DATPE (Direction de l'Aménagement du Territoire et Protection de l'Environnement).

4.3 The wood products

There are four main wood products from the AFOP tree plantation that will start entering the market places in the near future: poles, boards, fuelwood and charcoal.

4.3/1 Poles

Poles may be one of the most important product the farmers are expecting from their plantation both for auto-

consumption in their house construction and for the urban and regional markets where they are used in the construction of cement houses (scaffolder) and semi-urban houses. The present market includes species like Chrysophylum cainito (star-apple), conocarpus erectus (Button mangrose), Inga vera (Guaba), Mouriri domingensis (Murta), Ocotea leucoxylon (laurel) and Rhizophora mangle (mangrove). While there is no apparent price distinction between species when the question was asked in the Port-au-Prince Central Market, this should be investigated further by a local animator.

A price distinction is however made by diameter and length of the pole. In the Port-au-Prince market, Ronald Smith of ODH, was offered different prices following the approximated average dimension groups given below:

| | | | | | |
|---|---|---|---|---|---|
| Prices $/doz. | 3 | 4 | 6 | 8 | 10 |
| Mean top Ø(cm) | 3.3 | 3.9 | 5.0 | 5.5 | 6.7 |
| Mean stump Ø(cm) | 6.4 | 6.9 | 8.2 | 9.2 | 11.0 |
| Mean length (m) | 3.5 | 3.6 | 4.0 | 4.2 | 4.0 |

The price increases markedly by diameter class, however, it decreases per unit of volume, suggesting a cut-off point over which it may be preferable to make lumber or sell it for lumber instead of pole.

4.3/2 Lumber

The tree planted may well serve as lumber if the trees are maintained over a longer period of time than the 3 to 5 years initially thought. Yet the value of boards, planks and craft items may be such that it is worth financially to extend the rotation age of the tree.

Some of the local species used are Catalpa longissima, Mangifera indica (Mango), Ocotea leucoxylon, Pinus occidentalis, Phylostylon brasiliense, Switenia mahogani.

While prices vary by dimensions this is very difficult to quantify because of the total lack of measure standardization (except for imported lumber). A notable exception is the "Bwa pin" which is sold by board foot and sometimes planned and occasionally can be found in the regular 2" x 4" dimension. Mahogany can be found round wood, letting the consumers the choice to cut it at the dimensions they need. Pine commands often the highest price principally because the boards were better cut (by a sawmill, not handsaw) and sometimes planned. The price per volume is always higher than for poles.

4.3/3 Charcoal

Charcoal was intended to be initially the main product resulting from the project plantations. This was a very dubious assumption as it is well known that it is the less efficient use of wood products. Fuelwood is usually a more efficient way to use it because huge loss are not incurred

in the carbonization process. Charcoal is however the only way to transport economically wood derived energy over long distances.

The species most often encountered or demanded, when a choice is possible (such a choice will diminish as wood resource depletion continues) are: Gayak (guaiacum officinale) usually coming from the north, Bwa fe (Colubrina arborescens or reclinata) mostly from the south and Bayahond (Prosopis juliflora) from the south also. The charcoal of low quality, usually a mix of species is referred to as "ti bwa. While price should vary per species, i.e. different quality of the charcoal as related to the species density, often the species are mixed and the weight of a standard sack may fluctuate widely around (usually below) the supposed to be 30 kg. This may not be a problem for the Haitian buyer who is said to buy always from the same person (until she got cheat) to insure a standard price per quality. For the marketing survey however, this points out to the necessity of weighing the charcoal sack while asking for its price.

Weight indeed is directly linked with charcoal quality. The moisture content of the charcoal does not need to be known (like for fuelwood) because the carbonization process will homogenize the moisture content in the around 2-12%. The energy value of charcoal is about 33 MJ/Kg (megajoules or $10^6$J) or

around 7,900 kcals/kg. This is approximately twice the energy content of wood per kg at a 15% moisture content.

4.3/4 Fuelwood

Fuelwood is of daily use in the rural areas for cooking and for some sugar cane processing and distilling. In the urban area fuelwood is used also in restaurant cooking, dry cleaning, baking and as fuel cooking for low income family. Different species of wood are used such as different fruit trees, Haematoxylum campechianum (Kampech), Prosopis juliflora (Mosquite), Rizophora mangle, Switenia mahogani. Here also the unit of sale is difficult to assert for lack of standardization of the unit sold such as wood of different species and moisture content and different dimensions. The marketing surveyors will have to weigh the bundle of firewood for which they are given a price. This is not enough however to assess quality, as, contrary to the charcoal, the moisture content of the fuelwood may vary up to 100% from one sample to the other.

4.3/5 Secondary forest products

The first thing is to establish which of these products are traded in the markets and in what part of the country. Tree leaves may be sold for fodder and mulch on a rural market if organic material has become a limiting factor to agricultural crop in that specific region. We saw Leucaena seeds sold up to $3 ground marmite to be mixed as a powder with coffee.

This shows the importance of investigating to what extent a real market exists or could be developed for these secondary forest products. Some tree secondary products are certainly traded in some rural markets but we don't have any information on this matter.

4.4 Marketing survey

A questionnaire to be used by the marketing team has been designed and is given appendix II. The form has been made as simple as possible while still obtaining the important characteristics of the wood products that explain their price per unit. The questionnaire aims at defining the wood products as precisely as feasible in order to price it correctly. However, the questionnaire is not limited to that, it also tries to explain the channels of commercialization by asking questions related to provenance, distance, means of transportation, destination of the products, to what extent part of the production has been auto-consumed, and final uses or supposed final uses when dealing with the seller. These data not only will give us information on the price structure of these wood products but also to what extent the consumer appreciate and use these products and how important their auto-consumption is. Because the forest products from the plantations of new exotics will not be found on the market, the consumer preference study, will try to relate the existing species use with the new species to be introduced soon

in the market. It is proposed that CARE and PADF which both intended to enlarge their present charcoal price survey collect that information. The AFOP research team would check in the field around 2 or 3% of the animator questionnaires to see how they are filled out and to eventually ask some complementary questions. The sample size will depend on the variability in price per wood product units, provided that these units have been well enough defined and the data fiably collected.

Having the overall goal of the research component of the AFOP in mind, it seems important to have an idea of the relative price of the wood products compared to other agriculture products with which the tree plantation is competing in terms of labour or/and soil nutrients, moisture and light. Historical trend if they can be collected would be useful in this regard because the relative price increase of the wood products could be used, to some extent, in pricing future production. In any case, the price of the most important agriculture crops in the market survey could eventually be collected in order to obtain this particularly important information for long term forestry investments. If not, different sources of agriculture commodity prices are available. L'Institut Haitien de Statistique et d'Informatique et la Secrétairerie d'Etat du Commerce et de l'Industrie, both published quarterly consumer prices of agriculture products including some wood products.

## 5. Consumer Preference Study

The overall objective of the consumer preference study is to associate present wood products and species found in the markets with the products to be harvested soon from the AFOP tree plantations.

The study of the physical properties of the wood products made of the rapid hardwood seedling growth and coppices, together with a user test of these new species (wood products could be obtained from some ODH already mature plantation) could allow to make this association. In a first stage the quick user test could be initiated and limited sales of the already harvestable products made.

The quantity and type of forest products that could come from the new plantations, how much and in what proportion could these products be consumed, which ones would be preferred and finally to what extent present species and products can be associated to these future products for their price and hence quality has to be investigated.

### 5.1 Plantation products yields

Before comparing the plantation outputs with what is found today in the market, we need to know what products and in what proportion, will be obtained from the harvestable biomass. Conversely knowing what wood products are in high demand, mostly

through the price-marketing study as well as a quick user preference test and the producer survey for would be auto-consumed products, some recommendations could be made as far as the management of the plantation: initial spacing, thinning regimes, pruning, rotation age, number of coppicing, etc... Most of the information we have so far concerning biomass yield and its break down by products has been made by ODH. Their findings are very interesting and well documented. Similar efforts should be undertaken in different ecological zones located in the different experimental plots of FAO, World Bank and others, but also on the properties of farmers themselves who planted under the auspices of CARE or PADF.

