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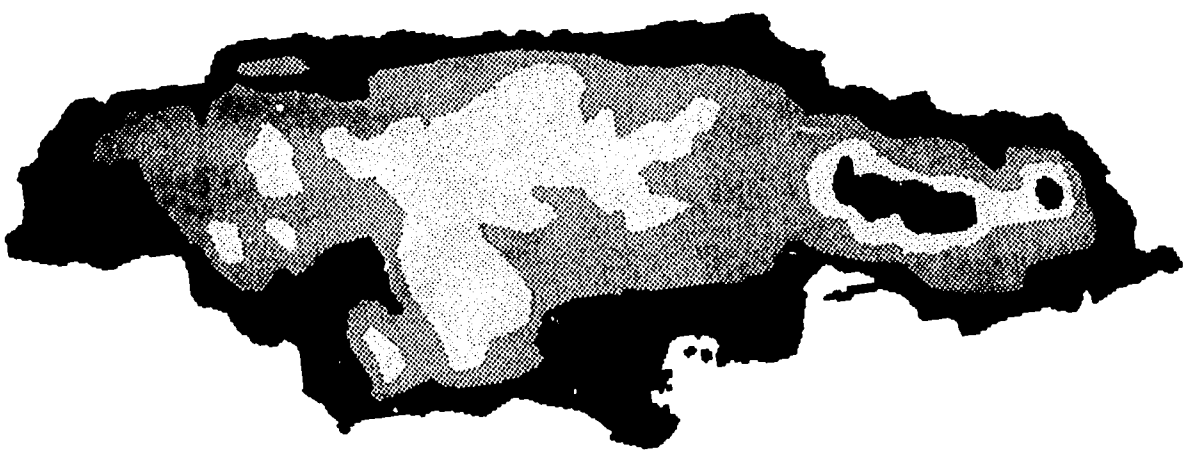
Impact Evaluation of the Hillside Agriculture Project



Submitted by:

Tropical Research & Development, Inc.
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List of acronyms

FISH	Foundation for International Self Help
HAP	Hillside Agricultural Project
IICA	Inter-American Institute for Agricultural Cooperation
MINAG	Jamaican Ministry of Agriculture
JAMPLES	Jamaica Physical Land Evaluation System
JAS	Jamaica Agricultural Society
MOA	Ministry of Agriculture
MIS	Management information systems
PCC	Project Coordinating Committee
PMU	Project Management Unit
PACD	Project-assistance completion date
SPIA	Sub-project implementing agencies
UNITAS	A Jamaican non-governmental organization

Executive summary

The Hillside Agriculture Project officially started in February 1987 with a life-of-project of seven years. USAID obligations are authorized up to US$10 million. Technical assistance and physical inputs for tree crops are provided to farmers in the Rio Cobre and Rio Minho watersheds through sub-projects funded and supported by a central Project Management Unit.

HAP has introduced technical packages which typically include farm planning, fertilizers, increased plant density, improved plant stock, pest and shade management and weed control, as well as low-cost soil-conservation techniques. The aftermath of Hurricane Gilbert in September 1988 reoriented the project towards rehabilitation of trees and away from the planting of new seedlings. Cocoa and coffee figure as the two most important crops in the Hillside Agricultural Project (HAP), but fruit, timber and coconut enterprises play a lesser role.

The impact of HAP on both productivity and production is clearly positive. Pre-project productivity levels of participating farmers were on the order of 8 to 12 boxes per acre for coffee and 6 to 12 boxes for cocoa, well below national, average yields of about 50 boxes per acre for both coffee and cocoa. Taking 50 boxes as a reasonable estimate of yields after HAP assistance, participating farmers should realize increases of 300 percent to 400 percent for these two crops.

As of December 1991, some 4,444 farmers have received benefits from 13 sub-projects. Data on farm and non-farm income, input costs and demographic characteristics are sparse. Nevertheless, by using available information and "best guess" estimates, a 14-percent increase in income is a reasonable expectation for the average farm family.

Up to the end of 1991, cocoa planting for all sub-projects was 517 acres, cocoa resuscitation 1,949 acres, coffee planting 163 acres, and coffee resuscitation 232 acres. The net present value of incremental production forthcoming from these activities is estimated at Ja$24.2 million, evaluated in constant, 1990/91 Jamaican dollars. This is a crude estimate of the contribution of HAP to the Jamaican economy; it also is a very tentative estimate because of the previously mentioned lack of good data and because of ongoing changes in the macro economy.

The project areas were chosen because they are composed of hilly, easily erodible terrain and because degradation of these lands due to agricultural practices is readily apparent. HAP has promoted both "engineering" and "agronomic" measures to reduce degradation of the environment in the targeted watersheds. Participating farmers clearly have adopted these practices, resulting in a positive environmental impact.

HAP has focused its data-collection efforts on agronomic variables. Information on farmers and farm characteristics is sketchy. Physical and biological measures used to reduce soil erosion, and the measures used to manage and reduce pesticide use are the most meaningful environmental indicators; data on these measures could be extracted from administrative files or collected in sample surveys. All these types of data could be organized and entered in a management-information system for easy access, analysis and reporting. Development of the MIS began as early as 1988, but has lagged badly. Consequently, the wealth of data already collected by the various sub-projects cannot be effectively analyzed without an inordinate expenditure of time on the part of the analyst.

