

**Communal Afforestation: A Report on the Results of A
Socio-Economic Survey and the Status of the Project**

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1. Summary: Findings and Recommendations

1.1 Introduction

The Rwanda Communal Afforestation Project began its activities in Cyeru Commune in April, 1984 and has to date achieved the objectives that were targeted for the first 18 months of operation. These were focused on the establishment of nurseries, the training and employment of extension workers, and the planting of communal forests. The emphasis in the remaining two years of project life will be placed on planting trees on privately owned farms, largely in agroforestry configurations. This objective will be considerably more difficult to attain insofar as agroforestry is an approach to land management which requires increased labor inputs and greater management skills than does plantation forestry. Extension agents especially will need to be instructed on a regular basis in agroforestry principles and approaches.

The socio-economic survey conducted in June, 1985 establishes that the extension service of the Project has been operating reasonably well to date, that especially in Cyeru Commune where the Project has been active the longest there is a strong indication that the extension program is reaching the residents of the area regularly and that these rural families have begun to put into practice the technologies the Project is promoting. Thus it appears that the sub-structure needed for the Project to move forward in the coming two years is already in place and functioning at an acceptable level. By examining the results of the survey the Project Direction can identify the tree species which rural families want and need, the sites where they are or should be planted, the individual members of the family who should be counseled by the monagris (extension agents), and the severity of the fuelwood "crisis" in the Project zone. By so doing the Project can make certain that its program is designed for the needs and capabilities of the people of the region who are its clients and whom the Project reaches not only through its extension program but as a result too of employment generated by Project activities in Kirambo sub-Prefecture.

The objective of the socio economic survey undertaken in the sub-prefecture is to furnish to the Project information on current sylvicultural and agroforestry practices for inclusion in the design and administration of the technical and extension programs. Additional baseline information has been collected on the economics of various sylviculture/energy activities, especially those related to the use and sale of fuelwood, and on the rights of men and women to harvest and use wood.

The survey was conducted in the two communes of the sub-prefecture where the Project has operated these past 18 months - Cyeru and Butaro. Project extension agents administered the questionnaire to individuals from 148 households, approximately 1% of the total households in the 2 commune area. The monagris were supervised by their immediate agronome supervisors,

the Project Direction, and OAR/R. Although there is an indication that in Butaro Commune the survey was not administered as carefully as in Cyeru, largely the survey seems to have been carried out well; responses to different questions on similar subjects are consistent with one another. Those enumerators in Butaro who were unable or unwilling to follow the stated procedure in administering the survey have been identified to the Project Direction. The principal methodological problem in the survey was that one of the main independent variables, farm size, proved to be invalid after the results were tabulated. It appears that neither farmers nor enumerators were able to make accurate estimations of the size of parcels.

1.2 Findings

The results of the survey are presented in two sections. In the first, the responses to questions of technical, social, and economic interest are tallied and reported. The second section presents results by three main variables: commune, progressive farmer, and sex of respondent. Tables presenting the results are found both in the body of the report and in an appendix.

1.2.1 Sylvicultural Practices

There is much to indicate that trees on the farm are being planted at appropriate sites and used appropriately as well. This means, for example, that Eucalyptus is used almost exclusively as fuelwood and for construction, and that it is found mostly in woodlots; that Markhamia is a popular tree found in crop fields, and that it is used for carpentry and tools. There is little difference in the reported frequency between the species used and those desired, save for a greater desire to use Grevillea for carpentry and erosion control. Fruit trees are extremely popular among the area's residents and should be furnished in quantities sufficient to meet the demand (a fee should be charged for the purchase of fruit tree seedlings, as is reported below). Some 30% of the respondents report problems in their sylvicultural practices, which include theft of seedlings, slow growth (in Cyeru, where the soils are of inferior quality), and disease and infestation. It is recommended below that appropriate action be taken to minimize such problems.

1.2.2 Agroforestry

A majority of respondents - 70% - already have experience in growing trees in crop fields. Largely they use Grevillea, Leucaena, Markhamia, and Fruit trees, all appropriate agroforestry species. At statistically significant levels crops are reported to grow better when planted amongst these species. When crops are interplanted with Eucalyptus or Bamboo, farmers have observed worse crop production. There appears to be a sound foundation upon which the Project can build its agroforestry program in the coming year. The prevalence of appropriate tree species in crop fields varies directly and significantly with the number of visits a farmer

receives from a *monagri* in Cyeru, where the extension service has been active longer, significantly more tree - food crop interplanting is found. Approximately 21% of all fuelwood comes from trees planted in crop fields, an encouraging sign for the agroforestry program.

1.2.3 Energy

There does not appear to be an energy crisis yet in the Project zone, although two-fifths of the respondents report difficulty in obtaining fuelwood. The problem is greater for those families of non-progressive farmers who constitute the majority of the residents of the area. More than half the respondents report spending more than one hour per day in search of fuelwood. This is a significant observation insofar as time spent searching for wood is time not spent in other agriculturally productive ways. It must be remembered that women are responsible for the collection of fuelwood and for most of the agricultural work on the farm. The Farming Systems Improvement Project will want to consider these facts when they propose technologies which may require greater labor inputs from members of farm families.

The fuelwood problem is more severe and more immediate in Butaro Commune. As most fuelwood is found on the farm itself, the strategy the Project has begun to implement - on-farm planting - is sound. Only in Butaro should consideration be given to an immediate effort at planting fast-growing plantation species. Wood is the overwhelming choice of the area's residents as a cooking fuel although crop residues and woody vegetation are used to a not insignificant degree, especially by the area's poorer families. The fuelwood problem seems to be particularly severe for female-headed households.

1.2.4 Extension

Forty percent of the respondents in the survey claim to have met a forestry *monagri* at least one time; 22% have received more than two visits from an extension agent. Where trees are found in crop fields there is a significant association with the number of visits made by an extension agent. This association is valid for Cyeru Commune as well where the extension service is more firmly entrenched. Thus it appears that there is a positive relationship between the strength of extension activity and the adoption of agroforestry practices. The extension program is relatively widespread for this moment in the Project's evolution and is transmitting its message relatively well. Over 80% of the respondents express interest in meeting an extension agent once to twice per week, a further indication that the program is being well-received in the area. The challenge for the extension service lies yet ahead as agents trained by the Project instruct farmers in the management of agroforestry systems.

1.2.5 Social Forestry

It is apparent that men are de facto owners of wood. Although about one-half the respondents report that women may cut dead fuelwood species - Eucalyptus and Black Wattle - without asking their husbands' permission, in fact even this practice is said by women to occur less often than it is reported to take place. Otherwise women cannot cut wood of other species or for other uses. By contrast, women and men share a perception of the fuelwood shortage and there is no discrepancy between the species men want and those that women want. Thus the rights of women to the use of wood are limited but they and men together are viewing their woods needs similarly.

1.2.6 Economy

About one-third of the families in the area appear to be engaged in wood sales and purchases. There is evidence to indicate that intermediaries are involved in these transactions as the market price for a bundle of wood is nearly twice that for which farmers sell it. There is strong evidence to indicate that most farmers are willing to purchase seedlings for a minimal fee. Fruit trees especially could be sold in this fashion to generate revenue for the Project. The Avocado is the most desirable species in its improved (grafted) form. It will bear fruit in 2-3 years rather than 7-8, and respondents claim they would spend 13 FRW per seedling on the average for the grafted variety. If this widespread interest in purchasing or trying an improved variety is a generalized phenomenon in the region, the Farming Systems project will want to take note. The revenue which the sale of fuelwood generates for families is still relatively low but not insignificant for that minority of families (25%) who are selling wood.

1.2.7 Commune

Repeatedly the segregation of data by Commune yields significant results, all supporting the more widespread impact of the extension program in Cyeru: farmers are receiving more visits, planting trees in crop fields more often, and more willing to purchase seedlings. The shortage of fuelwood is less severe in Cyeru as well, where woody vegetation and crop residues are burned less often than in Butaro. By the same token the availability of fuelwood in Butaro is reportedly low, and the Project has been advised to consider Butaro's fuelwood needs immediately. The "slow growth" sylviculture problem in Cyeru referred to earlier is a function of the generally inferior quality soils in that Commune; the Project will need to decide how best to minimize this problem.

1.2.8 Progressive Farmer

Twice the number of progressive farmers were interviewed in Cyeru as in Butaro, although Cyeru has in principle only 50% more progressives in its population. Occasionally this has made the interpretation of the survey results more problematical. It is not always clear whether variation by

Commune is a function of the longer period of Project activity in Cyeru or the greater number of progressives interviewed there. In either event, it is clear the progressives have been receiving more frequent visits from extension agents; this has been intentional. The Project is attempting to transfer technology largely through the progressive farmer program. Progressives appear to be wealthier than other farmers - they sell more wood and report little problem in satisfying their fuelwood needs. They seem to be more acute observers of silviculture as well insofar as they report problems with disease and infestation of trees growing on the farm at significantly higher levels than do other farmers. Despite the quality of progressive farming systems it has not been demonstrated that technologies introduced through them actually diffuse to others; a study to determine whether or not this takes place is recommended below.

1.2.9 Gender (Sex of Respondent)

Gender is not a significant variable in accounting for reported differences in several of the survey categories. Mostly men and women share perceptions of tree species desired, the severity of the fuelwood crisis, the rights women have to cut and use wood, and in knowledge about where trees should be correctly planted. Women do claim significantly more frequently than do men that they cannot cut dead fuelwood species, indicating that in principle men accord them a right which in fact they do not have. Otherwise the most glaring difference between men and women concerns the frequency of visits they receive from extension agents. Women are visited less often. Given that they will assume responsibility for the care and maintenance of agroforestry species, it is essential that the Project make a concerted effort to reach women through its extension program.

1.3 Recommendations

Based on the results of the socio-economic survey, interviews conducted on the farm, and discussions with Project personnel and technical advisors, the following recommendations are made.

1.3.1 Management

The challenges the Project faces in the coming years will be considerably greater than those that have been met to date. The Project will need to improve its operation at both the technical and managerial levels. Technically the quality of nursery soils in Cyeru will need to be improved; inoculant will have to be used on appropriate leguminous species. Nursery operations will have to be better managed: workers should be paid by task and not on a day-wage basis; work plans must be developed earlier, thought-out more clearly, and followed more closely. In general the management of the Project will need to be more carefully planned to cope with the increased work load that will result from an expansion of Project activities into a third commune and onto an agroforestry demonstration farm. Activities must be begun and completed on time. Project personnel must organize more efficiently their own schedules.