Some indications on the information needed for the user preference study about the quantity and quality of the different forest products from the project plantations are discussed briefly here.

5.1/1 Total Biomass

Knowledge about the plantation yields will permit to assess the supply of woody biomass to be expected from the project and its probable influence on wood availability and different wood product prices (probably negligible). The yield study will be the single most important physical information needed for the B/C analysis together with the break down of this biomass in different components: trunk, branches, twigs and leaves. This

information is needed for the first rotation and successive coppices. Trunks and branches have yet to be classified by diameter classes as these classes will include woods of different physical properties that commands different final uses. Wood density and moisture contents are two easily quantifiable physical parameters that could help classify the biomass for appropriate user groups. More refined wood tests such as module of elasticity, contractibility, vertical pressure, chemical test to assess resistance to insects, fungi and moisture could improve this cassification of user groups further. These tests should probably be reserved for future research. Once the classes of possible end user for the biomass have been established based on physical characteristics and consumers', and producers' in case of autoconsumption, preferences, the biomass will have to be disaggregated in different outputs following these criteria.

5.1/2 Poles

If price is an indication of consumer preference, pole is probably the most needed output to be produced by the project plantation. The price per plank is higher but need some equipments and labor to be processed, while the poles can be sold or used directly after harvesting and trimming the branches. Like we said earlier, different diameter classes have to be distinguished in the user preference study because for a same species, the physical properties, and thus uses, vary with diameter classes.

Furthermore, the substitution possibility of poles by other wood products, e.g. fuelwood and charcoal for crooked stems and branches or planks for the highest diameter trees, requires the classification of the trees per diameter classes.

The user preference study needs to assess the potential use of trees for poles and substitutability of poles for other uses in function of its physical characteristics and the level of demand for these other uses vis-à-vis the demand for poles. Another important variable to inquire about is the quality i.e. durability of the exotic species compared to the local species for a same diameter pole. It may very well be that Leucaena leucocephala cannot in any way replace the local Leucaena glauca for use in the main structure of a rural house because its durability is nowhere near the durability of the local species. This information can be obtained from the user themselves if they are well informed but again a comparison of some physical properties of the exotic species with the locally used ones seems needed to give an objective answer to these questions.

5.1/3 Boards

Boards, planks and lumber command the highest price in the Port-au-Prince market (Barkley, 1983). The potential users of these boards will depend on the quality of the sawing (sawmill or handsaw), the species, and the dimension (diameter, lengbh) of the logs from which the boards were sawn. The user

preference needs to find the minimum diameter required to use the tree for lumber. The plantation volume about this minimum diameter need to be quantified for different species with different rotation age in different ecological zones. The physical characteristics of the boards produced from these trees will permit a comparison with the boards from local species (or imported) presently on the market.

5.1/4 Fuelwood

Almost all the biomass resulting from the AFOP could go to fuelwood depending on the needs of the producer. For the part of the tree production that the producer doesn't need to burn, he has still the choice of using or selling it for poles and planks or/and selling it for the urban charcoal market or the local fuelwood market.

Some parts of the biomass can only be consumed internally as fuelwood (branches smaller than 1.5 cm in diameter and twigs) unless the farmer decided to let them with the leaves on the ground to improve the soil fertility. In this case, it would be interesting to know the nutrient content of this organic material to quantify the fertilization-mulching effect of this cutltural practice.

To be able to quantify the calorific value of the biomass used for fuelwood, the information asked in the marketing

survey are indispensable to know i.e. weight and moisture content. Weight and moisture are directly related. Moisture can be given on a dry basis: $\frac{\text{wet weitht - dry weight}}{\text{dry weight}} \times 100$

where the dry weight is oven dry (bone dry) weight. Sometimes the moisture content is given on a wet basis i.e. the ratio of the weight of the moisture to the weight of the wet wood. There are moisture content meters which are used routinely in lumber yard that could be purchased by the project for the marketing survey. For the biomass measurement on experimental plots, samples of the wood has to be collected in airtight containers and the moisture content measured with an oven dry in laboratory. The actual moisture content of fuelwoods depends on the drying time and conditions, the ambient temperature, relative humidity and the wood anatomic characteristics. For wood cut green, the moisture content could be 100 percent or more (dry basis measure). If the wood is first allowed to dry out and becomes "air dry", then the moisture content may be around 12 to 15 percent depending on the characteristics enumerated above.

Once the moisture content established, the calorific value of wood, irrespective of species, is more or less the same on a weight basis. One kilogram of wood on an oven dry basis is around 20 megajoules. The same kilogram of wood at 15 percent moisture content, when burnt will give off about 16 megajoules or

around 3,820 kilocalories or 15,170 BTU's. The comparison of fuelwood from the plantation and locally used species is particularly easy in comparison to poles and boards for which the user preference analyst will have to dedicate more time.

5.1/5 Charcoal

The production of charcoal was initially thought to be the simple most important output from the plantation. This has changed and the farmers see more advantages in producing other wood products for their own use and even for the market. Except for ODH plantations near Port-au-Prince with which charcoal will be made with the crooked trees and tops that cannot be sold for poles, a small proportion of the tree planted should be sold for charcoal. Leucaena harvested at the Madsen farm after 3 years had to use 60% of the dry biomass for charcoal production, being unable to sell it for poles. With a longer rotation period, however, a much greater proportion of the volume could be sold for poles and lumber and a much smaller percentage would be left for charcoal production.

The specification of the charcoal quality to be related with price is easier than for any of the other forest products. It is easier than the fuelwood specification for which the moisture content and weight need to be known. Here, moisture content is supposed to be relatively constant (around 5-15%, but this should be verified in laboratory and the variation

assessed statistically)and does not need to be collected during the marketing survey. Weight should be known and will directly be related to charcoal quality.

In rural area, the production of charcoal should not be encouraged as the wood utilization efficiency is 3 times lower compared to burning fuelwood directly. One $m^3$ of wood with an average density of 1.4 $m^3$/mt and a 15% moisture content will weigh around 714 kg or a total calorific value of 2.7 Mkcal. The same $m^3$ of wood transformed to charcoal will produce around 100 kg equivalent to .78 Mkcal or a relative calorific value three times lower for the same initial volume of wood. Charcoal should not be recommended for the farm hillside for which the tree has a conservation function on top of its cash crop value and should have longer rotation than on flat land. Charcoal is the enemy no. 1 of deforestation and should be produced only from extensive plantations (economy of scale for the plantation and charcoal making) on flat land if no other wood products are more profitable. The main advantage of producing charcoal from these semi-industrial plantations is to reduce pressure on the hillside woody vegetation. If the plantations are very close to urban markets, fuelwood instead of charcoal could be sold (at least partly) and would be a better use of the wood product from an energy point of view but this should be verified economically.

## 5.2 Plantation products consumption

Having an idea of the possible yield of the tree plantations per ecological zones and species and its break down per possible wood products, we need to know what the relative farmer's needs for these products are in terms of auto-consumption and apport of cash from market sales.

The amount of cash crop wood that will reach the market will be the residual of the native species wood yield and the marginal yield from the plantation (i.e. more (or less) than what would have been produced by the native species in the absence of the plantation) from which the auto-consumed wood products have to be substracted. The new income generated will be that residual yield in the form of whatever products would bring him the highest revenue on the market place. To quantify this highest revenue the prices from the marketing study complemented by the user preference study will be used. Before to do that however we need to know how much of the plantation yield will be autoconsumed and in what forms, for what uses.

### 5.2/1 Poles

Most of the autoconsumed poles will probably be used for house construction. The user preference study should try to come up with a plan of a rural house and all the wood products (mostly poles and planks) it contains. The study will try to answer some questions like: What certain diameter poles

are used for, of what species, i.e. what quality, what is the ideal length these poles need to have, etc.