Participating farmers' production undoubtedly will increase over the next several years as newly planted and resuscitated trees reach maximum yield levels. Also, some "spread" effects are occurring and are likely to increase in the next few years. In the long run, however, we do not believe that higher production levels will be sustained without the presence of HAP or similar assistance to hillside farmers. Cocoa and coffee production, in the absence of continuing assistance, probably will peak about five to ten years from now and begin a gradual decline.

To assure sustained production growth, two actions are recommended. First, extend the life of HAP to February 1997. This extension will enable the project to serve more farmers in the Rio Cobre and Rio Minho and possibly in other watersheds as well. Second, HAP should develop detailed plans and try to institute a permanent, self-sustaining system to provide technical assistance and possibly capital infusions to small tree-crop farmers. At this point, what organizational forms or funding mechanisms will be feasible, let alone optimum, is impossible to determine. HAP, however, is in an unique position to study this issue, put forth a plan and help implement it. As an intermediate target, HAP should develop a detailed plan within the next year and circulate it for discussion to all interested parties.

To support this initiative, HAP must make a special effort to improve its socioeconomic data collection and analysis and put in place a systematic, comprehensive and up-to-date MIS as soon as possible.

I. Project impact

This section analyzes and assesses project impact in five sub-sections. The first four examine the Hillside Agriculture Project's effects on production and productivity of beneficiaries, as well as subsequent impact on income and living standards of farmers, overall impact on the Jamaican economy and assesses farmer attitudes towards new technologies and cultural practices. The final sub-section reviews and assesses HAP's impact on the physical environments of the Rio Minho and Rio Cobre watersheds.

The evaluation team undertook field visits, interviewed project personnel and examined project and sub-project documentation. Where possible, team members sought to substantiate assessments of impact with quantitative data. The current status of HAP's data-collection, monitoring, and tracking activities is discussed in detail in the following in sections. Project documentation indicates that a considerable amount of information has been and is being collected. However, very little of it had been analyzed and reported at the time of this evaluation. The following sub-sections on the topic of beneficiary impacts, thus, rely chiefly on field visits and interviews with project personnel. (Lists of field visits and persons interviewed are provided in Appendices D and E).

A. Impact on production and productivity

It is clear that some of HAP's direct beneficiaries -- the participant farmers -- have experienced dramatic rises in both production and productivity. HAP has introduced technical packages which typically include the following inter-related components: farm management, fertilizers, increased plant density, improved plant stock, pest and shade management and weed control, as well as low-cost soil-conservation techniques. In some cases, field visits found that the impact of these technical packages among participants has resulted in increases in productivity of as much as 400 percent for cocoa and coffee trees.

This rise in both productivity and subsequent output is primarily a result of the application of technical packages to rehabilitated trees. New trees, introduced to improve genetic stock and to optimize plant density, are only now beginning to bear fruit. With appropriate farm management and external support, new trees have the potential to provide a continuous rise in output from project areas over the next ten-odd years. This and other aspects of post-project sustainability are discussed in detail in Section III.

The aftermath of Hurricane Gilbert in September 1988 reoriented the project towards rehabilitation of trees and away from the planting of new seedlings. This reorientation was largely due to the destruction of nurseries operated by the Cocoa and Coffee boards, as well as to post-disaster efforts to clear and restore agricultural land and rural infrastructure.

Cocoa and coffee figure as the two most important crops in HAP, although fruit, timber and coconut trees were also provided. The scale and content of HAP's endeavors in this regard are shown below in Table one.

Table 1.
Trees Rehabilitated, Trees Planted and Acreage
(December, 1991)

Type	Target	Attained
Cocoa seedlings	438,701	224,744 (51%)
Equivalent acreage	1,009	517
Cocoa rehabilitated	N/A	848,614
Equivalent acreage	N/A	1,951
Coffee seedlings	221,948	142,114 (64%)
Equivalent acreage	255	163
Coffee rehabilitated	N/A	202,187
Equivalent acreage	N/A	232
Fruit trees, seedlings	N/A	25,395
Timber trees, seedlings	N/A	19,030
Coconut seedlings	N/A	4,216

Note: These data are based on the first 13 sub-projects, which started in 1988/'90; later sub-projects have not had sufficient time to make substantial progress toward targets and thus are excluded from this tabulation. Targets for rehabilitation of cocoa and coffee; fruit, timber and coconut seedlings are not available.

Field trips among project farmers revealed that pre-project levels of productivity were well below the current national averages, which are, for both coffee and cocoa, some 50 boxes per acre. This level of productivity is equivalent to 3.4 lbs per tree for coffee and 6.9 lbs. per tree for cocoa. Farmers indicated that pre-project productivity was on the order of 8 to 12 boxes per acre for coffee and 6 to 12 boxes per acre for cocoa. Expressed in terms of tree productivity, these productivity levels indicate a pre-project range of .55 lb to .83 lb for coffee and between .83 lb and 1.7 lbs per tree for cocoa. Yields can be attained of up to 75 boxes per acre for cocoa and as much as 100 boxes per acre for coffee. However, taking the national average of 50 boxes per acre as a reasonable estimate of productivity in project areas; this indicates an increase of roughly 300 to 400 percent for these two crops.