1.3.2 Extension

The extension service will need to be improved both in Butaro Commune, where it has been revealed to operate somewhat carelessly, and more generally to meet the increased work load brought on by the push to promote agroforestry. Weekly staff meetings should be initiated in which the monagrjs receive instruction from their agropome supervisors, based on a curriculum developed by the Project Director and his technical advisor, and in which they have also the opportunity to discuss extension problems related to their experiences. The monagrjs should be making observations of trees already planted on the farm by the area's residents to verify that correct procedures are being followed. Where farmers are experiencing sylviculture problems the monagrjs should be reporting these to the Project Direction for action. They should attempt as well to make initial contact with the people of the Commune more at public centers - markets, the Commune, health and nutrition centers, and so forth, before they give individual farmers their personal attention on the farm. This should be a public relations activity and not actual technical extension. In this way they can spread the word of their program and identify interested clients. The Project should consider granting nursery "permits" to those farmers who have completed an instructional stage as a means of dramatizing their message and improving the quality of on-farm sylviculture and agroforestry. Finally a greater effort to reach women must be made, especially with agroforestry messages.

1.3.3 Energy

The present effort at promoting on-farm planting of fuelwood species, and especially in agroforestry configurations, must be strengthened. The fuelwood problem suffered by non-progressive farmers, female-headed households, and the residents of Butaro Commune must be addressed by the Project through its extension service. It is not sufficient for the better part of the Project's efforts to be spent working with those progressive farmers whose fuelwood situation is more secure. The Farming Systems project should be made aware of the amount of time women spend searching for fuelwood as it plans its own program of on-farm intervention.

1.3.4 Nurseries

Nurseries must be stocked with the appropriate proportions of those species which farmers want and need. These should include especially fruit trees and agroforestry species. Those agroforestry species compatible with the agro-ecological conditions of the region must be identified, grown in the nurseries, and distributed to farmers as part of the promotion of agroforestry by the extension service.

1.3.5 Women

The Project must increase its effort to reach women. They are the principal agricultural laborers, they maintain trees planted in crop fields, and they head poor and fuel-deficient households. Extension agents must plan their agendas to include women in their schedule of weekly visits, both on the farm and at those places where women collect in groups, e.g. health and nutritional centers.

1.3.6 Technology Transfer

The effort to extend technology through progressive farmers should be continued but not limited to them. A study to follow the diffusion of new technologies should be undertaken to determine how the progressive/model farmer program works in practice, and should propose a course of action based upon its findings. The experience with grafted Avocados, which are an improved variety well-received by the residents of the Project area, should be recorded by the Farming Systems project as an indication of the willingness of the area's residents to try-out and utilize new technology.

1.3.7 Revenue

The Project should request that the Forestry Service approve, on a trial basis, the sale of seedlings in the Project zone. Especially for fruit trees, seedling sales are a potential source of regular and continuous revenue for the Project, the Commune, and the Forestry Service.

1.3.8 Methodology

Future surveys should note that extension agents and others with less than a secondary school education who are used as enumerators must be as closely supervised in the field as is realistically possible. In general they do not possess the skills which enable them to follow correctly with minimum supervision the procedure which survey administration requires. Estimations of farm size must be based on actual measurements of parcels and not left to the imagination of extension agents and farmers.

2. Introduction

The Rwanda Communal Afforestation Project, based in the 3 communes of Kirambo sub-Prefecture - Cyeru, Butaro, and Nyamugali - in Ruhengeri Prefecture, is a USAID-financed regional sub-project jointly implemented by the Rwanda Forestry Service and Energy Initiatives for Africa. Funding for the Project was obligated initially in August, 1983; Project activities began in earnest in April, 1984. Despite a late start the Project met or exceeded its goals for the first year, especially with regard to hectareage planted in communal forests. AID has committed \$500,000 to the Project. The Government of Rwanda (GUR) will contribute, in salaries and services, \$335,000. A Peace Corps Volunteer is assigned to the Project as technical advisor. At present two forestry technicians assist the Rwanda Chief-of-Project, a forester, in managing the program.

The Project is located in a high altitude zone, 1800-2500 meters, where land is farmed on slopes of up to 60%. Soils are said to be of good structure, texture, and color, cultivable to depths of 50-80 centimeters. The total population of the 3 communes, according to a 1983 census, is 134,233. Population density is highest in Nyamugali Commune, at 323/km², followed by Butaro at 301/km² and Cyeru at 222/km². The principal crops of the region are beans, bananas, maize, sorghum, peas, potatoes, and sweet potatoes. Some livestock is raised, most notably cattle, goats, sheep, and chickens. Trees generally are planted on the crests of hills and on land too steep to farm. Valley bottoms contain the richest soil and are rarely planted in trees. Small woodlots often are found on farms although increasingly the competition for agricultural land makes this practice impractical.

The goals of the Project are straightforward and clearly delimited: 400 hectares of communal forest and 2500 hectares of private farm land are to be planted, the latter as woodlots and tree - food crop interplantings. Given the relatively small size of farms in the sub-prefecture, about 1 hectare on the average, there is generally little land available to devote exclusively to the production of trees. As a result the Project has targeted the agroforestry approach as the most realistic, with the greatest potential benefits, for the farm families in the 3 commune area. By September, 1987, when USAID financing will end, the Project will have had constructed 5 houses and an office, have established 45 nurseries (at least one per sector), and have trained 37 extension agents. It is expected that by the time the Project has completed its program a Communal forestry support system will be in place to continue the promotion and management of afforestation and agroforestry activities.

To date the Project has planted 220 hectares of communal forest and 350 hectares of privately-owned farm land in Cyeru and Butaro Communes. The

thrust of the Project's effort in the 2 years which remain will be directed toward the latter activity, especially in the form of tree - food crop interplanting. Thirty-three nurseries are functioning at present and 25 extension agents have been trained and operate in the field, providing a support structure capable of reaching individual farm families with information, counsel, and seedlings. The construction of three houses and an office have been completed. In October, 1985, the Project will extend its effort to the third and final commune in the sub-prefecture, Nyamugali. This will represent a period of 20 months from the date of commencement in Cyeru Commune, in April, 1984; activity began in Butaro in December, 1984.

Despite the success the Project has had in meeting its targets during the first 18 months of operation, several problems - technical and managerial - continue to impair the efficiency and effectiveness of the program. The heavy soils used for germinating seedlings has lowered the germination rate; it has been advised that compost and sand be added to the potting mix to improve the environment for seedlings. Leguminous species were not inoculated prior to sowing during the first year and thus were incapable of fixing nitrogen in the soil; inoculant has been requested by the Project and it is expected that it will be used to treat seedlings of leguminous species. Poor germination rates for Eucalyptus and Grevillea were widespread the first year; it has been advised to use sandboxes to facilitate germination. The rate of germination would be improved also through greater exposure of the seed beds to sunlight. Finally the Project has been advised not to re-plant converted Eucalyptus stands with Eucalyptus.

The scheduling of nursery and planting operations has been problematical for the Project. Trees are sometimes planted too late in the season and plants not weeded early enough. Nursery workers, who to date have been paid on a daily rather than a task basis, have carried out their duties inefficiently and consequently have slowed down the Project's momentum. Work plans need to be developed earlier and followed more closely.

The continued training of extension agents has not yet taken place with the regularity needed to increase their knowledge of silviculture and agroforestry, and/or to improve their communication skills. The Project has been advised to initiate weekly staff meetings in which the extension agents in each commune meet with their supervisors to discuss their experiences and problems, and to receive further instruction in the approach and practices the Project is promoting. Especially as agroforestry is introduced, monagris will need to be guided more by their agropome supervisors.

Finally the Project needs to receive a stronger commitment from the GOR, particularly the local authorities. The salaries of a number of Project employees have not been picked-up by the GOR. More importantly the use of communal labor to aid and support the Project, which is in fact making an investment on behalf of the Commune, must be increased. The

Project too must pay closer attention to recurrent costs, with an eye toward the future - after AID financing ends. As discussed in this report, there is convincing evidence to support a policy of charging farmers a fee for seedlings. The revenue generated from such sales would be a major boost to the Communal treasury and an important indicator of future financial self-sufficiency for the local forestry service. Finally, an early Project document indicates the the Ruhengeri agricultural officer would assist the Project in training extension agents. To date this has not taken place. Nor has the Project received the assistance of the agronomist of the sub-prefecture.

3. Objectives of the Socio-Economic Survey

Several data collection efforts have been undertaken to date by OAR/R on behalf of the Project. The most recent and extensive is the socio-economic survey of farm families in Cyeru and Butaro Communes in June, 1985. Previously members of farm families had been interviewed on the spot by the OAR/R social science advisor in order to furnish to the Project information relevant to its implementation and management. The objective of these efforts has been to inform the Project of current practices and preferences among the rural populace as these bear upon the kind of technical recommendations the Project extends to farmers; it is understood that technical packages are to be compatible with the agro-ecological, social, and economic conditions under which farming is practiced in the Project zone. The information obtained from these efforts will better enable project management to:

1. make technical recommendations suitable to the needs and capabilities of farmers, themselves grouped according to the relative level of development of their agricultural and silvicultural systems;
2. develop an extension service capable of identifying incorrect or inappropriate silvicultural and agroforestry practices and correspondingly of introducing technically sound ones; and
3. identify sound silvicultural and agroforestry practices already followed by the region's farmers and promote these more widely.

In addition to providing descriptive information on current silviculture systems the socio-economic survey will furnish baseline data against which the progress of the Project may be measured. These data will supplement the information already being collected by the Project as part of its normal records-keeping activities. Those data critical to assessing the progress of the Project include monies earned and spent vis-a-vis silviculture/agroforestry, extent of adoption of promoted technologies, rights of access to and use of wood growing on the farm, decision-making as it pertains to harvesting and utilizing wood, and extent and nature of agroforestry practices employed.

This report presents the results of the aforementioned socio-economic survey and will serve to guide the Project Direction in developing its technical packages and extension program for the coming two years.