As the poles may end up in the market, at least in part, these poles may have a different final use as scaffolder or in the construction of semi-urban house. How does that semi-urban house varies from the rural house, how much more or less wood products is used in the semi-urban house, are the specifications (Ø, quality) the same... etc... All this information will allow to make an assessment about the substitutability of the poles produced from the plantation for the one existing now on the market. This comparison will then be used to price the plantation poles in the market.

5.2/2 Planks

The same discussion than for poles hold true here also. In addition to housing, furniture may be an important use of the planks and hand craft a minor use. For the consumer preference study, a carpenter may be asked to construct with a plantation species, the exact same piece of furniture he is used to do with native species. ODH could provide the raw material. The high price of planks in the market shows that there is an important demand for it. In fact, most of the lumber consumption of Haiti is imported. The apparent consumption (production + import-export) could be computed for a time series (last 10 years). The imported lumber price for the lowest grade should be compiled

for the same period of time. Projection of apparent consumption and price can be used to help pricing future production of boards coming from the plantation.

5.2/3 Fuelwood

Fuelwood is probably the singlest most consumed wood products in the rural area. How much fuelwood is the average haitian family consuming per day, per month, per year? This is an important consumption that deserves quantification. The fuelwood consumption can be derived indirectly by relating the type of food eaten or by actually weighing the fuelwood consumed over a certain period of time. This latter alternative could be done in the intensive case study. For the questionnaire survey, a relationship food cooked and fuelwood consumed could be worked out from the intensive case study. Some theoretical formulas of cooking efficiency and heat needed to cook different food could be used also.

5.2/4 Charcoal

The comsumption of charcoal in urban areas is very important and is related to the level of income of the population. Substitution exists with less efficient fuel for the lower income group (fuelwood) and with more efficient fuel (kerosene, electricity) for the higher income groups. The relative price of charcoal compared to the price of the food to be cooked is important to explain the substitutability of charcoal by another energy source.

The marketing study will give the correct charcoal price for a given quality (weight) but some ideas about urban consumption is probably needed to forecast future price trend. The historical price trend may not reflect future price to the extent that the forest resources from which the charcoal is made have to be found further and further from the important urban centers and it is made also with wood of a lower quality. A simple regression: Charcoal consumption/capita = f(income) could give the income elasticity of charcoal for a 10 year time series or a cross section of countries. The same regression could be run for alternative source of energy as fuelwood, kerozene and electricity.

5.3 Plantation products price

Once the types and volume of wood products from the plantation are quantified, their auto-consumption and sales estimated, we should be in a position to set a price on these potential wood products. The marketing study is providing a set of prices of comparable products available today in the markets. The user preference study is qualifying the relationship of existing wood products and future products from the project plantation. The products that are autoconsumed can be priced in relation to the market only if this is a realistic opportunity for the farmer. That market price will have to be calculated at the farm gate for the B/C analysis, i.e. substracting any transport and transaction costs. In many cases, the market is probably

not a realistic source of supply for the wood products consumed by the farmers and in this case, the wood product has to be valued by other means (see economic B/C analysis).

Now for projecting these prices over time, a precise scenario for these products production and consumption is needed. Such a projection is difficult however because past trends will not necessarily reflect what the future will look like. For the charcoal and lumber for which imported energy and low quality lumber substitutes exist, some quantification of the consumption (apparent consumption) is possible. For the other mostly auto-consumed products, the farmer consumption-user survey will be the only information to rely on to project future price scenario.

It is important that all the projections of price be made in relative terms only (not counting inflation) vis-à-vis the general price level or better vis-à-vis all the agriculture crop prices that may compete for the farm land space. As the B/C should be made in real value (not inflated) it is important that the price of all the inputs be priced that way also and that real discount rate be used (Harou, 1983).

Any seasonal variation of prices would be helpful to know the best time to sell the wood products. Such variation can only be picked if the marketing study collected monthly prices.

5.4 Questionnaire - Interview

Part of the information needed for the user preference study would be provided by the "uses" column of the marketing questionnaire. The test made with the final users of the product (e.g. carpenter testing boards) should be the result of an unstructured interview with the users to obtain good descriptive comments on the wood products made with the new species and how it compares with the native species wood products or the imported wood products. For the wood products auto-consumed, a series of questions should be asked in the producer decision questionnaire (See Annex III).

6. The Producer Decision Study

The producer decision sub-component of the socio-economic research should have three main objectives:

1. to ascertain the technical and socio economic assumptions under which the B/C is calculated from the farmer perspective.

2. to value the wood products autoconsumed by the farmer and assess the prices he hopes to get for the plantation products and the prices he gets for the wood products from native tree species already available on this land.

3. to estimate the quantity of wood products auto-consumed and to qualify the difference between the native and introduced species.

6.1 Benefit-Cost

We made allusion to the producer decision survey when we discussed the financial analysis made from the farmer standpoint. Such analysis should embody all his assumptions in a first time. Subsequently a B/C analysis could be based on what he ought to do based on the best technological information available.

The different information listed in the B/C section could be gathered through the producer survey. We gave a series of questions related with that analysis that could be included in the producer questionnaire (see Annex III).

6.2 Marketing

The marketing survey questionnaire (Annex I) will be used mostly on the market places. Many of the questions however could be asked to the farmer-producer-seller also. For the wood products auto-consumed if his alternative is to buy those products on the market the marketing questionnaires can be used for the farmer-buyer.

For the case in which the products autoconsumed would not otherwise come from the market, but from other sources these other sources have to be investigated and a price derived in some indirect ways (see shadow pricing in the B/C section). Some questions related to that should be asked in the producer decision questionnaire (See Appendix III).

### 6.3 User test

The farmer who plants may himself be the most important user of these trees and it is important to know how he envisions using the possible wood products he expects from the plantation. For those who already harvested, an unstructured interview should try to get at the main differences (advantages-disadvantages) between exotic and native species. The farmer will also be asked in this interview to what native species the exotic ones can be compared to. Finally, the farmer should give us the possible secondary tree product uses and their possible and actual importance.

As it can be appreciated, the list of questions that may be asked to the farmer may end up being very long indeed. It is thus important that a selection of questions be made following acceptable criteria. In our opinion the overriding criterion should be the usefulness of the questions in quantifying the cash crop hypothesis. This criterion then should respond to a set of sub-criteria which are:

- assessing the marginal physical inputs and outputs introduced in the farming system.
- assessing the value-price of these inputs and outputs.
- assessing auto-consumption and consumption of plantation wood products.
- assessing the B/C decision framework of the farmer.

A criterion, second in importance, is to provide information allowing an allocation of the project resources in a more efficient way i.e. to those farmers that will more effectively plant and harvest these trees and so will benefit the most from the subsidized seedlings.

A third criterion is to provide information to improve the education-extension campaign to ultimately permit the tree plantation activity to continue on its own merit.

Note that the selection criteria two and three are not enough in themselves to insure the selection of the questions but if a question related to criterion one is of dubious interest, the use of criteria 2 and/or 3 may help reach a decision on the question usefulness.

A final criterion that should be used for any question to be asked in the producer decision survey as for any survey is: to what extent a study has been made already with a sufficient or more detailed level of depth somewhere else and that relates to that question. With the same idea in mind: to what extent this question has been asked already in another survey, and if yes could the responses be used to respond to the question we had in mind.

Once the questionnaire established, we are left with the task to use it in the field. If a joint questionnaire can be worked out together with CARE and PADF for their "Case study form"

the problem would be resolved. If not, the concours of their animator or PVO will be indispensable. In this case UMO questionnaire should be complementary to theirs.

7. Survey Intensity and Site Locations

Once the questionnaire set, the sampling scheme has to be established. This has been discussed already for the marketing survey (4.4). For the producer survey, the problem is more difficult because the "farm population" is far from homogeneous and mostly unknown. A lot of physical factors are contributing to heterogenize this population: soils, climate, and related to these two altitude, slope, exposition, topography and a series of socio-economic factors such as external income, size the farm, size the family, etc... Faced with such an heterogeneity, the best one can do is to establish criteria for the selection of the sites. Subsequent statistical analysis should permit to gain some more insight in the variability of the population from which recommendations could be done for improving future sampling schemes.