In summary, the impact of HAP on both productivity and production is clearly positive from an agronomic perspective. The implications at the level of the farm enterprise are reviewed in the following sub-section.

B. Impact on income and living standards

Although the project has collected a significant amount of data concerning its activities and interventions, relatively little information was available concerning farm and family characteristics, especially with respect to household economic strategies, income and expenditure. The Project Paper's Social Soundness Analysis is a comprehensive and informative document. Essentially, it describes a multi-faceted, rural economy, with households spreading risk across a wide range of agricultural income sources. Household demographic characteristics indicate aged and very young people; youth and people in their most productive years have quit rural areas to seek employment in more lucrative sectors of the economy.

In order to make a reliable determination of project impact, it is necessary that some quantified appraisal of household income from all sources, including non-agricultural revenues, be provided. This information gives the relative importance of agriculture in general and tree crops specifically within the

context of total household revenue. This information sheds light on the logic of crop selection and the allocation of household resources to various alternatives.

Socioeconomic material available to the evaluators was limited to two statistical reports from Agro-Socio-Economic Research Ltd. and two papers from the IICA / MINAG: *Technical Report of the Preliminary Findings of the Informal Survey, 1989-90* and *Preliminary Findings HASP Baseline Survey*. Agro-Socio-Economic Research Ltd. reports are essentially statistical lists with no analysis. These reports fall well short of the list of deliverables for the HAP agreement with this contractor; the agreement is shown in Appendix A. Agro-Socio-Economic Research was given a contract extension to June 30, 1992 and delivery of the remaining reports is anticipated by that date. The IICA/MINAG reports are analytical and contain some useful information on producer-household characteristics. This section relies primarily on the IICA/MINAG reports, anecdotal evidence from field visits and information compiled by the HAP Project Management Unit.

Project documentation indicates that as of December 1991, some 4,444 beneficiaries have been involved in the first 13 sub-projects directly. The sub-projects commenced in the years 1988, '89 and '90. The level of involvement is equivalent to some 86 percent of the total number of 5,168 beneficiaries targeted in these sub-projects. This short-fall will likely be rectified or surpassed when projects begun in 1990 and '91 reach full capacity. In general, projects which started in 1988 and 1989 have met or surpassed their beneficiary targets. This level of success confirms the observations of field personnel, who reported a high level of interest among farmers in the project areas and suggests that the notion of consolidation and continuity figure as an important consideration in deliberations about expanding geographical areas of the project over coming years. (The question of geographical expansion is discussed in Section V).

Existing data are weak with respect to total family enterprise. These data would shed light on the capacity of farms to bear increased costs, especially for inputs and labor, through support from migrant remittances and off-farm employment. These data are important in assessing farm-level sustainability and strategies for investment in tree crops.

Available data confirm the Social Soundness Analysis as valid and add more precise information and detail. According to the *Preliminary Findings from the HASP Baseline Survey* (IICA, 1991a), the typical farm has the following characteristics: the bulk of the farmers were in the 50-years to 80-years age group; roughly one-third of farm household heads were women; eighty eight percent of the sample of 280 farms sold output to the commodity boards (coffee and cocoa); a lack of capital and the unavailability of labor were overwhelmingly given as constraints.

The Technical Report of Preliminary Findings: Informal Survey, 1989-'90 (IICA, 1991b), provides some additional characteristics on participant farms and farmers. Just under 16 percent of the farmers surveyed were less than 39 years old. Women comprised only 8 percent of all farmers, less than reported in other studies; evidently, women farmers are less numerous in the survey area, the northeastern part of St. Catherine, than in other parts of Jamaica. The median age range for women was 39 - 48; for men, the median age range was 59 - 68 years. Only 5 percent of farmers in this sample kept records. Average farm size was just over 8 acres with just over 40 percent of farms in the five-acre to 9.9-acre category. Thirty percent of farms were between two acres and 4.9 acres; less than 10 percent were smaller than two acres. Over 70 percent had two or more parcels. Roughly one-half of land was under cultivation; of this, almost 40 percent was given to tree crops. None of the sources could provide data on the demographic composition of farm families. This lack of data hindered the calculation of socioeconomic impact, and it coincided with the lack of data on family membership and income sources.

In spite of this sketchy situation with respect to farm-family-level data, rough estimates can be made of the likely impact of improved coffee and cocoa technologies on income and standard of living. Table 2 provides budgets for pre-project and post-project production of coffee and cocoa. All Jamaican dollar values are held constant and expressed as 1990 $J. Fertilizer costs used in post-project calculations are current, world-level prices, expressed as 1990 $J.

Calculations in Table 2 for post-project production assume that the farmer has passed over the one-year to two-year decline in production, incurred in rehabilitation of trees. In the case of HAP, the project assisted and subsidized the farmer over this period. The ability of farmers to replicate this transition without external support is examined below in the section on sustainability.