4. Methodology

Two communes were selected for inclusion in the survey: Cyeru and Butaro. It is here that the Project already has placed extension agents, themselves acting as enumerators for the administration of the survey. The decision to use monagris as enumerators was based on the desirability of having Project personnel themselves interact directly with farmers; in so doing the extension agents would, in principle, gain a better understanding of the agricultural and silvicultural systems of the region by being engaged directly in constructive dialogue with members of farm families. Approximately 1% of the 15,000 households of the area were included in the sample, yielding 148 cases. Each of the 25 Project moniteurs interviewed 6 individuals (save for two who interviewed 5 each) in the sector for which he/she is ordinarily responsible. At least one participant was chosen from each sector cell. A procedure of systematic sampling was used to select participants. In this form of random sampling every 7th household along a cell road or trail was considered for inclusion in the survey. No more than 2 participants per sector cell were chosen, and each enumerator was instructed to limit the number of men and women interviewed to three each. Table 1 presents the distribution of participants by Commune and Sex.

TABLE 1: SURVEY PARTICIPANTS by COMMUNE AND SEX OF RESPONDENT

Commune	Sex of Respondent			Total
	M	F	No Response (NR)	
Cyeru	42/51%	40/48%	1/01%	83/56%
Butaro	41/63%	22/34%	2/03%	65/44%
Total	83/56%	62/42%	3/02%	148/100%

It is apparent from a reading of Table 1 that the monagris in Butaro did not follow procedure as they were instructed to do. Thirty-four percent of the respondents in Butaro are women; in Cyeru this figure - 49% - more closely approximates the fifty-fifty distribution expected in the survey design. Although the monagris reported difficulty in finding women at the rygo during the day, it nonetheless appears that a greater effort to include women was made in Cyeru. This is but the first of several indicators demonstrating that the extension effort in Butaro is operating at a less effective level than it is in Cyeru.

The enumerators received an orientation from the OAR/R social science advisor before commencing work on the survey and participated in a review session with their agronome supervisors. After the first day's interviews they again reviewed the survey program; each questionnaire was examined by the Project Direction to identify problems in the administration of the survey. Each enumerator received instructive counsel from his/her

supervisor. Some of the first interviews were discarded and done over again. The remaining interviews were conducted during the first week of June, 1985.

The responses to the questionnaires were entered on an IBM/XT by the OAR/R social science advisor and subjected to statistical analysis using the Statistical Package for the Social Sciences (SPSS) program. Assisting in this procedure was the statistical advisor to the Agricultural Survey Unit of the Ministry of Agriculture. In interpreting the statistical significance of the results of the analysis it was decided that significance levels of 10% for associated variables would be accepted, i.e. no more than 10% of the observed association would be accounted for solely by chance variation. Most reported associations are in fact significant at the 5% level. Generally these relationships as they are expressed in the report have the meaning: "it is significant at the 3% level that more respondents in Cyeru Commune plant trees in crop fields than would be expected by chance alone." The interpretation of the survey results have been the responsibility of the OAR/R social science advisor.

The main independent variables in the study are presented in section 6: commune, progressiveness, and sex of respondent. A fourth independent variable, size of farm, presented in Table 2, was eliminated from the analysis after an examination of responses revealed reported farm size to be considerably larger than the regional average of approximately 1 hectare (as determined by the national agricultural survey). It has been concluded that neither the extension agents nor the farmers themselves are capable of estimating accurately the size of their dispersed parcels. With over one-half the farms reported to be greater than 2 hectares, and with an average of 3.3 hectares, the farms in the Project zone would be of a size they are in fact known not to be. Soliciting such estimations from farmers and extension agents is not a reliable means of determining farm size and should not be attempted in other surveys. Actual field measurements must be taken to have confidence in these data.

TABLE 2: FARM SIZE (Ha)

Hectares	f	%
less than 1	25	17
1-2	40	27
2-3	30	20
3-4	20	14
4-5	10	07
5-6	7	05
6-7	6	04
7-8	4	03
more than 8	6	04
Total	148	100

Average: 3.3 hectares

The survey instrument, a questionnaire, was devised in collaboration with Project personnel and forestry advisors, and was based on information collected in on-farm interviews. On four occasions sample questions were posed to members of farm families on their farms. The final questionnaire solicits the kind of information needed by the Project to effectively develop and manage its program.

Table 3 presents a breakdown of participants by the criterion of "progressiveness." These progressive or model farmers, as discussed in greater detail in section 6.2, constitute a disproportionately large percentage of the participants in the survey - 31%. In fact the 20 progressive farmers per sector in the Project zone represent approximately 4% of the sector households. Thus it is highly unlikely that, by chance, the sample would include so many progressive farmers. One explanation for this discrepancy is that some enumerators intentionally sought progressive farmers to interview; alternatively it is possible that some farmers who are not progressive reported themselves to be so. In either case, the fact remains that the proportion of progressive farmers in the sample is unusually high. By Commune, the percentage of progressives is higher in Cyeru (37%) than in Butaro (23%). (In Butaro the percentage of farmers not responding to the question is high, a finding discussed in section 6.) As there are a number of instances in which survey results are significant at the Communal level and by the criterion of progressiveness, it is difficult at times to know the extent to which communal differences are a function of the high proportion of progressive farmers in the surveyed communes or vice versa. These issues are again discussed in section 6 of this report.

TABLE 3: SURVEY PARTICIPANTS by PROGRESSIVE FARMER and COMMUNE

Progressive	Commune		Total
	Cyeru	Butaro	
Yes	31	15	46/31%
No	51	38	89/60%
NR	1	12	13/09%
Total	83	65	148/100%

5. Results I: Technology, Social Structure, Economy

5.1 Sylviculture: tree species grown on farm, wood use by species, species preferences, sylviculture problems, fruit trees.

The trees most often reported to be growing on the farms in the Project zone are fruit species. This is not to say that they are the most numerous.. A census of trees on the farm was not a component of this study. "Fruit" represents a category to which farmers responded most often when asked about the kind of trees growing on the farm. Table 4 shows the distribution of species on the farm by location.

TABLE 4: LOCATION OF TREES ON FARM by SPECIES (X = column)

Species	Near House	Field Boundary	Woodlot	In Field	Total
Eucalyptus	15/06X	3/02X	132/56X	5/03X	155/20X
Pine/Cyprus	53/22X	3/02X	30/13X	0/00X	86/11X
Grevillea	10/04X	37/28X	11/05X	28/18X	86/11X
Black Wattle	6/02X	2/02X	47/20X	1/00X	56/07X
Markhamia	17/07X	59/44X	2/01X	44/28X	122/16X
Leucaena	13/05X	9/07X	1/00X	19/12X	42/06X
Acacia	2/01X	2/02X	6/03X	1/00X	11/01X
Avocado	58/24X	1/01X	1/00X	21/13X	81/11X
Other*	68/28X	17/13X	4/02X	39/25X	128/17X
*Fruit (70%)					
*Ficus (20%)					
Total	242/100X	133/100X	234/100X	158/100X	768/100X

Table 4 reveals that 17% of the trees growing on the farm fall into the "Other" category. Approximately one-half of these are fruit species: Papaya, Maracuja, Prune, and Guava (non-fruit species in this group include Ficus - 13%, Erythrina - 11%, Iboza - 10%, and Cedrella - 5%). When added to the responses for Avocado - 11%, fruit trees become the most widely reported type on the farm. Eucalyptus is the second most commonly reported species (20%) but is no doubt the most numerous in the region. Although the landscape is dominated by Eucalyptus, much of this is communal forest. Markhamia, an on-farm species, is the 3rd most commonly reported tree. If percentages of responses are computed on the basis of the total number of participants in the survey, we gain an idea of the distribution of species on the farms in the area. Eucalyptus, for example, is reported to be a woodlot species by 132 of 148 respondents, or 89%. This figure helps to communicate the great extent to which Eucalyptus is grown on the farms in the region.

Table 4 further classifies species by location on the farm. The trees most commonly grown near the house, for example, are fruit species, followed by Pine and/or Cyprus (common for live fencing). Markhamia (44%) and Grevillea (26%) are the species most commonly found on field boundaries. Eucalyptus and Black Wattle constitute three-fourths of the woodlot species, while Markhamia (26%), Other (25%), and Grevillea (18%) are the species most often reported growing in fields with other crops. Table 20 in the appendix presents each species and the location on the farm where it is most commonly found. Thus, for example, Eucalyptus is cited as a woodlot species by 85% of the respondents having Eucalyptus on the farm, whereas 62% of the respondents who report growing Pine/Cyprus locate these species near the house, and so on. It is interesting to note that of all the reported species only Leucaena is found more in crop fields than elsewhere. As Leucaena is predominantly an agroforestry species there is thus an indication that although limited in prevalence (it is grown by 6% of the farmers surveyed) it is nonetheless being used appropriately. It is important to note that Leucaena is essentially an unproven species in the high altitude Project zone. Because it has yet to be inoculated, its nitrogen-fixing potential is not yet a reality. More generally the results in Tables 4 and 20 reveal that the different tree species are being grown at appropriate sites on the farm.

Table 5 indicates which species are most commonly used for particular purposes, such as fuel, construction, or carpentry, and the percentage of respondents who prefer to use that wood for the purpose cited. The most commonly cited fuelwood species, for example, is Eucalyptus (64%), followed by Black Wattle (22%). Slightly more respondents (70%) would prefer to use Eucalyptus for fuelwood than are presently doing so, which is in all likelihood a function of the unavailability of Eucalyptus on some of the poorer farms. Generally the species used are the ones farmers prefer to use for each purpose. The most notable discrepancies are found in carpentry, where respondents would like to use more Grevillea and less Markhamia; for tools, where more Markhamia is preferred to Other (probably Ficus); and for erosion control, where more Grevillea and more Leucaena are preferred to the Markhamia presently used.

TABLE 5: TREE SPECIES ACTUALLY USED FOR VARIOUS PURPOSES and SPECIES OF CHOICE(p) FOR EACH PURPOSE (x = column)

Species	Fuel	Construction	Carpentry	Tool	Erosion Control
Eucalyptus	134/64x	129/70x	26/11x	17/13x	05/05x
Pine/Cyprus	10/05x	08/04x	68/28x	04/03x	00/00x
Grevillea	04/02x	03/02x	50/21x	02/02x	30/32x
Black Wattle	46/22x	22/12x	01/00x	07/06x	02/02x
Markhamia	05/02x	19/10x	74/30x	55/44x	25/26x
Leucaena	03/01x	00/00x	01/00x	00/00x	20/23x
Acacia	03/01x	00/00x	05/02x	02/02x	00/00x
Fruit	00/00x	00/00x	00/00x	00/00x	02/02x
Other	05/02x	02/01x	18/07x*	39/31x*	09/09x
* probably Ficus					
Eucalyptus (p)	124/70x	113/68x	17/07x	07/07x	05/03x
Pine/Cyprus (p)	01/00x	8/05x	72/28x	09/09x	01/00x
Grevillea (p)	03/02x	04/02x	77/30x	06/06x	34/40x
Black Wattle (p)	35/20x	20/12x	01/00x	03/03x	03/02x
Markhamia (p)	01/00x	20/12x	64/25x	51/51x	25/16x
Leucaena (p)	01/00x	00/00x	00/00x	00/00x	23/27x
Acacia (p)	05/03x	00/00x	09/04x	01/01x	00/00x
Fruit (p)	01/00x	00/00x	00/00x	00/00x	00/00x
Other (p)	05/03x	02/01x	15/06x	22/22x	19/12x

In the appendix Table 21 describes the uses of trees by species. Eucalyptus is most commonly used as fuelwood and for construction; pine/cyprus for carpentry and fencing; and so on.