Three types of criterion have to be used to direct the sampling scheme:

1. Ecological criterion.
2. Socio-economic criterion.
3. Previous AFOP involvement criterion.

7.1 Ecological criterion

It is difficult to use only one index to qualify an environment which may depends on numerous factors: climate, soils, topography, geomorphology, etc... Furthermore, Haiti being a mountainous country, a great variability of micro-environment exists which is influenced by exposition to the alizean winds and light, irregular soils pocket and altitude.

A factor, however, that picks an important part of this variability is altitude. Altitude is directly related to pluviometry (50-100 mm/100 m depending on the region of the country) temperature (0.6ºC (mean average) per 100 m), the depth and pedogenesis of the soils, as the DATFE maps show (1978). It seems thus logical to combine the altitude factor which is the most significant to explain ecological zones in Haiti with another factor which characterizes soils such as parent material, soil depth or topography.

7.2 Socio-economic criterion

Within an ecological zone, farms can still be different because of the different socio-economic characteristics of the farmers. While there are maybe more variables to be taken into consideration to explain a farmer's behavior, than factors that can explain the ecological zones, there is also one factor that usually correlates well with most of these variables: income. Income is our easier information to get in

industrialized countries. In developing countries living in part on a subsistence economy different proxies have to be found to approximate the relative wealth of different farmers. One variable that could be used in a rural economy is the area of the farm. This area may be given for a certain density of population in that area, Which itself is probably linked to the fertility of the land. To own one carreau in the uphills or the plaine is not equivalent. The area owned should also be related to the size of the family to be meaningful. To qualify this income proxy, i.e. area/persons for a certain density of population, other variables could be used such as non-agricultural income, offer or demand of labour, and livestock and poultry stock owned for instance.

### 7.3 Previous project activities criterion

Obviously the sample should be more intensive in these ecological zones and types of farm in which CARE and PADF have implemented most of their forestry plantation activities. While the general region where they worked are known, the particular ecological zones and the type of farms they have been working in should be sorted out from their participants' questionnaires if possible, if not through discussion with AFOP foresters. ODH farms should be studied also but offer less variability in eco-zones and farmer income.

## 7.4 Sampling scheme

Guided not by the variability of the numerous factors that could explain tree growth and uses, but the criteria established above, the following sampling scheme should be studied or eventually modified if other factors were to be considered more important. Three transects passing through a complete altitudinal profile should be chosen in three regions differentiated for their parent materials and where CARE and PADF have concentrated their activities. For instance, a NE transect could be drawn in the axe Anse Rouge - Port-de-Paix, in the south another transect could be Madian - Salagnac - Aquin, and in the Artibonite, Mirebalais - Hinche. The advantage of taking the transects M-S-A and M-H is that a sample of farmers in these transects have already been studied. The first one by the "Centre de Madian-Salagnac" (SERA, 1978) and the other by Texas A and M (Taylor 1982).

Once these transects defined, a cluster sampling should be used with a greater representation in the ecological zones and in the type of farms where the sub-grantees are working. Cluster sampling should be useful in such an heterogeneous environment. It would also drastically reduce the survey time and the logistic aspects of locating the farms. Non-project farms could be located in the same cluster. Once the farms have been

picked from the PADF and CARE data base, they should ideally be located on the 1978 aerial photos. This should permit to locate the properties on the 6 DATPE maps and help extrapolate the survey results to the rest of the region they fall in. Another advantage of the photo is to easily quantify the percentage of the farm covered by tree crowns in 1978. The change in cover may be interesting to study.

If the farmer questionnaires could not be used as a basis for sampling for whatever reasons, a meeting with the PADF and CARE field foresters should allow to establish, through delphi consensus method for instance, the most important eco-types and farmers-farms.

Once the sample of properties will be established and some of the questionnaires filled, the research team will soon have a good feeling for the most common type of agro-forestry schemes in the ecological zones where the project has concentrated its effort. An average farmer participant can be chosen in 2 or 3 of these more encountered type of farms. An in depth case study on these farms should give us a detailed picture of the whole system from a technical, social and economic standpoint. These should be a valuable experience that will allow to better comprehend the answers from producer decision questionnaires obtained on the sampled properties.

## 8. Conclusions and Recommendations

The overall objective of the project should be to substantiate the farmer cash-income hypothesis. The benefit-cost analysis should try to answer that question. The traditional agroforestry, silviculture and nursery-outplanting sub-components of the research will serve as an input to the technical benefit-cost analysis, or "ideal" analysis, from the farmer participant's point of view. The producer decision survey, a sub-component of the socio-economic research will help making the perceived benefit-cost analysis from the farmer's standpoint. Finally, an economic benefit cost analysis will quantify the benefits and costs of the agroforestry plantations from a societal point of view.

In order to quantify the benefits of the plantation a marketing research will study the prices of the different wood products available on the markets. The future plantation product outputs will be compared with the price and quality of the wood products actually on the market and some idea will be given on the consumption of these wood products.

A questionnaire has been designed for the marketing survey. The user preference study should use an unstructured interview. The producer decision survey should gather a series of information related to both the technical and socio-economic factors relating to the benefit-cost. This questionnaire is diffi-

cult to handle and will need pretesting and cooperation with the other sub-grantees. Ecological and socio-economic criteria should help designing a cluster sampling scheme based on information available from the sub-grantees.

Given limited time and budget resources, the research should concentrate on methodologies and their illustration based on a database of quality (not quantity!).

BARKLEY, M.S., December 1983. The economic viability of wood crops in Haiti: A survey of the Literature and the Port-au-Prince Market. USAID/Haiti AFOP, Port-au-Prince.

DATPE, 1978. Carthographie thématique d'Haiti. FAC Secrétairerie d'Etat du Plan. 209 p + 6 maps

HAROU, P.A., 1983a. Economic principles to appraise agro-forestry projects. Agricultural Administration (12): 127-139.

HAROU, P.A., 1983b. Quantification of the uncertainty and risk of forestry projects. Yale school of Forestry and Environmental Studies and Yale Economic Growht Center. p. 12.

HAROU, P.A., 1983c. On the real rate of discount. Forest Science 29(2): 249-252.

HAROU, P.A., 1984. Possibilities for shadow pricing forestry investment. International journal of Forest Ecology and Management (8): 59-73.

HAROU, P.A., 1985. On a social discount rate for forestry. Canadian journal of forest research (in press).

LA GRA J., G. FANFAN and W. CHARLESTON, 1975. Les marchés publics d'Haiti. Document No.16. Project: Analysis and Diagnosis of the Internal Marketing System for Agriculture Products in Haiti. Interamerican Institute of Agriculture Sciences (IICA) of the OEA:

LUGO, A., R. SCHMIDT and S. BROWN, 1981. Tropical forests in the Caribbean. Ambio 10(6): 318-324.

MURRAY, G.F. 1979. Terraces, trees and the Haitian peasant: An assessment of 25 years of erosion control in rural Haiti. USAID/Haiti 521-C-99 P.15.

SERA, 1978. L'Agriculture traditionnelle en Haiti. Fonctionnement des systèmes de cultures et valorisation du milieu. Centres de Madian-Salagnac. Port-au-Prince, Haiti.

SMUCKER, G. 1983. Supplies of Credit among Haitian peasants. AID-Haiti/PADF. Port-au-Prince.

TAYLOR, M. 1982. Annual report of the Texas ASM component of the "Projet de Développement Agricole Integré."

WORLD BANK, 1983. World Development Report. Oxford University Press. pp 148-214.