Table 2.
Pre-Project and Post-Project Crop Budgets
Coffee and Cocoa

Pre-Project Coffee		Post-Project Coffee	
Yield:	12 boxes/acre	Yield:	60 boxes/acre
Price:	$J 146 / box	Price	$J 146 / box
1 Acre value:	$J 1,752	1 Acre value:	$J 8,760
Labor*:	2,000	Labor**:	3,000
Fertilizer:	0	Fertilizer***:	900
Phytosanitation:	0	Phytosanitation:	250
Net Return:	- 248	Net Return:	4,610
		Increase = 163%.	

* Labor estimated 40 person-son-days/acre x $J 50 / day.
** Labor estimated 60 person-days/acre x $J 50 / day.
** Fertilizer: 4 bags/acre x $J 225 / bag.

Pre-Project Cocoa		Post-Project Cocoa	
Yield:	12 boxes/acre	Yield:	60 boxes/acre
Price:	$J 77 / box	Price:	$J 77 / box
1 Acre value:	$J 924	1 Acre value:	$J 4,620
Labor+:	1,000	Labor++:	1,500
Fertilizer:	0	Fertilizer+++:	900
Phytosanitation:	0	Phytosanitation:	250
Net Return:	- 76	Net Return:	1,970
		Increase =	113 %.

\+ Labor estimated 20 person days/acre x $J 50.
++ Labor estimated 30 person days x $J 50.
++Fertilizer: 4 bags/acre x $J 225 / bag

Table 2 makes a best-guess estimate of labor used in the production of these two crops. Given that labor is the most significant component in the production budget, HAP should expend resources and effort to verify the realities of production at the farmer level. The reader should bear this observation in mind in the subsequent analysis.

In spite of a return to coffee which was greater than two fold, the general preference among producers for cocoa over coffee is probably linked to very limited capital and to cocoa's requirement for less labor and organization than coffee. Pre-project production of cocoa, at 12 boxes or less per acre, would not require significant amounts of hired labor. Unpaid family labor would not figure directly in the farmer's calculus, which would probably focus first on cash-flow exigencies. For this reason, the gross crop value is used as the farmer's return in subsequent analyses of profitability and impact.

Under the post-project scenario -- an increase of 163 percent for coffee and an increase of 113 percent for cocoa -- coffee remains more remunerative, but requires twice the labor of cocoa. Given these two alternatives, farmers with low capital resources will likely continue to favor cocoa because of its lower labor requirement, this despite coffee's higher profitability. HAP has demonstrated that coffee is a viable contributor to hillside farming systems.

Available data show that the typical farm is roughly eight acres. Of this area, about 40 percent, or 3.2 acres is given to trees. Using the estimate of one and one half acres of cocoa and one half acre of coffee, annual post-project farm revenue from these crops is on the order of $J 5,260 (in 1990 dollars), or approximately $US 526. Information on farm income is sketchy and derived from various sources. As noted, data on remittances are missing; although Agro-Socio-Economic Research (1991a) reports average off-farm earnings in the Manchester area are some $J 4,200 per year. In the absence of data on earnings from other agricultural production (yams, vegetables, bananas, etc), a best-guess estimate is $J 5,000. Average total farm income is roughly $J 20,000 per year, including livestock. Interviews with farmers indicated that earnings from coffee and cocoa are about 12 percent to 16 percent of the total.

Impact on farm income can be estimated on the basis of total farm income of $J 20,000. Farmers' estimates of 15 percent of total farm income from coffee and cocoa put their pre-project revenue at about $J 3,000. This estimate approximates the "cash-flow" earnings, or gross value, of one half acre of coffee and one and one half acres of cocoa (about $J 2,400). Using this lower figure of $J 2,400 as the pre-project coffee/cocoa component value, an increase of 119 percent, to $J 5,260, would raise farm income from $J 20,000 to almost $J 22,860. In sum, estimated impact on farm income from coffee and cocoa from the Hillside Agriculture Project is just over one-seventh (14 percent).

Unlike some previous projects in Jamaica, the HAP does not provide cash to participating farmers to hire labor. Farmers receive inputs, such as fertilizer and seedlings, specified in the farm plan prepared by HAP field personnel. Cash grants could easily be diverted to uses other than those intended and therefore are not considered appropriate.

C. Aggregate economic impact

The aggregate impact of HAP can be measured in terms of increased net production (the value of incremental farm production minus incremental farm costs) of tree crops. This kind of analysis can be conducted at any point in time and may serve as a useful guide to project performance. The economic analysis annex in the project paper, for example, projected production and costs over the life of the project to calculate the expected economic rate of return. We now have data on actual HAP field activity and, thus, can estimate increased net production expected to accrue therefrom.

Quantitative evaluation of tree-crop production impacts requires more than the usual number of assumptions because of the time profile of production. Coffee and cocoa plantings start producing in about the third year and can be expected to produce for another 20 or 30 years. Thus, major costs are incurred in the first few years with little or no revenue, and the payoff for this substantial investment

occurs over two or three decades in the future. HAP field activities started about three years ago, and estimates of increased net production can be based on reported new plantings and resuscitated area and assumptions regarding incremental yields and costs.

To estimate the value of HAP activities, cocoa and coffee were analyzed. These crops account for most of the HAP field activities. Up to the end of 1991, cocoa planting for all sub-projects was 517 acres; cocoa resuscitation was 1,949 acres; coffee plantings were 163 acres, and coffee resuscitation was 232 acres. Based on information in HAP documents and field observations, incremental yields and costs per acre were estimated.