The most commonly reported silvicultural problem is theft of wood (27%) - mostly seedlings being stolen. The slow growth (20%) problem, which is mostly in Cyeru Commune, is probably a result of the poor soils found there. Other problems are reported in Table 6. Approximately 25% of the respondents reported problems of one kind or another.

TABLE 6: PROBLEMS WITH TREES GROWING ON FARM

	Insects Disease	Slow Growth	High Mortality	Theft	Wind Damage	Neighbor's Herds
Problem reported (multiple responses)	37/25x	44/30x	15/10x	59/40x	31/21x	32/22x

When asked which species of fruit tree they would most like to grow on the farm, overwhelmingly the people surveyed chose Avocado (87%). Fruit trees, as evidenced in Table 7, are among the most highly desired of all tree species.

TABLE 7: FRUIT TREES DESIRED

Species	f	% (multiple responses)
Avocado	129	87
Prune	113	76
Maracuja	85	57
Guava	73	49
Coeur de Boeuf	70	47
Other	24	16

5.2 Agroforestry practices: planting trees in crop fields.

The results of the survey indicate that a relatively large percentage of respondents (70%) already have experience in planting trees in crop fields. The species most commonly grown in this configuration are Fruit trees (38%), Grevillea (29%), and Leucaena (17%), all appropriate agroforestry species. This interplanting of trees and food crops, known as agroforestry, is being widely promoted at present by the Rwandan Forestry Service as a means of providing wood, improving soil fertility, checking erosion, and furnishing fodder, mulch, and food for use by farm families. Given the small size of the average farm and the high population density in the Project zone it is becoming increasingly difficult for farm families to meet simultaneously their food and wood needs. Agroforestry is seen as a potential solution to the dilemma these people face. The Project has begun to promote agroforestry in the region through its extension program and the creation of a demonstration farm at Kirambo. The percentage of agroforestry species in sector nurseries will be increased to meet the demand generated by the extension effort.

When asked how tree and food crop production is affected by intercropping, one-third of the farmers surveyed claim that crop production is improved, while slightly more than one-half cite good tree growth resulting from this practice. The percentage of farmers not responding to these questions is relatively high, around 33%. It is likely that such observations are neither easily made nor easily recalled. Statistical tests of the degree of association between better crop production and the use of particular tree species reveal that crops grow significantly better when

interplanted with *Grevillea* (100% confidence level) and *Leucaena* (94% confidence level). There is as well a strong association (100% confidence level) between worse crop production and having interplanted "Other" tree species. Among the responses in the "Other" category are *Eucalyptus* spp., *Arundinaria alpina*, *Iboza riparia*, *Vernonia amygdalina*, and *Cupressus* spp., none of which is an appropriate agroforestry species. Thus it appears that farmers in the area are experiencing different results from different tree - food crop interplantings and may even recognize this themselves. (Certainly the negative influence of *Eucalyptus* on food crops is widely known; farmers report verbally that they have learned from prior experience that *Eucalyptus* "poisons" the soil.) With such a base to build upon the Project can increase the level of knowledge of agroforestry among the area's inhabitants and diffuse it widely in the Project zone. No doubt some of these observations already are a function of the extension effort in the region. Such observable indicators of the effectiveness of tree - food crop interplantings are of considerable value in promoting agroforestry in the area. These data are found in Tables 22 and 23 in the appendix.

5.3 Energy: types and frequencies of use, problems in obtaining fuelwood, sources of fuelwood, time spent searching for fuelwood, quantity of fuelwood used.

Rwandans need to put under cultivation as much land as they can in order to meet the growing food needs of a rapidly increasing population (3.5% per year). Energy needs increase too as does population and this creates the dilemma referred to previously. If land is taken out of wood production, where do people obtain fuel to meet their energy needs? The survey reveals that wood (49%), crop residues (30%), and woody vegetation (18%) constitute the principal cooking fuels in the region. These percentages do not refer to the quantities of each fuel used but rather the proportion of total responses attributed to each fuel type. Respondents were asked separately to estimate the quantity of fuelwood used per month (see Table 11); such estimations were not obtained for quantities of crop residues and woody vegetation (to do so would entail a study of a different order entirely, with regular monitoring of cooking fuels used by families).

Table 8 presents more clearly the relationship between type of cooking fuel used and frequency of use. Wood is overwhelmingly the fuel of choice. Fully 100% of the respondents use wood as cooking fuel all or part of the time. Crop residues are commonly used some of the time (57%), as is woody vegetation (28%). Fuels claimed never to be used are manure (96%), charcoal (97%), and petiole (99%).

TABLE 8: TYPE OF FUEL USED FOR COOKING and FREQUENCY OF USE (X = row)

Fuel	Always	Frequently	Sometimes	Never
Wood	56/38%	67/45%	24/16%	0/00%
Crop residue	0/00%	4/03%	85/57%	59/40%
Woody vegetation	2/01%	9/06%	42/28%	94/64%
Manure	1/01%	0/00%	4/03%	143/96%
Charcoal	0/00%	1/01%	3/02%	144/97%
Petrole	0/00%	0/00%	1/01%	147/99%

The wood used by the people of the region comes mainly from living trees which are cut down. Slightly more than one-half of all fuelwood is obtained in this way. Table 9 shows the percentage of respondents who obtain wood from the sources cited, where more than one source per respondent has been identified.

TABLE 9: SOURCE OF FUELWOOD

Source	f	X (of yes responses)	X (of total activity)
Cut down live trees	131	89	52
Collect dead wood	45	30	18
Purchase wood	40	27	16
Cut branches of live trees	37	25	15
total activity	253		

This wood is found mostly on the individual's own farm (68%), much less so on neighbor's farms (14%) or in communal forests (10%). Table 24 in the appendix presents information on the location of fuelwood, where multiple responses are possible. The relative infrequency of obtaining wood from communal forests would indicate that the Project should direct the better part of its effort at on-farm rather than plantation silviculture; in fact the Project calls for approximately 6 times as much land (in hectares) to be planted on the farm as in communal forests. The emphasis placed upon agroforestry is consistent with this strategy.

The location of the source of fuelwood on the farm itself is identified in the survey. Woodlots are cited in 63% of the responses; trees in crop fields (21%), on property boundaries (11%), and in live fences (8%) are less common sources. Table 25 in the appendix indicates where respondents find wood on the farm, where multiple responses are possible. The relatively high proportion of fuelwood obtained from trees planted in crop fields is encouraging insofar as the agroforestry component of the program can proceed from the base of a practice already known and relatively widespread in the area.

The tools used to cut wood are invariably the axe and machette. A small number of farmers use a saw or pick in addition.

When asked if they have a problem in satisfying their need for fuelwood, 56% of the respondents say they do not. When the responses to this question are segregated by the criterion of progressiveness, it is revealed at a statistically significant level (5%) that more non-progressive farmers than would be expected by chance do have a fuelwood supply problem (the converse is true for progressives). Apparently the relatively high percentage of individuals who report that the supply of fuelwood is not problematical is largely a function of the relatively high proportion (31%) of progressive farmers in the sample. It can be concluded at this time that a fuelwood crisis is not yet widespread in the Project zone but that the majority of families in the area are experiencing difficulty in locating enough fuelwood to satisfy their needs.

Table 10 shows the average time spent per day in search of fuelwood although it was not determined if in fact wood is collected on a daily basis. This too is an indicator of the availability of wood in the region. Although a large percentage of respondents (43%) average one hour or less per day searching for wood, 57% spend more than one hour per day engaged in this activity, and fully 15% spend more than 3 hours per day in obtaining wood. Time spent searching for fuelwood is time not spent on other productive activities. This is a particularly significant observation given that the Farming Systems Improvement Project, based in Cyeru Commune, is likely to promote new technologies for increasing agricultural production which will require greater labor inputs from the members of the region's families. If agroforestry is promoted, the time otherwise spent locating fuelwood can be put to more productive use managing activities on the farm itself. Given too that it is women who both do the major part of the agricultural work and collect wood, the potential value of raising wood on the farm while at the same time improving soil fertility and increasing crop production is not to be underestimated.

TABLE 10: TIME SPENT PER DAY SEARCHING FOR FUELWOOD

Time (hours)	f	z
less than 1	64	43
1-2	43	29
2-3	13	09
3-4	12	08
4-5	4	03
5-6	6	04
NR	6	04

The quantity of fuelwood used per family in the Project zone is reported in Table 11, by faggots (bundles) per month. It seems that a faggot varies in weight from 15 - 20 kgs. depending upon the size of the person carrying it; thus estimates of the amount, in weight, of per capita wood use cannot be made with accuracy. Per capita wood use by faggot is 2.06/month in the wet season and 1.39/month in the dry season. As the average size of a household in the survey is 6.5 persons, the monthly averages per household are 13.37 in the wet season and 9.04 in the dry season. The range in fuelwood used per month is extraordinary, varying from 1/5 faggots per person to 21 faggots per person; by household the corresponding figures are 1 and 60. Dry season wood consumption is reduced by an average of 4.3 faggots/month/family, with 76% of families using less than 15 faggots/month in the dry season. The figure for the wet season is 54%.

TABLE 11: QUANTITY OF WOOD USED (faggots per month) by SEASON

Quantity	Wet		Dry	
	f	z	f	z
1-5	12	08	23	16
6-10	27	18	39	26
11-15	21	14	23	16
16-20	23	16	19	13
21-25	8	05	3	02
26-30	10	07	3	02
more than 30	11	07	2	01
NR	36	24	36	24

5.4 Extension: frequency of visits, preferred frequency of visits, contact with nurseries, experience planting trees on the farm.