ANNEX I

Wood Products Marketing-Consumer/Producer Preference Survey

Dat_____ Non Ankétè_____ Komin_____ Ajans_____

Seksyon riral_____ Localité_____

Animate localité a_____

| Species | Diameter (cm) | | Length (m) | Price (G/unit) | Buyer Seller | Transport (km) -car -boat -animal -foot | Producer Auto-consumed %Quantity | Merchant reselling or purchasing prices | Uses |
|---|---|---|---|---|---|---|---|---|---|
| Poles | top | base | | | | | | | |
| | | | | | | | | | |
| Boards | width cm | thick cm | | | | | | | |
| | | | | | | | | | |
| Fuelwood | weight Kg | Moisture % | | | | | | | |
| | | | | | | | | | |
| Gharcoal | | Volume $m^3$ | | | | | | | |
| | | | | | | | | | |

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# ANNEX II

| N° dans la carte | Type du Marché: Urbain | Régional | Semi-Rural | Nom du Marché | N° de la carte 1/100.000 |
|---|---|---|---|---|---|
| 1 | | | X | Môle Saint Nicolas | 1 |
| 2 | | | X | Desforges | 1 |
| 3 | | | X | Bombardopolis | 1 |
| 4 | | X | | Mare Rouge | 1 |
| 5 | | | X | Baie de Henne | 1 |
| 6 | | | X | Jean Rabel | 1 |
| 7 | | | X | Réserve | 1 |
| 8 | | | X | Nan Pont | 1 |
| 9 | | | X | La Coma | 1 |
| 10 | | | X | Nan Paul | 1 |
| 11 | | | X | Haut Moustiques | 1 |
| 12 | | | X | Tanthée | 1 |
| 13 | | | X | Barbe Pangnol | 1 |
| 14 | | X | | Beauchampe | 1 |
| 15 | | | X | Poison | 1 |
| 16 | | | X | Cabaret | 1 |
| 17 | X | | X | Nan Dubois | 1 |
| 18 | X | | | Marché en Fer (Pt de Px) | 1 |
| 19 | | | | Marché du Bord de Mer (Pt-de-Px) | 1 |
| 20 | | X | | Chansolme | 1 |
| 21 | | | X | Paillette Grace | 1 |
| 22 | | | X | La Pointe | 1 |
| 23 | | X | | La Croix St Joseph | 1 |
| 24 | | | X | La Plate | 1 |
| 25 | | X | | Bassin-Bleu | 1 |
| 26 | | | X | Guédon | 1 |
| 27 | | X | | Saint-Louis du Nord | 1 |
| 28 | | | X | Berger | 1 |
| 29 | | | X | Bonneau | 1 |
| 30 | | | X | Gaspard | 1 |
| 31 | | | X | Mayance | 1 |
| 32 | | | X | Anse à Foleur | 1 |
| 33 | | | X | Citty | 1 |
| 34 | | | X | La Vallée | 1 |
| 35 | | | X | Mare Rouge | 1 |
| 36 | | | X | Palmistes | 1 |
| 37 | | | X | Basse-Terre | 1 |
| 38 | | | X | Borgne | 2 |
| 39 | | X | | Petit Bourg de Borgne | 2 |
| 40 | | | X | Rivière Laporte | 2 |
| 41 | | | X | Pilate | 2 |
| 42 | | | X | Vieille Eglise | 2 |
| 43 | | | X | Figuette | 2 |
| 44 | | | X | Bayeux | 2 |
| 45 | | | X | Port Margot | 2 |
| 46 | | | X | Pt Bourg de Port Margot | 2 |
| 47 | | | X | Camp Coq | 2 |
| 48 | | | X | Gobert | 2 |
| 49 | | | X | Plaisance | 2 |
| 50 | | | X | Chatard | 2 |
| 51 | | | X | Bas Quartier | 2 |
| 52 | | X | | Limbé | 2 |
| 53 | | | X | Bas Limbé | 2 |
| 54 | | | X | Carrefour Cangnette | 2 |
| 55 | | | X | Acul du Nord | 2 |
| 56 | | | X | Baquiny | 2 |

| N° dans la carte | Type du Marché: Urbain | Régional | Semi-Rural | Nom du Marché | N° de la carte 1/100.000 |
|---|---|---|---|---|---|
| 61 | | | X | Haut du Cap | 2 |
| 62 | | X | | Chany (Cap) | 2 |
| 63 | | X | | Abattoir (Cap) | 2 |
| 64 | | | X | Madeline | 2 |
| 65 | | | X | Carrefour des Pères | 2 |
| 66 | | | X | Milot | 2 |
| 67 | | | X | Carrefour Jn Bernard | 2 |
| 68 | | | X | Gde Rivière du Nord | 2 |
| 69 | | | X | Dondon | 2 |
| 70 | | X | | St Raphael | 2 |
| 71 | | | X | Limonade | 2 |
| 72 | | X | | Bahon | 2 |
| 73 | | | X | Garde Iram | 2 |
| 74 | | | X | Sevanette | 2 |
| 75 | | | X | Pignon | 2 |
| 76 | | | X | Bord de Mer Limonade | 2 |
| 77 | | | X | Ste Suzanne | 2 |
| 78 | | | X | Lassigie | 2 |
| 79 | | | X | Côtelette | 2 |
| 80 | | | X | Ranquitte | 2 |
| 81 | | | X | Caracol | 2 |
| 82 | | | X | Dupity | 2 |
| 83 | | | X | Trou du Nord | 2 |
| 84 | | | X | Grosse Roche | 2 |
| 85 | | | X | Mombin Crochu | 2 |
| 86 | | | X | La Victoire | 2 |
| 87 | | | X | Terrier Rouge | 2 |
| 88 | | | X | Paulette | 2 |
| 89 | | | X | Grand Bassin | 2 |
| 90 | | | X | Danda | 2 |
| 91 | | | X | St Antoine | 2 |
| 92 | | | X | Perches | 2 |
| 93 | | | X | Bas Morne | 2 |
| 94 | | | X | Magitonne | 2 |
| 95 | | | X | Vallières | 2 |
| 96 | | | X | Gde Savanne | 2 |
| 97 | | | X | Phaëton | 2 |
| 98 | | | X | Gde Saline | 2 |
| 99 | | | X | Fort Liberté | 2 |
| 100 | | | X | Bonnement | 2 |
| 101 | | | X | Acul Samedi | 2 |
| 102 | | | X | Bois Laurence | 2 |
| 103 | | | X | Dérac | 2 |
| 104 | | | X | Ferrier | 2 |
| 105 | | | X | Savane au Lait | 2 |
| 106 | | | X | Ouana-minthe | 2 |
| 107 | | | X | Dosmond | 2 |
| 108 | | | X | Acul des Pins | 2 |
| 109 | | | X | Savane Longue | 2 |
| 110 | | | X | Capotille | 2 |
| 111 | | | X | Mare Jouille | 2 |
| 112 | | | X | Gens de Nantes | 2 |
| 113 | | X | | Mont Organisé | 2 |
| 114 | | | X | Carice | 2 |
| 115 | | | X | Silvestre | 2 |
| 116 | | | X | La Mine | 2 |
| 117 | | | X | [illegible] | 2 |