Calculations are further complicated by the rapid change in prices in the last two years. Given the limited data, 1990/91 prices were used to value farm outputs and inputs. (See Appendix B for the enterprise budgets used in calculations). Because of the dynamic changes underway in the Jamaican economy, relative prices may change significantly, and, consequently, valuation of increased net production at a later date could change significantly. Ideally, shadow prices would be used, but their estimation would require thorough study of international markets for cocoa and coffee, shadow pricing of foreign exchange and careful analysis of labor markets, all of which are beyond the scope of this evaluation. HAP, however, may want to sponsor research along these lines; the IICA/MinAg sub-project is probably in the best position to conduct the analysis.

The net present value of incremental coffee and cocoa production discounted at six percent is J$24.2 million. Assuming an average exchange rate of 10 Jamaican dollars per US dollar during the 1990/91 period, this is equivalent to US$2.4 million. The net present value, in this context, represents the contribution of HAP to the economy of Jamaica. These numbers, however, underestimate the HAP contribution because only cocoa and coffee production are included. Other HAP contributions include a small amount of production of other tree crops and incremental value added in post-harvest activities. In any case, these numbers are tentative because of unavailability of shadow prices, as discussed above, and the preliminary nature of the enterprise budgets.

Economic analysis in the project paper calculated several different internal rates of return, ranging from 8 percent to 22 percent for the entire life-of-project. These results imply increased net production, resulting from the planned seven years of project activity equal to HAP expenditures when both are discounted at the IRR. (The IRR is the discount rate, which equates discounted incremental net production to discounted project costs.) Our calculations are based on actual performance from the start of the project to the end of 1991, during which time substantial start-up costs were incurred before even one tree was planted. If one were to conduct a similar calculation two or three years from now, one would expect a much higher value of net production. Thus, our calculations are basically consistent with the project-paper analysis.

In conclusion, experience to date indicates that HAP is performing well and is likely to yield a satisfactory rate of return over the life of the project.

D. Attitudes of targeted farmers

Field visits and available documentation confirmed that the project has been instrumental in changing farmers' attitudes toward hillside farming through the use of improved practices and new production technologies.

Many farmers were not aware of the optimal levels of shade needed for cocoa and coffee; farmers generally over-shaded their plots. In general, farmers did not realize the deleterious impact of weeds, which harbor pests and compete with crops. The project also demonstrated the optimum densities for tree crops, which were often well below ideal levels. Farmers had been extremely reluctant to cut back and prune coffee trees. HAP clearly demonstrated that substantial gains from pruning and resuscitation of coffee and cocoa trees could be attained after a temporary interruption in production.

The importance of fertilizers was generally well known in the project area. However, fertilizer use was low, principally because of financial constraints imposed by the pre-project, low-productivity farming system. The project informed farmers of appropriate application levels and demonstrated the gains to farmers which can be achieved through judicious fertilizer use.

Soil-conservation practices were reported to have been known and implemented by one-third of farmers before the project. However, HAP demonstrated a number of new, low-cost innovations, which have been put into use by project farmers and appear to have been replicated by others.

It is clear that attitudes have changed among participant farmers; anecdotal evidence indicates that others outside the project have also been influenced. To date, the extent of this change in attitudes does not appear to have been surveyed and quantified. Improvements in the HAP Management Information System and sub-project tracking are recommended to close this gap in information. Nevertheless, general acceptance and appreciation of these new techniques and innovations is evident from both project personnel and farmers.

E. Impact on degradation of targeted watersheds

The project areas were chosen because they are composed of hilly, easily erodible terrain. The degradation of land caused by agricultural practices in these areas is readily apparent. Soil erosion has been severe, as indicated by gullying, loss of topsoil and turbidity of streams and rivers after heavy rains.

Many measures have been instituted through the project to reduce degradation of the environment in the targeted watersheds. These methods include both engineering and agronomic. Measures which can be used to quantify land-use changes over time are recorded in the files and reports of the sub-projects and include the following:

1. Establishment of stone barriers, waterways, barriers of various kinds of plant material,individual planting basins.

2. Establishment and maintenance of mulch cover on the soil surface.

3. Establishment of tree crops in formerly bare soil areas.

4. Distribution of plants of many species to increase crop diversity and land coverage.

5. Establishment and maintenance of adequate shade plants to reduce soil degradation.

6. Management and documentation of pesticide usage in project areas.

7. Control of pests without the use of chemical pesticides.

Including measurements of changes in soil and water quality in the project area would, if possible, be desirable. These measurements should include data on amounts of silt in water and amounts of pesticide residues in soil and water.

The farmers involved in the project have clearly instituted many practices that reduce the harm done to the environment.

II. Data collection and indicators

A. Baseline data collection

In accordance with its orientation towards production support, HAP has focussed primarily on the collection of agronomic and agricultural data. Data was sufficient to make estimates of gains in productivity and production. A more rigorous and comprehensive approach to data collection on agronomic interventions/demonstrations plots is, however, clearly needed.