It is through the extension service and the nurseries that the Project reaches farmers with information about correct silviculture and agroforestry practices. It is essential that the extension program be effective if the Project is to have planted 2500 hectares of privately-owned farm land. The survey indicates that 21% of the respondents (125 of 592 total responses) have had contact with an extension agent more than two times, and 40% have been reached at least once. Table 12 shows the distribution of visits by extension agents and where they have taken place.

TABLE 12: FREQUENCY and SITE OF VISITS BY EXTENSION AGENT (% = column)
(multiple responses possible)

Frequency	On Farm	Neighbor's Farm	Common	Elsewhere
Once	20/14%	7/05%	11/07%	12/08%
Twice	36/24%	10/07%	13/09%	5/03%
More than twice	56/38%	10/07%	33/22%	26/18%
Never	36/24%	121/82%	91/62%	105/71%

Seventy-five percent of the respondents have met extension agents on their own farm at least one time, which is a statement of the effectiveness of the extension program at present. Yet meetings on neighbor's farms, at the Communal center, and at markets, sector meetings and nurseries are taking place much less often. If the Project is to reach most of the households in the sub-prefecture it will be necessary to make initial contact at those places where people periodically collect; these meetings would supplement those already taking place on the farm. The Project ought to consider as well establishing a system whereby farmers who wish to receive seedlings from sector nurseries must first undergo a brief stage, of about 1 hour's duration, to acquaint them with the program the Project is promoting and with Project personnel. They would receive a permit afterward entitling them to receive seedlings. This system could be elaborated so that farmers wishing to obtain yet additional seedlings would have to develop in collaboration with the *monagri* a tree-planting configuration scheme to ensure that each species will be used and sited appropriately.

Another indicator of the extension service's effectiveness is the number of respondents who express an interest in meeting *monagri*. Eighty-one percent of the farmers surveyed indicate that they would like to receive 1-2 visits per week from a *monagri*. Ordinarily there is little farmer interest in meeting with agents unless farmers believe they will

profit from the contact. Table 26 in the appendix presents this information. It is noteworthy that when these responses are segregated by Commune (see section 6.1), the respondents in Cyeru express significantly greater interest in meeting agents than do those in Butaro (98% confidence level). As the Project has been active for a longer period of time in Cyeru, it can be postulated that the success of the program in reaching farmers has generated more widespread interest in the Project's extension activities. It can be expected that this interest will yet develop in Butaro Commune.

The proportion of people in the survey zone who have received seedlings from a sector nursery in the past year also is an indicator of the number of households being reached by the Project. Sixty-one percent of the respondents have obtained seedlings in this manner. Table 13 shows the frequency of farmers receiving seedlings from sector nurseries and the desirability of doing so. Ninety-four percent of the respondents would like to receive seedlings from Project nurseries. A demand of this magnitude is especially meaningful if a program to sell seedlings is to be implemented (see section 5.6).

TABLE 13: SURVEY PARTICIPANTS HAVING RECEIVED PROJECT SEEDLINGS IN THE PAST YEAR and THOSE WHO WOULD LIKE TO RECEIVE SEEDLINGS

	Yes	No	HR
Having received seedlings	90/61%	55/37%	3/02%
Would like seedlings	139/94%	8/05%	1/01%

The practice of planting trees in food crop fields, a principal component of the Project's agroforestry program, is not unfamiliar to the area's residents (70% have intercropped trees and food crops). The percentage of respondents following this practice varies significantly (5% level) with the frequency of visits from a *monagri*. Thus where agents visit farms more often trees are more often found growing in crop fields. Where the Project has been more active, i.e., in Cyeru Commune, the association with intercropping also occurs at a significant level (3%). Thus it can be argued that there is a significant relationship between the extent of extension activity and adoption of agroforestry practices.

Not all on-farm planting will be in agroforestry configurations. Most farmers report (88%) having already planted trees on the farm. As part of the extension effort *monagris* should see what farmers have planted and offer counsel on site and species selection and on how to improve the care and maintenance of seedlings and young trees.

5.5 Social Forestry: men's and women's rights of use and access to wood, who cuts wood for particular uses, women's right to cut fuelwood and dead wood by use and species.

The determination of which members of the farm family will profit most from improved silviculture/agroforestry practices can aid the Project in promoting equity on the farm. As a hypothetical example it can be argued that promoting construction-wood species at the expense of fuelwood species would benefit men and penalize women. In Rwanda there is little indication that men perceive the fuelwood problem to be less critical than do women. Although rights to harvest and use wood do vary considerably by gender, the perception of the family's wood needs and the rights of members of the household to wood does not vary significantly by the sex of the respondent (see section 6.3).

The issue in this section is focused on the male and female heads of the household. It is widely known in Rwanda that women spend more of their time performing agricultural work than do men, in addition to being responsible for cooking, child rearing, and wood and water collection. Historically the production and harvest of trees have fallen within the domain of the man. It is important at this time to identify the extent of women's and men's involvement in silvicultural activities and the rights to use wood that is on the farm. In the future it will be necessary to see how these patterns have evolved. Among the questions we must ask is: whose responsibility will agroforestry be - the woman who works the fields or the man who cares for trees?

Table 14 indicates which member of the family cuts wood, depending upon the use to which that wood will be put. Men clearly dominate in all categories, save for "medicine," in which "no response" dominates. Interviews conducted on the colline prior to the start of the survey revealed that women usually inform their husbands when they need fuelwood and he then arranges for the wood to be purchased and/or cut. She and the children haul it. Table 14 indicates that 81% of the respondents report that cutting fuelwood is a man's activity.

TABLE 14: PERSON CUTTING WOOD by USE OF WOOD (x = column)

Person	Fuel	Construction	Carpentry	Medicine	Fencing	Tools
Man	120/81x	129/87x	96/65x	18/12x	109/74x	100/68x
Woman	17/12x	0/00x	0/00x	54/36x	2/01x	2/01x
Other	8/05x	8/05x	25/16x	9/06x	3/02x	15/10x
NR	3/02x	11/07x	27/18x	67/45x	34/23x	31/21x

The fuelwood question is pursued further in the survey by inquiring if a woman has the right to cut a living tree without first asking her husband for permission (recall that most fuelwood is obtained by cutting down live trees). Ninety-one percent of the respondents report that a woman cannot cut live wood for fuel without permission from her husband. Clearly the need for fuelwood does not give a woman the right to cut it at her own discretion.

The respondents were asked if a woman can cut dead wood without asking permission from her husband; the responses are segregated by tree species. These results are presented in Table 15. It is noteworthy that for only two species are the "yes" responses equal to or more numerous than the "no" - Eucalyptus and Black Wattle. These are the two principal fuelwood species. Thus it appears that, to a degree, women can cut dead fuelwood. Her rights to cut live wood or wood to be used for purposes other than as fuel are limited, however.

TABLE 15: WOMAN CUTTING DEAD WOOD WITHOUT ASKING PERMISSION FROM HUSBAND
by TREE SPECIES (X = column)

	Eucalyptus	Pine	Grevillea	Black Wattle	Markhamia	Leucaena	Acacia	Fruit
Yes	66/45X	04/03X	03/02X	90/61X	09/06X	23/16X	04/03X	39/26X
No	67/45X	129/87X	130/88X	43/29X	124/84X	110/74X	129/87X	94/64X
NR	15/10X	15/10X	15/10X	15/10X	15/10X	15/10X	15/10X	15/10X

Table 27 in the appendix again segregates responses by wood use. In contrast to the information presented in Table 14, which describes who in the family actually cuts wood for various uses, this table shows those uses for which women can cut wood without asking their husband's permission. Fuelwood and medicine are the only categories in which the "yes" responses dominate. This supports the information in Table 15 which demonstrates that women have occasional access to Eucalyptus and Black Wattle, fuelwood species (and the former used for medicinal purposes as well).

As a summary statement of the proportion of women actually cutting fuelwood without first asking their husband's permission, we can consider the responses to two questions: 12% of the women cut fuelwood and 60% can cut fuelwood without asking permission. Sixty percent of 12% or approximately 7% of the women in the Project zone are in fact cutting wood without asking a husband for permission. This is curious. Approximately 20% of the rural households in Rwanda are headed by women (the agricultural survey reports 20.7% as the average in Ruhengeri Prefecture and 21.7% as the national average). Thus we would expect some 20% of the women surveyed to

be cutting wood without first going to a husband. It can be hypothesized that the figure of 7% is a reflection of the especially poor status of most female-headed households. Wood, in all likelihood, is not available on these farms; woody vegetation and crop residues are burned instead. The effort to associate type of fuel used with a wealth variable, in this case farm size, proved to be unrewarding because of the presumed invalidity of the responses to the question on size of farm (as discussed previously in section 4).

5.6 Economy: seedling purchases, fuelwood sales and purchases, revenue from fuelwood sales, person selling wood, person keeping revenue.

A few simple measures of the monies involved in fuelwood transactions are obtained in the survey. Approximately one-third of the respondents have bought and/or sold fuelwood at one time or another. These data are presented in Table 16. It is interesting to note that the average price for purchasing a faggot of fuelwood is almost twice the farmer's selling price. This suggests that intermediaries are involved in the transactions. No such conclusion can be drawn from the sale of trees, however. It appears therefore that the sale of fuelwood is an economic activity which profits both the farmer and other entrepreneurs. There is a weak association (11%) between progressive farmers and wood sales (see section 6.2), indicating that progressives are selling more wood than one would expect by chance. No doubt they are economically better off than other farmers, perhaps itself in part a function of having wood to sell.

TABLE 16: PURCHASE and SALE OF FUELWOOD (X = row)

	Yes	No	NR	Price/bundle (FRW)	Price/tree (FRW)
Sale	55/37%	91/62%	2/02%	30	345
Purchase	49/33%	96/65%	3/02%	56	335

When asked the frequency with which they buy fuelwood, the great majority of farmers surveyed (76%) do not answer the question. This percentage is slightly higher than the two-thirds of the respondents who claim never to purchase fuelwood. It is likely that most of these are the same people. Of those who do respond, 15% claim to purchase fuelwood 1-2 times per month; 9% buy fuelwood more than 3 times per month. Non-progressive farmers do not buy fuelwood any more often than do progressives. The latter can likely satisfy their fuelwood needs from their own supply; the former, without as large a supply and without as great a purchasing power, must burn more crop residue and woody vegetation (see section 6.2 for a more complete discussion of fuelwood and progressiveness).