| N dans la carte | Urbain | Régional | Semi-F | Nom du Marché | Zone de la Ville | N dans la carte | Urbain | Régional | Semi-F | Nom du Marché | Zone de la Ville |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 121 | | | X | Sources Chaudes | 1 | 181 | | | X | Les Palis | 3 |
| 122 | | | X | Corridon | 1 | 182 | | | X | Pablocal | 3 |
| 123 | | X | | Lagon | 1 | 183 | | | X | Ouangouman | 3 |
| 124 | | | X | Terre Neuve | 1 | 184 | | | X | Dariagrand | 3 |
| 125 | | X | | Pendu | 1 | 185 | | | X | Thamossique | 3 |
| 126 | | | X | Gros Morne | 1 | 186 | | | X | Laurannette | 3 |
| 127 | X | | | Gonaives | 3 | 187 | | | X | Gards Salnave | 3 |
| 128 | X | | | Bord de Mer (Gonaives) | 3 | 188 | | | X | Boc Banic | 3 |
| 129 | | X | | Pont l'Estère | 3 | 189 | | | X | Fonds Baptiste | 4 |
| 130 | | | X | Desdunes | 3 | 190 | | | X | Saintard | 4 |
| 131 | | | X | Villard | 3 | 191 | | | X | Corail | 4 |
| 132 | | X | | Pont Sondé | 3 | 192 | | | X | Luly | 4 |
| 133 | | | X | St-Marc | 3 | 193 | | | X | Arcahaie | 4 |
| 134 | | | X | Haut de St-Marc | 3 | 194 | | | X | Léger | 4 |
| 135 | | | X | Pierre Payen | 3 | 195 | | | X | Fonds Blancs | 3 |
| 136 | | | X | Goyavier | 3 | 196 | | | X | Casale | 4 |
| 137 | | | X | Montrouis | 3 | 197 | | | X | Duvalier-Ville | 4 |
| 138 | | | X | La Branle | 1 | 198 | | | X | Ti Tanyin | 4 |
| 139 | | X | | Poteaux | 3 | 199 | | | X | Délice | 3 |
| 140 | | | X | Passe Reine | 3 | 200 | | | X | Ste-Cécile | 3 |
| 141 | | | X | Bayonnais | 3 | 201 | | | X | La Salle | 3 |
| 142 | | | X | Jean Denis (Savism) | 3 | 202 | | | X | Crochus | 4 |
| 143 | | | X | Liancourt | 3 | 203 | | | X | Duverger | 3 |
| 144 | | | X | Ennery | 3 | 204 | | | X | Bon Repos | 4 |
| 145 | | | X | Savane Carrée | 3 | 205 | | | X | Pouiyé | 3 |
| 146 | | | X | Platana | 3 | 206 | | | X | Ville Bonheur | 3 |
| 147 | | | X | Dessalines | 3 | 207 | | | X | Terre Rouge | 4 |
| 148 | | | X | Poste Pierrot | 3 | 208 | | | X | Beudet | 4 |
| 149 | | | X | Fiéfié | 3 | 209 | | | X | Chambot | 3 |
| 150 | | | X | Pte Riv. de l'Artibon | 3 | 210 | | | X | Domond | 3 |
| 151 | | | X | Deschapelles | 3 | 211 | | | X | Regalis | 3 |
| 152 | | X | | Verrettes | 3 | 212 | | | X | Mirebalais | 3 |
| 153 | | | X | Désarmes | 3 | 213 | | | X | Thomazeau | 4 |
| 154 | | | X | Dos Parc | 3 | 214 | | | X | Savane l'Ail | 3 |
| 155 | | | X | Montagne Terrible | 3 | 215 | | | X | Petit Fond | 3 |
| 156 | | | X | Marmelade | 3 | 216 | | | X | Sarazin | 3 |
| 157 | | | X | Bas de Sault | 3 | 217 | | X | | Canard | 3 |
| 158 | | X | | Saint Michel de l'Attalaye | 3 | 218 | | | X | Aux Plègues | 3 |
| 159 | | | X | Marmont | 3 | 219 | | | X | Nan Cassé | 3 |
| 160 | | | X | Cahos | 3 | 220 | | | X | Lascahobas | 3 |
| 161 | | X | | Médor | 3 | 221 | | | X | Colombier | 3 |
| 162 | | | X | Pérodin | 3 | 222 | | | X | Cornillon | 3 |
| 163 | | | X | Savane à Roche | 3 | 223 | | | X | Abrillot | 3 |
| 164 | | X | | La Chapelle | 3 | 224 | | | X | Dos Bois Rouge | 3 |
| 165 | | | X | La Loma | 3 | 225 | | | X | Mare Georges | 3 |
| 166 | | | X | Lacidras | 1 | 226 | | X | | Oranger | 3 |
| 167 | | | X | L'Ermitha | 3 | 227 | | X | | Nan Poste | 3 |
| 168 | | | X | Rantionobl | 3 | 228 | | | X | Rosec | 3 |
| 169 | | | X | Madame Joa | 3 | 229 | | | X | Savanette | 3 |
| 170 | | | X | Bois Rouge | 3 | 230 | | | X | Couret | 4 |
| 171 | | | X | Corail | 3 | 231 | | | X | St-Pierre | 4 |
| 172 | | | X | Chapeau Carré | 3 | 232 | | | X | Coupe Mardi Gras | 3 |
| 173 | | | X | Figue | 3 | 233 | | | X | Belladère | 3 |
| 174 | | | X | Maissade | 3 | 234 | | | X | Croix-des | 3 |
| 175 | | | X | Bouly | 3 | 235 | | | X | Baptiste | 3 |
| 176 | | | X | Létang | 3 | 236 | | | X | Liane Piché | 3 |
| 177 | | | X | Hinche | 3 | 237 | | | X | Tête de l'eau | 3 |
| 178 | | | X | Abricot | 3 | 238 | | | X | Banane | 3 |
| 179 | | | X | Thomonde | 3 | 239 | | | X | Camy | 3 |
| 180 | | | X | Cerca Cavajal | 3 | 240 | | | X | Fonds-Verrettes | 3 |

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| carte | U | R | S | | d | 1/ |
|---|---|---|---|---|---|---|
| 241 | | X | | Forêt des Pins | 4 | |
| 242 | | X | | Orient | 4 | |
| 243 | | | X | Bodarie | 4 | |
| 244 | | X | | Thiotte | 4 | |
| 245 | | | X | Boucan Guillaume | 4 | |
| 246 | | X | | Tarlonge | 4 | |
| 247 | | | X | Anse à Pitres | 4 | |
| 248 | | | X | Fond Parisien | 4 | |
| 249 | | | X | Haut Pichon | 4 | |
| 250 | | | X | Bas Pichon | 4 | |
| 251 | | | X | Cakumette | 4 | |
| 252 | | | X | Carail Lamothe | 4 | |
| 253 | | | X | Fraîcheur | 4 | |
| 254 | | X | | Mapou | 4 | |
| 255 | | | X | Belle Fontaine | 4 | |
| 256 | | | X | Dumé | 4 | |
| 257 | | | X | Ganthier | 4 | |
| 258 | | | X | Labrid | 4 | |
| 259 | | | X | Bel Air | 4 | |
| 260 | | | X | Bel Anse | 4 | |
| 261 | | | X | Letellier | 4 | |
| 262 | | | X | Pays Pourri | 4 | |
| 263 | | | X | Greffin | 4 | |
| 264 | | | X | Mare Mirande | 4 | |
| 265 | | | X | Marc Briol | 4 | |
| 266 | | | X | Baie d'Orange | 4 | |
| 267 | | X | | Croix-des-Bouquets | 4 | |
| 268 | | | X | Mlle Touraine | 4 | |
| 269 | | | X | Coteaux | 4 | |
| 270 | | | X | Macari | 4 | |
| 271 | | | X | Corail Soult | 4 | |
| 272 | | | X | Seguin | 4 | |
| 273 | | | X | Chaudry | 4 | |
| 274 | | | X | Molle | 4 | |
| 275 | | | X | Fond Jn Noël | 4 | |
| 276 | X | | | Pétion-Ville | 4 | |
| 277 | | | X | Douret | 4 | |
| 278 | | | X | Kenscoff | 4 | |
| 279 | | | X | Maroca | 4 | |
| 280 | | | X | Eugène Nau | 4 | |
| 281 | | | X | Godé | 4 | |
| 282 | | | X | Furey | 4 | |
| 283 | | | X | Pérédo | 4 | |
| 284 | | | X | Marigot | 4 | |
| 285 | X | | | Croix-des-Bossales | 4 | |
| 286 | X | | | Vallières | 4 | |
| 287 | X | | | Salomon | 4 | |
| 288 | X | | | Morne Nélio | 4 | |
| 289 | X | | | Martissant Marché Poissons | 4 | |
| 290 | X | | | Cinquième Avenue | 4 | |
| 291 | X | | | Cité Cadet | 4 | |
| 292 | X | | | Cité Simone | 4 | |
| 293 | X | | | Crespac | 4 | |
| 294 | X | | | Fort Saint Clair | 4 | |
| 295 | X | | | La Rochelle | 4 | |
| 296 | X | | | Mont Horeb | 4 | |
| 297 | X | | | Morne Marinette | 4 | |
| 298 | X | | | Nirvana | 4 | |
| 299 | X | | | Poste Marchand | 4 | |
| 300 | X | | | Ravine Pintade | 4 | |