Information on farmers and farm characteristics is sketchy, especially in areas which would serve to gauge socioeconomic impacts. The IICA/MINAG sub-project, at just under $J 7 million, is the second-largest undertaking in HAP's portfolio to date. It employs a farming systems/extension approach. This method appears to be progressing toward institutionalization in the Ministry of Agriculture's Research and Development Division.

During the course of the evaluation, the Project Management Unit (PMU) provided printouts of data on various aspects of the project. Information also has been tabulated and analyzed for the Project Coordinating Committee (PCC).

Formal reports are limited. IICA / MINAG has produced two baseline documents, which proved useful for this evaluation. These reports are *Technical Report of the Preliminary Findings of the Informal Survey, 1989-90* (IICA/MINAG, 1991a) and *Preliminary Findings HASP Baseline Survey* (IICA/MINAG, 1991b).

Agro-Socio-Economic Research Ltd. of Kingston was commissioned to undertake baseline surveys and analyze the data collected for a group of eleven of the smaller sub-projects. To date, only tabulations without further analysis, published as *Baseline Survey - Manchester Land Authority* and *Baseline Survey - Guys Hill* have been provided. Tables in these reports provided the evaluation team with some information on use. However, these tables contained very little data of use in undertaking the assessment of socioeconomic impact. Interestingly, while both participating and non-participating farmers were sampled in the eleven areas, statistics for the two groups were not reported or compared. Statistical analysis could provide some useful insights on the characteristics of participants compared to their non-participant neighbors.

In short, baseline data and analyses reported at the time of evaluation fell well short of the evaluation team's needs. Given that it is the farm family which will ultimately sustain and replicate achievements made through HAP, greater attention should be given to data collection and systematic analysis of farm dynamics and farm family status.

B. Indicators of socioeconomic impact

Measurement of impact centers on the farm household as the primary unit of analysis. The household is the production unit and the locus of decision-making with respect to the allocation of limited supplies

of land, labor, and capital to production. Insufficient knowledge of this fundamental unit of social and economic organization can lead to misguided interventions and incorrect assumptions concerning the relevance and direction of project interventions and activities.

Impact is generally measured in terms of productivity, income and adoption of new, more productive techniques and technologies. Reliable assessments of impact depends upon knowledge of the following data:

(1) Demographic composition of the household, which provides information on labor capacity, including allocation of labor to both agricultural and non-agricultural ends.

(2) A resource inventory, which typically includes land, trees, equipment and the like.

(3) All income sources that comprise the household income portfolio. This data includes remittances from family members abroad, off-farm employment, rents, savings, etc. These data are fundamental to understanding levels of expenditure, financial capacity, the beneficiary's capability to adopt new technologies and the need for credit under improved farming systems.

A representative sample of farmers within intervention areas is needed in HAP for the above reasons. Agronomic data with test-plot measures of gains in productivity and production are the appropriate starting points, but these data are insufficient as measures of impact. Actual use of agronomic improvements can only be understood through socioeconomic analysis. Baseline data and monitoring surveys must be included as an integral part of the project-implementation process so that progress is tracked, obstacles are identified and interventions are relevant.

Assuming that baseline socioeconomic data have been collected and a sample group is being monitored, the following items are suggested as impact measures:

(a) Changes in the size and composition of the farm-household income portfolio.

(b) Changes in savings, the use of credit, and expenditures (agricultural and non-agricultural).

(c) Changes in investment, especially as concerns purchase of land and equipment.

(d) Changes in the demographic composition of the household; i.e, increase in supply of family labor, number of children in school, etc.

(e) Changes in the use of hired labor.

(f) Changes in productivity and output for all crops.

(g) Improvements to housing and farm living conditions.

At the project level, these kinds of data support measures of the rate of adoption of new technologies and improved farming practices. The ultimate measure of project impact is the diffusion of new farming systems, measured in terms of replication and a sustained output from agricultural production.

General, and largely anecdotal, information indicates that HAP is on the right path toward raising production and productivity and ameliorating incomes and living standards of beneficiaries. But a well-designed and well-focused socioeconomic research effort is needed to optimize and verify impacts. IICA / MINAG have collected data in this domain although it appears that the aspect of the farm-family unit has not been thoroughly researched. Data from Agro-Socio-Economic Research Ltd. have been analyzed in only rudimentary fashion thus far.

HAP should concentrate on analysis of available data in the immediate future then determine what additional data collection is needed. It will then be possible to more precisely specify in contracts what data are to be collected and how they are to be analyzed. Methods and expertise for this type of research are well known and should be locally available. A common set of methods and an agreed reporting schedule which traverses all project areas should be applied to a sample of farmers.

Data and analyses from this exercise should be included in the central MIS. Currently the IICA / MINAG sub-project appears to be the only element in HAP that has the capacity to establish such a system; this suggests that the continued involvement of IICA /MINAG to the end of project is necessary and desirable.

A systematic, comprehensive and up-to-date management-information system should be more highly developed at this middle stage in project implementation. The delay is apparently due to the inability to recruit and retain a person with the required analytical and organizational skills. A new MIS expert has been identified and is expected to join the PMU soon. Hopefully, this individual will greatly accelerate development of the system. A fully developed MIS is fundamental to a clear and accurate final evaluation and essential for the identification and design of future interventions in Jamaican agriculture.