The information presented in Table 17 represents respondents' estimates of the percentage of total farm revenue obtained from the sale of fuelwood. It is apparent again that most respondents (74%) are unable or unwilling to make such an estimate. Otherwise the majority of those individuals who provide a figure report less than 20% of total farm revenue obtained in this fashion. This figure should be regarded as a rough estimate in consideration of the high proportion of respondents - 3 of 4 - who have not answered the question.

TABLE 17: REVENUE FROM SALE OF FUELWOOD

Percent of total farm income	f	z
00-10	17	11
11-20	7	05
21-30	3	02
31-40	5	03
more than 40%	7	05
NR	109	74

At this time it appears that the sale of fuelwood is an activity which brings a small but not insignificant income to about 25% of the families in the Project zone.

The sale of wood is largely a male activity: only a single respondent reports that it is the woman who sells wood (women-headed households generally are too poor to have available wood to sell). Most respondents (62%) do not answer the question. Thus it appears that when fuelwood is sold (in about one-third of the cases) it is men who make the sale (37 of 38 respondents report this to be so).

It is interesting to note that when asked who keeps the revenue generated by the sale of wood, women are cited in 9% of the cases. Again there is a large percentage (62%) of individuals who do not respond to the question. Of those who do, 71% claim that men keep this revenue. It appears that in a few cases, then, men sell wood and give the revenue to their wives. This finding is not inconsistent with information obtained in on-farm interviews. It is characteristic of Rwandan families that, to a degree, men and women create work and economic arrangements which suit their own lifestyles and personalities.

It is of value to the Project and the Forestry Service to know how receptive rural dwellers are to the idea of purchasing seedlings. Certainly the sale of seedlings would add considerably to the funds available to the Project and the Commune, especially for financing the forestry extension program after AID support ends. The survey results strongly indicate a willingness on the part of farmers to buy seedlings. These data are presented in Table 18.

TABLE 18: WILLINGNESS TO PURCHASE SEEDLINGS and PRICE

Species	f	%	price (FRW)
Avocado	107	72	13.17
Eucalyptus	93	63	1.86
Prune	82	60	2.87
Grevillea	74	50	2.57
Maracuja	60	41	1.90
Guava	60	41	2.45
Coeur de Boeuf	57	39	6.20
Pine/Cyprus	57	39	1.75
Markhamia	51	34	2.00
Leucaena	38	26	1.32
Acacia	35	24	2.00
Black Wattle	33	22	2.18

In four instances more than one-half the respondents express a willingness to purchase seedlings. These highly desired species are Avocado (72%), Eucalyptus (63%), Prune (60%), and Grevillea (50%). Fruit tree seedlings are consistently cited in more than two-fifths of the responses, at prices generally above 2 FRW/seedling and as high as 6 FRW for Coeur de Boeuf and 13 FRW for Avocado (grafted or improved). These results should encourage the Forestry Service to begin selling seedlings in the immediate future. If rural dwellers prove as eager to purchase seedlings as they claim, the sale of seedlings will enable the Forestry Service to take an important step forward toward financial self-sufficiency in the coming years.

6. Results II: Commune, Progressive Farmer, Sex of Respondent

Four main independent variables were selected in the design of the survey to measure significant differences among respondents. Of the four, the variable chosen to represent wealth, i.e. farm size, proved to be unusable. As discussed in section 4 of this report, average farm size in the Project zone was reported to be considerably larger - 3.3 hectares - than has been documented for the area by the National Agricultural Survey. The Project Direction has concluded that neither the *monagris* nor the farmers themselves are capable of estimating field size. There remains yet another variable which likely reflects differences in wealth among farmers - that of progressiveness. Significant differences associated with this variable are numerous and can be understood to represent differences in wealth; yet this criterion mostly reflects differences in the quality of farming systems, as discussed previously in section 4. Thus the variables which remain valid segregate the population of the region by Commune (and by extension, duration of Project activity), quality of farming system (and by implication, extent of contact with the Project's extension program), and gender (and the accompanying differences in rights and responsibilities with regard to agro-economic activities).

6.1 Commune

The Project began its activities in Cyeru Commune in April, 1984. It was not until December of that year that the effort was extended to Butaro Commune. To date the Project has worked for two planting seasons in the former commune and for one in the latter. This difference in time of activity between the two communes is especially meaningful with regard to the extension program and its effectiveness, and more particularly with reference to the *monagris* themselves. In principle, more experience as an extension agent should increase one's overall effectiveness. The results of the survey indicate that in fact "Commune" is an important variable for what is revealed about the activities of the Project in the two communes. Consistently the program appears to be operating more successfully in Cyeru Commune. This of course accords well with the expectation of greater effectiveness with increased length of time of operation. **It should be noted that despite the relative success of the Project in Cyeru there is yet considerable room for improvement in the extension effort in that commune.**

The most statistically significant results in this category are the associations between Commune and type and frequency of visits farmers have received from extension agents. Respondents in Cyeru Commune consistently report more frequent visits for all locations of extension activity: on the farm, on neighbor's farms, at the Commune, and elsewhere. The confidence level is very high for these associations - 99%. Thus it appears that significantly more households are being reached in Cyeru.

additional support for this conclusion can be drawn from other survey results, such as the frequency with which trees are planted in crop fields. This feature of the agroforestry program is being promoted by the Project. At a confidence level of 97% tree - food crop interplanting is positively associated with Cyeru Commune. This is an indicator of the successful extension of a critical feature of the Project's technical program, a consequence of the time and effort spent in Cyeru Commune.

There is convincing indirect evidence that the fuelwood problem is less pronounced in Cyeru. At a significance level of 8% the use of wood for fuel is positively associated with Cyeru and negatively so with Butaro. The reverse is true for woody vegetation as a fuel. In this instance, at a confidence level of 100%, the use of woody vegetation is positively associated with Butaro and negatively so with Cyeru. Thus it would appear that the residents of Butaro Commune are burning less wood and more inferior material because they are unable to locate or afford to purchase fuelwood. Since we cannot segregate responses by wealth, we do not know in fact if the respondents in Butaro are less wealthy than those in Cyeru. The number of progressive farmers in the survey is approximately two times greater in Cyeru than in Butaro, a fact which could account for the differences noted here. It is demonstrated in section 6.2 that progressives receive more visits from extension agents than do other farmers. Yet there are significant associations which vary at the Communal level but not by the criterion of progressiveness which supports the contention that the variable "Commune" is meaningful in its own right. In any event, the Project would do well to consider that the fuelwood needs of Butaro Commune may be more immediate than they are in Cyeru and consequently to structure its program accordingly (e.g. by concentrating on planting more fast growing fuelwood species).

There is one silvicultural problem which is significantly greater in Cyeru Commune. At the 10% level there is a positive association with slow growth. This is likely a function of the relatively poor soils in Cyeru. We might consider as well that there are more progressives surveyed in Cyeru and that they may be better observers of agricultural phenomena than are non-progressives and thus more cognizant of a problem of this type. There is evidence in the following section to support this conclusion.

Finally we notice that there are significant differences by Commune with regard to the willingness of residents to purchase seedlings. For six species - Pine/Cyprus, Leucaena, Black Wattle, Acacia, Coeur de Boeuf, and Guava - the respondents in Cyeru express significantly greater willingness to buy seedlings (significance levels vary from 0% for Pine/Cyprus to 8% for Coeur de Boeuf). Curiously these species are among the least popular in the region (see section 5.6). Could it be that average farmers are not interested in them but that they are of greater value to progressives, particularly in light of the fact that progressive farms are larger than others? If so, then the higher proportion of progressives in Cyeru can again be cited as a significant factor. Alternatively, the extension effort in Cyeru may be promoting these species for specialized sites and uses and thus the residents of the Commune are more receptive to them.

6.2 Progressive Farmer

Twenty farmers per sector in the Project zone have been identified by the Agronomes of the Sub-Prefecture as progressive. Among the characteristics their farms exhibit are a brick house with tile roof, stabled livestock, newly introduced agricultural technologies, live fencing, and generally a more readily observable, high quality farming system. It is likely that these farms are larger and the households wealthier than are others. Of this there is no doubt: these farmers receive first and most completely the new agricultural technologies which are introduced into the area. Nor is there much doubt that in many ways these are model farmers: their families are hard-working and their farms are well-managed. The Project has expressly directed its extension effort at progressives following the dictates of the Forestry Service. This approach works - up to a point. It can be demonstrated that progressive farmers adopt and utilize new and/or promoted technologies more regularly than do other farmers. It has not been demonstrated that interventions made on progressive farms diffuse to others. **It is critical that a study be undertaken to determine whether or not the progressive farmer program in Rwanda is an effective means of spreading desired technology.** It should be determined as well the magnitude of the benefits progressives receive vis-a-vis other farmers. The development literature is rich with examples of the failures of "model farmer" programs. There is no need to add Rwanda to that list. Rather, it should be documented that technology does in fact diffuse from progressives to others; if it cannot be demonstrated that this is so, then a procedure should be proposed to promote it. At this time in the development of Rwanda it would be a mistake to abandon altogether the model farmer program. It has been proven an effective means of trying new technology in cooperative and capable hands and forms a solid foundation upon which other efforts and other approaches may be built.

There are a number of indicators which suggest that progressive farmers are wealthier than others. Fewer progressives report a problem in obtaining enough fuelwood to satisfy the needs of their family (5% level of significance). At a significance level of 11% progressives sell more wood than do other farmers. At the 8% level of significance fewer progressives depend upon live fences as a source of fuel. Progressive farmers, we may conclude, are more secure in their supply of fuelwood, even to the point of being able to sell some of it.

Although variation in agroforestry practices reveal that Communal differences are significant, this cannot be said to be so for the progressiveness variable. Planting trees with food crops appears to be more a function of extension counselling than of progressiveness at this time. It is worthwhile here to examine the figures on progressive farmers in the two communes of the study. These are presented in Table 19 below.