| carte | U | R | S | | d | 1/ |
|---|---|---|---|---|---|---|
| 301 | X | | | St-Martin | 4 | |
| 302 | X | | | Tête Boeuf | 4 | |
| 303 | X | | | Trou Sable | 4 | |
| 304 | X | | | Cabotage | 4 | |
| 305 | | | X | Bady | 4 | |
| 306 | | | X | Procy | 4 | |
| 307 | | | X | Peau Canne | 4 | |
| 308 | | | X | Fond Maion | 4 | |
| 309 | | | X | Cochon Gras | 4 | |
| 310 | | | X | Nan Marc | 4 | |
| 311 | | | X | Montagne la Voûte | 4 | |
| 312 | | | X | La Gosseline | 4 | |
| 313 | | | X | Grande Rivière | 4 | |
| 314 | | | X | Bizoton | 4 | |
| 315 | | | X | Bois Thoz | 4 | |
| 316 | | | X | Arcachon | 4 | |
| 317 | | | X | Carrefour | 4 | |
| 318 | | | X | Dégan | 4 | |
| 319 | | | X | Bongas | 4 | |
| 320 | | | X | Vergeon | 4 | |
| 321 | | | X | Gaillard | 4 | |
| 322 | | | X | Cayes-Jacmel | 4 | |
| 323 | | | X | St-Antoine | 4 | |
| 324 | | | X | Gressier | 4 | |
| 325 | | | X | Lérault | 4 | |
| 326 | | | X | Coupeau | 4 | |
| 327 | | | X | Campant | 4 | |
| 328 | | | X | Malanga | 4 | |
| 329 | | | X | Lafond | 4 | |
| 330 | | | X | Cap Rouge | 4 | |
| 331 | | | X | Mahautière | 4 | |
| 332 | | | X | Ravine Normande | 4 | |
| 333 | X | | | Jacmel | 4 | |
| 334 | X | | | L'Acrobate | 4 | |
| 335 | | | X | Mayard (Marché à best.) | 4 | |
| 336 | | | X | Mapou (La Buissonnière) | 4 | |
| 337 | | | X | Fond Droit | 4 | |
| 338 | | | X | Citronnier | 4 | |
| 339 | | | X | Tom Gateau | 4 | |
| 340 | | | X | Découssé | 4 | |
| 341 | | | X | Desvarenne | 4 | |
| 342 | | | X | Morne Rouge | 4 | |
| 343 | | | X | Bouchi Piron | 4 | |
| 344 | | | X | Arrégui | 4 | |
| 345 | | | X | Baguette | 4 | |
| 346 | | | X | Bracha | 4 | |
| 347 | | | X | Léogane | 4 | |
| 348 | | | X | Darbonne | 4 | |
| 349 | | | X | Dellande | 4 | |
| 350 | | | X | Carrefour-Dufort | 4 | |
| 351 | | | X | L'Acul | 4 | |
| 352 | | | X | Trouin | 4 | |
| 353 | | | X | Deux Grigri | 4 | |
| 354 | | | X | Meilleur | 4 | |
| 355 | | | X | Gilbert | 4 | |
| 356 | | | X | Panicienne | 4 | |
| 357 | | | X | Bandin | 4 | |
| 358 | | | X | La Vallée | 4 | |
| 359 | | | X | Dard | 4 | |
| 360 | | | X | Pointe la Montagne | 4 | |

| dans la carte | Urb. | Rég. | Sem. | Nom de | de 1/1 |
|---|---|---|---|---|---|
| 361 | | | X | Gd Goâve | 4 |
| 362 | | | X | Carrefour Fauché | 4 |
| 363 | | | X | Carrefour Cassave | 4 |
| 364 | | | X | Panjou | 4 |
| 365 | | | X | Blockauss | 4 |
| 366 | | | X | Bainet | 4 |
| 367 | | | X | Petit Goâve | 4 |
| 368 | | X | | Molière | 4 |
| 369 | | | X | Roche Gata | 4 |
| 370 | | | X | Palmiste Avin | 4 |
| 371 | | | X | Aux Palmes (Bassce) | 4 |
| 372 | | | X | 7e Section (Petit Goâve) | 4 |
| 373 | | | X | Bellevue | 4 |
| 374 | | | X | Delatte | 4 |
| 375 | | X | | Vialet | 4 |
| 376 | | | X | Dessources | 4 |
| 377 | | | X | Arnaux | 4 |
| 378 | | | X | Yacinthe | 4 |
| 379 | | | X | Savane Henry | 4 |
| 380 | | | X | Mandé | 4 |
| 381 | | | X | Côtes de Fer | 4 |
| 382 | | | X | Nan Coupe | 4 |
| 383 | | | X | Magazin | 4 |
| 384 | | | X | Palma | 4 |
| 385 | | | X | Fdc Paret | 4 |
| 386 | | | X | Etroit | 4 |
| 387 | | | X | Nan Café | 4 |
| 388 | | | X | Plaisance | 4 |
| 389 | | | X | Lottoré | 4 |
| 390 | | | X | Pointe à Raquette | 4 |
| 391 | | X | | Ti Palmiste | 4 |
| 392 | | X | | Dent Griyin | 4 |
| 393 | | X | | Tomarin | 4 |
| 394 | | | X | Miragoâne | 5 |
| 395 | | | X | Lebrun | 5 |
| 396 | | | X | Chalon | 5 |
| 397 | | | X | Belle Rivière | 5 |
| 398 | | | X | St-Michel du Sud | 5 |
| 399 | | | X | Lhomond | 5 |
| 400 | | | X | Fonds des Blancs | 5 |
| 401 | | | X | Pemel (Fds des Nègres) | 5 |
| 402 | | X | | Morne Brice (fonds des Nègres) | 5 |
| 403 | | | X | La Colline | 5 |
| 404 | | | X | Pte Rivière de Nippes | 5 |
| 405 | | | X | Baké | 5 |
| 406 | | | X | Bouzi | 5 |
| 407 | | | X | Carrefour La Colline | 5 |
| 408 | | | X | Anse à Veau | 5 |
| 409 | | | X | Arnaud | 5 |
| 410 | | | X | L'Azile | 5 |
| 411 | | | X | Bidouze | 5 |
| 412 | | | X | Vieux Bourg d'Aquin | 5 |
| 413 | | | X | Aquin | 5 |
| 414 | | | X | Petit Trou de Nippes | 5 |
| 415 | | | X | Digoterie | 5 |
| 416 | | | X | O Pin | 5 |
| 417 | | | X | La Biche | 5 |
| 418 | | | X | Dupuy | 5 |
| 419 | | | X | Changeux | 5 |
| 420 | | | X | Charette | 5 |