C. Indicators of environmental impact

The Baseline Survey for the Hillside Agriculture Project includes data on land area, soil type, land utilization, kinds of crops, crop conditions, yields of the major crops, cultural practices, pest and disease management and conservation practices. Under the Watershed Inventory Sub-Project, extensive data have been compiled on land cover, land use, soil types, physical and chemical characterization of soils and susceptibility to erosion. The data from these surveys form a good basis for monitoring subsequent progress.

Of the indicators used to measure changes in the environment, the most meaningful are the physical and biological measures used to reduce soil erosion, the measures used to manage and reduce pesticide use and measurements of changes in yields of crops in the sub-project areas. These data can be collected relatively easily and inexpensively and should be adequate to measure progress of the project.

Measurements which would be very meaningful, but more difficult and expensive to collect, are data on residues of agricultural chemicals in soils and waterways and turbidity of streams and rivers. Funding of such work should be considered if the time frame of the project is extended.

The HAP Project Paper clearly indicates that monitoring impacts on the environment be undertaken. Early on in HAP's life, University of the West Indies made an undated proposal for monitoring pesticides in soil and river water and measuring water turbidity, which is a measure of soil erosion, in the two watersheds. This proposal was not approved, and since then, no action has been taken.

The evaluation team concurred that monitoring of soil erosion and some agro-chemical residues in a few representative areas is desirable. The most pertinent chemicals being the following: nitrogen, phosphorous, potassium from fertilizers as well as insecticides and fungicides being used in the project. Water turbidity or other relatively simple measures of soil erosion should also be measured.

III. Sustainability

Sustainability of the Hillside Agriculture Project is defined as the capability of project farmers to maintain production at levels achieved under HAP. Going beyond this definition, it is reasonable to expect additional production growth in the project areas due to diffusion and adoption by non-project farmers.

Fertilizer and agro-chemical prices and availability will bear heavily on sustaining project gains. So too will the cost and availability of labor. Fertilizer has an obviously profound impact on output; labor is the more costly production budget item, especially at the time of harvest. Some work has been undertaken by IICA / MINAG Research and Development Department on obtaining nitrogen from poultry and composting; other work has been done on low-cost alternatives to chemical pest control.

Appropriate technologies that lessen the crop-budget burden for inputs are of obvious importance to sustainability. Likewise, these technologies will contribute to increased diffusion by lightening the investment and recurrent cost load of farmers who have not benefitted from project assistance during the one-year to two-year production slump over the transition period to new, more productive technologies. The same considerations apply to technologies that increase labor productivity.

Sustained impacts will ultimately depend upon market conditions that offer a reasonable level of profitability to farmers and to labor. It is reasonable to assume that the markets for cocoa and coffee will remain positive to producers. This appears likely in the case of coffee, for which Jamaican exports have a well-established reputation.

In addition to favorable output markets and physical input availability, extension support, which is fundamental to sustained productivity, will be needed. Given that it is highly unlikely that small farms can generate sufficient earnings to purchase extension services or technical assistance, this aspect figures prominently in the post-project scenario. In short, two factors will be crucial in the post-project period -- extension support and capital.

Because of the following conditions, capital flows to the small-farmer tree crops at less than socially optimal levels: (a) financial institutions customarily do not make the long-term loans required to finance tree crops; (b) transaction costs for lending to small farmers are high; and (c) small tree-crop farmers are very risk averse regarding borrowing; even if they could borrow, and thereby increase profits, they would not.

These market failures can be overcome by institutions and organizations dedicated and adapted to providing technical advice and capital to small farmers. To be viable, these organizations would need an assured income, perhaps derived from a cess or levy on the sale of tree-crop products.

Agencies charged with implementing HAP sub-projects are being strengthened and encouraged to assist farmers in the long-term. Several HAP initiatives, including promotion of youth involvement in farming, creation of farm input-supply stores and revolving loan schemes and other efforts to stimulate cooperative development and savings--will help sustain production beyond the life of the project.

The Cocoa and Coffee Boards, both of which are involved in the implementation of HAP, collect a cess. Their experience provides a starting point for the design of a system to fund further assistance to small tree-crop farmers.

Delivery of services in the future could be patterned after the successful practices of the sub-projects. Thus, technical advice would probably include the development of a farm plan and direct one-on-one advice to farmers in their fields, as well as demonstration plots and field days. Capital would probably be provided in-kind, including seedlings, fertilizer and pesticides.

Sustained production can be attained, but it will not happen automatically. HAP is headed in the right direction; it now needs to draw out implications of the many efforts to promote tree-crop production, both under the project and otherwise and to formulate a realistic plan for sustaining production.

Participating farmers' production undoubtedly will increase over the next several years as newly planted and resuscitated trees reach maximum yield levels. Also, some "spread" effects are occurring and are likely to increase in the next few years. In the long run, however, we do not believe that higher production levels will be sustained without the presence of HAP or similar assistance to hillside farmers. Cocoa and coffee production, in the absence of continuing assistance, probably will peak about five to ten years from now and begin a gradual decline.