TABLE 19: PROGRESSIVE FARMER by COMMUNE

Progressive	Cyeru	Butaro	Chi-square = 2.44	Sig. = .12
yes	31	15		
expected value	25.8	20.2		
no	51	38		
expected value	49.7	39.1		

There is not a strong association between progressiveness and Commune; nonetheless the difference in absolute numbers of progressive farmers in the 2 communes (31 versus 15) itself is meaningful. It should be borne in mind that 56% of the survey sample is taken from Cyeru Commune, which is larger than Butaro. We would expect by chance that more progressives would be found in the Cyeru survey sample. But not twice as many. It should be noted as well that of the 13 individuals who do not answer the question on progressiveness, 12 are from Butaro. It is not at all clear why so many respondents in Butaro do not know whether or not they are progressive. Of course it is possible that several enumerators in Butaro did not solicit this information for reasons which are at the moment unknown. All the blank responses on the questionnaires can be attributed to 3 *monagris*/enumerators; they have been identified to the Project Direction. They will be asked to explain this finding. In sum, the greater number of progressive farmers in Cyeru may have influenced some of the variation at the Communal level; most of that variation, however, appears to be a function of the extension program which is more firmly entrenched there.

As surmised in the preceding section, there is a significant relationship between the identification of silvicultural problems and progressiveness. More progressive farmers are identifying problems with insects and disease (2% level of significance). As already suggested, it is likely that progressives are observing more closely the condition of their trees and thus are more aware of the problems which strike them. Otherwise it is difficult to guess why infestation and disease would attack more often the trees on progressive farms.

Finally it is of significance at the 6% level that progressive farmers receive more visits from extension agents than do others. This is intentional and the survey merely records the fact. Progressives do not receive seedlings any more often from sector nurseries, however. The Project's policy to date has been to provide seedlings to whomsoever wishes them. The Project ought to explore the possibility of granting nursery permits to those farmers who have completed a silviculture/agroforestry stage as a means of limiting access to those individuals schooled in correct practices (as discussed in section 5.4).

6.3 Gender (sex of respondent)

Often it can be hypothesized in advance that gender will be a variable of considerable significance in coming to understand better agricultural and socio-economic behavior. In this instance gender is a nearly completely insignificant factor in explaining variation in the responses of persons surveyed. Approximately 42% of the sample is composed of women, of whom 10, or 22%, claim to be progressive; yet their responses rarely differ significantly from those of men. Only in a single instance does this prove not to be so. At a significance level of 6% more men and fewer women than one would expect by chance indicate that a woman can cut fuelwood without first asking the permission of her husband. As it is women who engage in this activity, their response seems to indicate that in fact they do not very often do this; men's responses appear to reflect more the expression of a principle - that women can perform this activity as described. Such a distinction between "real" and "ideal" culture is commonly made. In this instance it demonstrates that women may have less freedom to act (vis-a-vis cutting fuelwood) than men would like to say they have.

Otherwise gender does not explain variation with regard to the responses communicating silviculture knowledge (which species to plant where), difficulty in obtaining fuelwood, time spent searching for wood, nor the species of dead wood a woman can cut. There is, on the other hand, something to suggest that the most frequent visits of extension agents are with men. Men receive twice as many visits as do women. This is of particular importance given the emphasis the Project is placing on agroforestry. The care and maintenance of agroforestry species will likely be the responsibility of women and it will be essential for the monagris to reach them. The Project should make a clear and concerted effort to extend its program to women, both individually on the farm and in groups at health and nutritional centers, adult education centers, and cooperative gatherings.

7. Conclusions and Recommendations

7.1 Conclusions

The Communal Afforestation Project faces a challenge at this time which is entirely of its own creation: to continue the success it has achieved to date by reaching the majority of households in the Project zone of Kirambo sub-Prefecture with a silviculture and agroforestry technology that is critical to meeting simultaneously the needs of farm families for fuelwood and increased crop production. The small farms on which Rwandans practice agriculture leave little room for the creation of discrete wooded parcels, yet the needs of the family for cooking fuel continue to grow each year along with the population. The fuelwood "crisis" which does not yet exist in Cyeru and Butaro Communes can be put off indefinitely if farmers take it upon themselves to secure an on-farm wood supply which does not encumber other agricultural activities. Agroforestry is an approach to land management which is designed expressly to satisfy a multitude of needs: for wood, nitrogen fixation, erosion control, fodder, mulch, and food. It is apparent that farmers are to varying degrees already familiar with tree - food crop interplanting, have observed the consequences of planting different species with different crops, and are receptive to receiving visits from extension agents. Thus there is in place a sound sub-structure upon which the Project may build with confidence a successful agroforestry program. But herein lies the challenge presented above: can the Project continue to meet the expectations it has generated through the attainment of initial goals by reaching yet more difficult ones in the coming years?

The establishment of nurseries and the planting of communal forests were fundamental activities for the first 18 months of Project operation; planting more than 2000 hectares of individually owned farmland in the remaining 2 years will be considerably more difficult yet. The challenge is basically two-pronged: organizational and instructional. The Project's activities, increasingly complex and widespread (work in Nyanzali Commune begins in October, 1985), will need to be planned and implemented with greater care, greater efficiency, and greater forethought. Increased and regular instruction for extension agents will necessarily be a component of the program. At present the *mwagiris* simply do not know enough about agroforestry to be capable of successfully extending its technology. Weekly staff meetings between the *mwagiris* of each Commune and their *agapanga* supervisors should be instituted immediately. Only through the increased efforts of all Project personnel will the success of the Project to date be replicated and even surpassed in the next two years.

The socio-economic survey conducted in Cyeru and Butaro Communes has furnished the Project with much data to be integrated into its work plan. The varieties and locations of trees growing on the farm have been identified, as have been their uses; farmers' preferences for tree species

likewise have been solicited and recorded. The extent of farmer familiarity with agroforestry has been noted, as have the consequences of tree - food crop interplanting. The severity of the fuelwood shortage in the region has been crudely estimated from farmers' statements on the availability of various fuel sources, the frequency with which they are used and the time spent searching for fuelwood. Farmer perceptions of the severity of the fuelwood crisis have been recorded. Differences in rights to cut and use wood among men and women have revealed that men are predominately the owners of wood; yet men and women share a perception of woods preferred and needed, and the impression is of a household which strives in cooperation to meet its fuelwood needs. The extension program has been demonstrated to be functioning at an acceptable level, especially in Cyeru Commune where the Project has been active since its debut. It is expected that in time the program in Butaro will improve as well. In both Communes there is a desire for more visits from extension agents, a wish the Project should strive to fulfill. Especially with regard to providing instruction in the methods of agroforestry will the Project need to improve the skills of the monagris. There is little to date to indicate that the economics of silviculture are of major importance in the overall rural economy; yet the survey demonstrates that the potential for greater revenue generation exists. The willingness of the region's residents to purchase seedlings can be taken as an indication of the value they place in wood; when considered in light of the 30% or so of the families in the region who already are selling fuelwood it suggests further a confidence in the investment value of wood.

The survey highlights the role of progressive farmers in technology transfer and brings out the differences in the effectiveness of the program in the 2 communes. Progressives are being reached by the extension effort and are adopting the technologies the Project is promoting. Although there is still no clear indication that technologies extended in this fashion diffuse to other farmers, there is nonetheless evidence of technology adoption. It remains for yet additional investigation to monitor the diffusion of technologies transferred. At base, the extension effort is stronger where the Project has been longer active and it can be expected that with yet additional time in the field the impact of the Project will touch yet greater numbers of residents in the sub-prefecture.

Following is a discussion of the findings of the survey and a presentation of recommendations derived therefrom.

7.2 Findings and Recommendations

7.2.1 Methodology

Although the manner in which the survey was conducted proved rewarding, two problems were evident: the failure of the enumerators/extension agents in Butaro to select participants according to the survey plan and the inability of the farmers and monagris to estimate accurately farm size.

Recommendation 1: Survey enumerators need to be supervised closely in the field to minimize non-sampling error; the size of parcels on the farm must be measured for accuracy.

7.2.2 Sylvicultural Practices

Most wood on the farm that is used for fuel, construction, carpentry, and so forth is of the variety farmers prefer for each usage. There is an indication that farmers would like more *Grevillea*, both for carpentry and erosion control, and more *Leucaena* for the latter.

Recommendation 2: Nurseries should be stocked with the appropriate proportion of seedlings of each species based on the demand for each type.

Sylviculture in the Project zone is not practiced problem tree. Theft of seedlings and live trees, slow growth in Cyeru, and disease and infestation all are cited by at least 25% of the respondents as problematical.

Recommendation 3: The Project should identify species suffering from disease and infestation and undertake corrective action. Species selection should be based on varieties suitable to the agro-ecological conditions of the region. Theft should be called to the attention of the Conseiller of the sector where and when it occurs.

Fruit trees, and in particular Avocado, Frone, Maracuja, Guava, and Coeur de Boeuf, are extremely popular with the area's residents.

Recommendation 4: Nurseries should be stocked with sufficient numbers of fruit tree seedlings to meet the demand of the people in the Project zone.

7.2.3 Agroforestry

Agroforestry species, including *Grevillea*, *Leucaena*, *Markhamia*, and Fruit trees, are already being grown in crop fields. Farmers report that crops grow well in these configurations, and notice as well worse crop production when *Eucalyptus* is used for intercropping. The prevalence of trees in crop fields varies significantly with the number of visits farmers receive from *monagris*. Thus the extent of adoption of agroforestry practices appears to be a function of the frequency of visits from extension agents, which is a reason for the extension service to be highly motivated. Some 21% of all fuelwood comes from trees planted in crop fields, indicating that farmers already are aware of the potential of agroforestry to satisfy fuelwood needs through non-woodlot configuration planting.

Recommendation 5: Agroforestry species should be in sufficient supply in the nurseries to meet the demand the Project will create through extending agroforestry technology; monagris should be encouraged by the receptivity of farmers to agroforestry and strengthen their effort to meet with and instruct them.

7.2.4 Energy

An energy crisis does not yet exist in the Project zone, although it is apparent that 40% or more of the area's families have trouble satisfying their fuelwood needs. The problem is more pronounced for members of non-progressive farmer families; they appear to burn less wood and more crop residue and woody vegetation. More than one-half the respondents must spend more than one hour per day in search of fuelwood. Most of the material used for fuel is wood, but crop residue and woody vegetation constitute important sources as well. As most fuelwood used is located on the farm itself and not in communal forests, the thrust of the Project's efforts must be directed toward on-farm site and species selection.

Recommendation 6: The Project must direct most of its effort into on-farm planting programs, assisting farmers in selecting appropriate fuelwood and other species and planting sites. The Farming Systems project based at Rwerere should be aware of the time women spend each day in searching for fuelwood as it is time not used in other agriculturally productive ways. Agroforestry would enable women on the farm to work to improve both tree and crop production.