| dans la carte | Urb. | Rég. | Sem. | Nom de | de 1/1 |
|---|---|---|---|---|---|
| 421 | | | X | Zanglais | 5 |
| 422 | | | X | St Georges | 5 |
| 423 | | | X | St-Louis du Sud | 5 |
| 424 | | | X | Plaisance | 5 |
| 425 | | | X | Barradères | 5 |
| 426 | | | X | La Plaine | 5 |
| 427 | | | X | Laroque | 5 |
| 428 | | | X | Lexandre | 5 |
| 429 | | | X | Parcroix | 5 |
| 430 | | | X | Buton | 5 |
| 431 | | X | | Cavaillon | 5 |
| 432 | | | X | Dory | 5 |
| 433 | | | X | Maniche | 5 |
| 434 | | | X | Laurent | 5 |
| 435 | X | | | Cayes | 5 |
| 436 | X | | | Bord de Mer | 5 |
| 437 | X | | | Marché Poissons | 5 |
| 438 | | | X | Grande Baie | 5 |
| 439 | | X | | Pestel | 5 |
| 440 | | | X | Desriveaux | 5 |
| 441 | | | X | Dominique | 5 |
| 442 | | | X | Kans | 5 |
| 443 | | | X | Torbeck | 5 |
| 444 | | | X | Bernagousse | 5 |
| 445 | | X | | Corail | 5 |
| 446 | | X | | Beaumont | 5 |
| 447 | | | X | Duchity | 5 |
| 448 | | | X | Solon | 5 |
| 449 | | | X | Poste Avancé | 5 |
| 450 | | | X | Camp Parrin | 5 |
| 451 | | | X | Leprêtre | 5 |
| 452 | | X | | Ducis | 5 |
| 453 | | | X | Péyan | 5 |
| 454 | | | X | Morasse | 5 |
| 455 | | | X | Arniquet | 5 |
| 456 | | | X | Maran | 5 |
| 457 | | | X | Carrefour Valère | 5 |
| 458 | | | X | Carrefour Joute | 5 |
| 459 | | | X | Débouchette | 5 |
| 460 | | | X | St-Jean du Sud | 5 |
| 461 | | | X | Ile à Vache | 5 |
| 462 | | | X | Port à Nanette | 5 |
| 463 | | | X | Chantal | 5 |
| 464 | | | X | Clermont | 5 |
| 465 | | | X | Cordé | 5 |
| 466 | | | X | Cafman | 5 |
| 467 | | | X | Roche à Bateaux | 5 |
| 468 | | | X | Nordely | 5 |
| 469 | | | X | Carpentier | 5 |
| 470 | | | X | Port Salut | 5 |
| 471 | | | X | Roseaux | 5 |
| 472 | | | X | Soulette | 5 |
| 473 | | | X | Coteaux | 5 |
| 474 | | | X | Gommier | 5 |
| 475 | | | X | Bois Sec | 5 |
| 476 | | | X | Grand Vincent | 5 |
| 477 | | | X | Lopino | 5 |
| 478 | | | X | Anette | 5 |
| 479 | | | X | Guillaume | 5 |
| 480 | | | X | Port à Piment | 5 |

| N° dans la carte | Type du Marché: Urbain | Régional | Semi-Rural | Nom du Marché | N° de la carte 1/100.000 |
|---|---|---|---|---|---|
| 481 | X | | | Jérémie | 5 |
| 482 | | X | | Léon | 5 |
| 483 | | | X | D'Ayer | 5 |
| 484 | | | X | Castillon | 5 |
| 485 | | X | | Randalle | 5 |
| 486 | | | X | Chardonnière | 5 |
| 487 | | | X | Carrefour Sanon | 5 |
| 488 | | X | | Marfranc | 5 |
| 489 | | | X | Jourdan | 5 |
| 490 | | | X | Préville | 5 |
| 491 | | | X | Milfort | 5 |
| 492 | | | X | Cosse | 5 |
| 493 | | | X | Mapou | 5 |
| 494 | | X | | Les Anglais | 5 |
| 495 | | | X | Carrefour Prince | 5 |
| 496 | | | X | Bonbon | 5 |
| 497 | | | X | Désormeaux | 5 |
| 498 | | | X | Leury | 5 |
| 499 | | X | | Moron | 5 |
| 500 | | | X | Sources Chaudes (Ti Paris) | 5 |
| 501 | | | X | Cabouans | 5 |
| 502 | | | X | Danglise | 5 |
| 503 | | | X | L'Ermithe | 5 |
| 504 | | X | | Chambellan | 5 |
| 505 | | X | | Abricot | 5 |
| 506 | | | X | Boudon | 5 |
| 507 | | | X | Boucan | 5 |
| 508 | | | X | Monteau | 5 |
| 509 | | | X | Germont | 5 |
| 510 | | | X | Jorgue | 5 |
| 511 | | | X | Tiburon | 5 |
| 512 | | X | | Dame Marie | 5 |
| 513 | | | X | Divineau | 5 |
| 514 | | X | | Anse d'Hainault | 5 |
| 515 | | | X | Gabriel | 5 |
| 516 | | | X | Mandou | 5 |
| 517 | | X | | Trois | 5 |
| 518 | | | X | Carcasse | 5 |

FARM NO._____ Animator _____
Name Name

DESCRIPTION

0. Inscription - Control forms

1. Topo MAP 1.1 distance, 1.2 market, 1.3 zone bioclimatique
1.4 potential, 1.5 population density.

2. Photo 78

3. Topo with gardens 3.1 slope,
3.2 soils - 3.2/1 gra anpil
3.2/2 fret/pa tro fret/cho
3.2/3 parent - 3.2/3/1 material
3.2/3/2 depth
3.2/3/3 texture
3.2/3/4 moisture
3.3 altitude
3.4 trees and crowns location
3.5 agriculture crop
3.6 livestock area
3.7 fallow area

Agroforestry
Sylvo pastoral
Fallow-tree
Fallow-livestock

INCOME

6. Land area own_____rented_____sharecrop_____

7. No. of persons living/sleeping on farm.

8. Non-farm income

9. Cash crop value: Product - Quantity - Value

10. Labor provided No. days received No. days
size quality use

11. Buildings: 1.
2.
3.

12. Livestock/poultry: Number_____age_____value_____

EDUCATION

13.

14

15. Can read_____, write_____

16. Religion

17. Organization

| | 83 | 84 | 85 | Comments |
|---|---|---|---|---|
| 18. | Labor (No. m., days | | | |
| | Farmer F | | | |
| | Crops JF MAMJ5A.... | | | |
| | 1 | | | |
| | 2 | | | |
| | 3 | | | |
| | Trees - fruit | | | |
| | - exotic | | | |
| | - native | | | |
| I | Fruit trees | | | |
| N | 1 | Planting | Man-hours | |
| | 2 | Weeding | | |
| P | 3 | Pruning | | |
| U | | Proketia | | |
| | | Harvesting | | |
| T | AF Trees | | | |
| S | 1 | | | |
| | 2 | | | |
| | 3 | | | |
| | 4 | | | |
| | 5 | | | |
| | SP Trees | | | |
| | 1 | | | |
| | 2 | | | |
| | 3 | | | |
| | 4 | | | |
| | Hedgerows | | | |
| | Line 1 | | | |
| | " 2 | | | |
| | " 3 | | | |
| | Wood | | | |
| | Group 1 | | | |
| | 2 | | | |
| | 3 | | | |
| 19. | Material | | | |
| 20. | Rent | | | |
| 21. | Capital | | | |
| 22. | Others | | | |

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OUTPUTS + PRICE + CONSUMPTION RISK

23. Crops marmitte/season
1
2
3
4

| 24. Fruit trees | Sp | Ø | Crown area | Under Crown Description (If crop in height) (If exotic replace native or additional) | Harvesting Unit/product | Auto Land | Market Price Local/MA Interim |
|---|---|---|---|---|---|---|---|

25. AF trees
1
2
3

1
2
3

26. Hedgerows
Line 1
2
3

27. Wood
Group 1
2
3
4

28.

29. Crop diversity index

30.

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UNSTRUCTURED INTERVIEW

PERCEIVED B-C

31. Exotic tree advantage
products (inexisting, better, faster)
increase land production
improve soils humidity, light, mulching
conservation
property right
with native

32. Exotic tree disadvantage
products
decrease productivity
problem with neighbor, birds
take too much space
with native

Without 1 Analysis

33. Did you plant before project? If yes which fruit trees? ≠ fruit trees?

34. Did you plant before project in field, hedgerow, woodlot, around house?

35. How did you plant (seed, plant, transplant)?

36. What native will the exotic replace, where, and for what purpose?

37. What other species would you rather be planting?

38. Will you plant less native?