7.2.5 Extension

At present the extension effort is reaching 40% of the households in the 2 commune area surveyed. Eighty-one percent of the respondents in the survey express a desire to meet regularly with extension agents. This figure varies significantly by Commune; in Cyeru, where the Project has been active longer, there is greater farmer interest in the extension service. It appears that the extension program has laid the groundwork for a yet more intensive effort in the next 2 years. Over 60% of the respondents report having received seedlings from Project-operated sector nurseries; 94% express an interest in doing so in the future. Thus exposure to nurseries is relatively high as well. Most respondents have had experience in planting trees on the farm, and the percentage of those who plant trees in crop fields is greater as the number of visits they receive from the monagris increases. In Cyeru Commune tree + food crop interplantings are more prevalent yet.

Recommendation 7: Extension agents must assume an advisory role in working with the area's residents. Where trees have been already planted on the farm they must be observed by the monagris to make certain that species and site selection coincide and that seedlings are being maintained properly. Meetings with farmers should take place on the farm and elsewhere (at the Commune, in markets) where groups of individuals can be reached. The

Project should consider granting nursery permits to farmers who have completed an instructional stage as a means of reaching people with the Project's program and increasing the likelihood that sound silviculture and agroforestry practices will be followed.

7.2.6 Social Forestry

The rights to cut and use wood are clearly dominated by men. Save for cutting dead fuelwood, particularly Eucalyptus and Black Wattle, women ordinarily must first ask permission from their husband before cutting. Only a small percentage - 7% - of wood is actually cut by women, reflecting the Rwandan tendency for men to cut or arrange to have cut wood for women to haul. Where women cut wood themselves it is likely they are the head of household, probably widowed, and almost certainly poor. These too are the families experiencing the greatest fuelwood shortages.

Recommendation 8: Both men and women are interested in planting fuelwood species. The Project need not be concerned about promoting "men's" wood at the expense of "women's" wood. The Project should determine who will care for trees planted in crop fields - it will likely be women, and make a concerted effort to direct extension counselling to them. Female heads of household should be identified by the Project and should receive regular visits and counsel from the monagris. The fuelwood crisis is most severe for them and they are the least capable of buying wood.

7.2.7 Economy

About one-third of the people surveyed are engaged in the sale and purchase of wood. It appears that the price of a faggo of wood in the market is almost 100% higher than the price a farmer receives when making the sale. Intermediaries must be involved in these transactions. The revenue from the sale of wood is a small but not insignificant part of the total revenue of some 50% of the families in the Project zone. Wood sales are a male activity, although occasionally it seems that women keep the revenue these sales generate. The interest area residents express in purchasing seedlings suggests that the Project and the Commune could generate much needed revenue by charging a fee for seedlings, dependent upon species.

Recommendation 9: The Project should propose to the Forestry Service that a fee be charged to farmers wishing to obtain seedlings. Fruit trees in particular, and especially grafted Avocados, would be distributed in this fashion.

7.2.8 Commune

Considerable variation in the survey can be explained by the results obtained from the different communes. There are a number of significant indicators to demonstrate that the extension program is more effective in Cyeru - more households have been reached, a higher percentage of households plant trees in crop fields, and willingness to purchase seedlings is greater. The extension effort in Butaro needs to be strengthened, especially in light of the shortage of fuelwood which appears to be more pronounced there. A problem of slow tree growth is reported in Cyeru, largely a function of the inferior quality soils in that Commune.

Recommendation 10: The extension program appears to be operating effectively in the Project communes, but more so in Cyeru. It is essential that this effort be strengthened through increased instruction for monagri at weekly staff meetings and improved organization/planning of the extension service's activities. The effectiveness of the extension program in Butaro needs to be improved and the Project Direction should monitor that process in the coming months. The Project might want to consider dealing with the more immediate fuelwood crisis in Butaro by planting there fast-growing fuelwood species.

7.2.9 Progressive Farmer

The intentional effort to reach progressive farmers has paid dividends for the Project. They report receiving more visits from extension agents and exhibit a greater awareness of trees, their uses and potentials, and the problems they experience. Progressives express a greater willingness to purchase seedlings. They sell wood more frequently. Their fuel supply appears to be more secure.

Recommendation 11: The Project should attempt to work with progressives in order to reach other farmers with the technologies the progressives are trying. A study of the diffusion of technologies transferred should be carried out in the near future.

7.2.10 Sex of Respondent

Gender proved to be of little value in explaining variation in the responses to survey questions. Generally men and women share a perception of wood desirability, rights to wood use, and silviculture/agroforestry knowledge. Women's perception of their right to cut dead fuelwood, however, is significantly different from that of the men. It appears that men believe women have the right to make such cuttings whereas women claim in fact they do not do so. There is evidence to indicate that women are receiving fewer visits from extension agents than are men.

Recommendation 12: Women must be placed on the visit schedule of extension agents. They will likely be charged with some of the responsibility for the care of agroforestry species and will need to be counseled in the correct procedures to follow.

8. Appendix

**TABLE 20: MOST COMMON LOCATION OF TREES ON FARM by SPECIES (Σ = row)
(Σ of responses)**

Species	Near House	Field Boundary	Woodlot	In Crop Field
Eucalyptus	10	02	85	03
Pine/Cyprus	62	03	35	00
Grevillea	12	43	13	33
Black Wattle	11	04	84	02
Markhamia	14	48	02	36
Leucaena	31	21	02	45
Acacia	18	18	55	09
Avocado	72	01	01	26
Other*	53	13	03	30

*mostly Fruit

**TABLE 21: MOST COMMON USES OF TREES by SPECIES (Σ = column)
(Σ of responses)**

Use	Eucalyptus	Pine/Cyprus	Grevillea	Black Wattle	Markhamia	Leucaena
Fuel	41	07	04	61	03	12
Construction	40	05	04	29	10	00
Carpentry	08	46	56	00	41	00
Tools	05	03	02	09	30	00
Erosion Control	00	00	34	00	14	88
Fencing	03	39	00	00	02	00
Medicine	03	00	00	00	00	00

TABLE 22: EXPERIENCE PLANTING TREES IN CROP FIELDS and SPECIES USED

yes	104/70%		no	43/29%	NR 1/01%
grevillea	29%				
leucaena	17%				
fruit	38%				
other	16%				

TABLE 23: RESULTS OF TREE - FOOD CROP INTERPLANTING

Result	f	%
improved crop production	51	34
worse crop production	18	12
no change in crop production	32	22
NR	47	32
good tree growth	81	55
poor tree growth	4	03
NR	54	36

TABLE 24: LOCATION OF FUELWOOD SOURCE

Location	f	% (of yes responses)	% (of total activity)
own farm	136	92	68
other farms	27	18	14
communal forest	19	13	10
roadside	4	03	02
other	13	09	07
total activity	199		

TABLE 25: LOCATION OF FUELWOOD SOURCE ON FARM

Location	f	% (of yes responses)	% (of total activity)
woodlot	132	89	63
live fence	11	07	05
trees in crop fields	45	30	21
property boundary	23	16	11
total activity	211		

TABLE 26: FREQUENCY OF EXTENSION VISITS PREFERRED

Frequency	f	%
once per week	66	45
twice per week	54	37
once every 2 weeks	17	12
other	7	05
NR	4	03

**TABLE 27: WOMAN CUTTING WOOD WITHOUT ASKING HUSBAND FOR PERMISSION
by WOOD USE**

Use	f	%
fuel	88	60
construction	17	12
carpentry	4	03
tools	22	15
medicine	80	54

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT

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Le 28 octobre, 1985
REF: AID-308/85

Mr. Ntezilyayo Anastase
Minister of Agriculture, Livestock,
and Forestry
Kigali

C/O Minister of Foreign Affairs
and Cooperation
Kigali

Dear Mr. Minister:

Attached is a copy of the report on the socio-economic survey undertaken by the office of the AID Representative/Rwanda for the Communal Afforestation Project (Cyeru-Butaro-Nyamugali.).

The objective of the study was to furnish to the Project information on current silvicultural and agroforestry practices for inclusion in the design and administration of its technical and extension programs.

The survey was undertaken in June, 1985 in Cyeru and Butaro Communes under the supervision of Dr. Edward Robins, Social Science Advisor to the AID mission in Rwanda. Dr. Robins was assisted by Rubagumva, Alphonse, a graduate of the National University of Rwanda; additional support was provided by the Project Chief, Dusenge, Evariste and his staff of extension officers and agents. The extension agents themselves acted as enumerators for the survey.

The survey established that the Project has achieved the objectives which were targeted for the first 18 months of operation. These were focused on the establishment of nurseries, the training and employment of extension workers, and the planting of communal forests. The results of the survey reveal that attempts to introduce agroforestry principles and practices into the region have been initially successful, especially in Cyeru Commune, where the Project has been operational since its debut in April, 1984, and where the farmers are responding positively to the agroforestry messages of extension agents.

In general it appears that the extension service is more effective in Cyeru than in Butaro. We would like to believe that this is as it should be: activities in Cyeru have been underway for 18 months, while in Butaro it has been 12 months since the Project began its effort. If we can look forward to the improved performance of the extension service in Butaro in the coming months, we can expect greater Project effectiveness there during this next year.

Among the more important findings of the study are the following:

1. Farmers recognize that appropriate agroforestry species planted among food crops promote better yield;
2. More than 40% of the respondents report difficulty in obtaining fuelwood (this percentage would be considerably higher if progressive farmers were excluded from the sample);
3. Farmers express a willingness to purchase seedlings for a fee ranging from 2-13 FRW, especially for fruit tree species; and
4. Progressive farmers are, by design, being reached by the extension service more often than are other farmers, but it is not clear if technologies introduced first to progressives actually diffuse to other farmers.

Among the more important recommendations forwarded to the Project Direction are the following:

1. Management of nurseries and Project activities needs to be improved; more careful and earlier planning of activities is necessary;
2. Extension agents need to receive more training, especially in agroforestry ideas and practices;
3. Households headed by non progressive farmers and women also need to be reached by the Project and a greater effort should be made in that direction; and
4. A program for the sale of seedlings should be undertaken on a trial basis as a means of generating revenue for the Project.

Basically our office believes that this project is operating well technically; there is serious concern about its financial operation, however, insofar as more monies have been spent on casual labor costs than had been budgeted. As a result the Project's activities and finances will need to be reviewed and re-organized. Already an audit of the Project has been conducted. We intend to meet shortly with the Forestry Service to adopt a plan of action for the 2 years which remain before the termination of aid support for this project.

Please feel free to comment upon this report. We would be happy to assist your office further.



Emerson Melaven
AID Representative