To assure sustained production growth, HAP should take the lead in a coordinated effort to institute a permanent, self-sustaining system to provide technical assistance and possibly capital infusions to small tree-crop farmers. At this point, what organizational forms or funding mechanisms will be feasible, let alone optimum, cannot be specified. HAP, however, is in an unique position to study this issue, put forth a plan and help to implement it. This process would entail sponsoring seminars and discussions and stimulating public debate on this issue to forge a consensus for action among farmers, cooperatives, non-government organizations, government agencies, statutory bodies, foreign assistance agencies and the private sector. As an intermediate target, HAP should develop a detailed plan within the next year and circulate it to all interested parties for discussion.

IV. Project implementation and effectiveness

A. Project management unit

To understand the effectiveness of the Project Management Unit (PMU) in managing the project and sub-projects, the organizational structure of the project must be understood. The structure includes the following:

(a) the Project Coordinating Committee (PCC), consisting of eight members drawn from USAID, Ministry of Agriculture (MOA) and the Jamaica Agricultural Society (JAS).

(b) the PMU consist of the project manager, deputy project manger, information officer, accountant, officers from the sub-projects and other supporting staff.

Interviews with various persons at different levels suggest that coordination of the sub-project implementing agencies and direction of overall project development is quite good. Management and allocation of resources, including human and capital resources, appears to be operating smoothly. Except for the placement of an officer in the management-information area, the staffing seems to be quite adequate to perform the functions assigned.

The Ministry of Agriculture operates at two levels with the PMU. At one level, it is a joint client with IICA on a sub-project based in Southwest St. Mary. On the other level, it is directing and supporting the PMU; here the PCC is chaired by the Permanent Secretary of the Ministry of Agriculture.

Because of proper budgeting and financial control, financial resources have been adequate to operate the PMU. Because of the subsequent devaluation of local currency relative to the US dollar, expenses are lower than anticipated at the time of project design.

B. Sub-project implementing agencies (SPIA)

Wherever sub-projects are implemented, local structures called Local Management Committees or Farmer Action Committees are developed. These organizations report directly to the HAP project manager and normally consist of primary producers, representatives, sub-project coordinators, JAS representatives, RADA representatives and farmers. These organizations operate as the local, project-oversight committee. Each SPIA has a sub-project coordinator with supporting staff consisting of field officers, assistant field officers and accounting staff. With the assistance of district cooperatives, commodity boards, agricultural credit institutions and RADA, the SPIA staff services the beneficiaries.

For those sub-projects approved and being implemented at the time of evaluation, most had honored their obligations in terms of delivery of services, reaching target farmers and facilitating transfer of technology; others are fine tuning their structures to better serve the beneficiaries. In terms of cooperation and coordination, these agencies, where necessary, have worked well and in the interest of the project.

C. Technical assistance and networking

It appears that the project implementors have received adequate technical assistance. This assistance has been provided in several ways, and the team was informed that the number of training sessions and the number of participants have exceeded the original expectations of project administrators.

Specific training functions have included workshops, two retreats and the preparation of various documents containing detailed information on project procedures. Extensive training was given on pest management and recommended usage of pesticides. HAP also has initiated a series of one-day, training-of-trainers sessions to update field staff.

Several key people have been sent to short-term courses abroad. HAP has sponsored study tours to Costa Rica to observe coffee production and to the southern U.S. to visit cooperatives. And HAP has supported participation in the Caribbean Food Crop Society.

The project includes extensive networking. Many of the implementors have come from other agencies, but now spend all or part of their time on the project. Many of the sub-projects involve one or more other agencies. These agencies include the Ministry of Agriculture, RADA, the Cocoa and Coffee Boards, CIDCo, JAS, IICA and private, volunteer agencies, such as FISH.

Project administrators meet regularly with Sub-Project managers to discuss progress, problems, and future plans. Minutes of the meetings are sent to participants. A project newsletter is published periodically and further assists in disseminating information.

D. Participation of women

HAP's broad objective is to "fund self-managing projects that promote production and productivity of perennial crops." The community-based and locally-directed sub-projects should translate this major objective into one which can be implemented.

The focus on establishment of perennial crops immediately inhibits participation of many women because cultivation of these crops require strenuous physical activities generally outside the capability of most women. The last agricultural census (1978) indicates that women comprise only about 20% of the farming population. More recent surveys and studies have not pointed to any significant increase in this category. The project paper's annex on social analysis pointed out that women in agriculture tend to be primarily engaged in the most menial tasks and assume managerial roles largely as a result of the death of the male partner.

The level of involvement of women in HAP appears to vary among sub-projects. Participation at Windsor, Blackwoods and Elgin was said to be about 50 percent, while at Above Rocks and IICA Sub-Projects, women's involvement was estimated at 20 percent - 25 percent. On average, the number of women participating in HAP in terms of production is not significantly greater then for agriculture nationally. In terms of marketing, the involvement is reported in the region of 50 percent. It must be noted that none of the sub-project documents attempt to focus on women as an interest group. Rather, the focus is on a specified number of farmers. These are selected according to interest and experience in coffee/cocoa, their land capability and willingness to follow the directives of the project officers.

Although this policy does not discriminate against any particular group, it does not seek to identify and meet the requirements of any whose needs might be different from the population norm. Production of coffee and cocoa require strenuous labor, and although both sexes might need to supply labor, which reportedly is difficult to obtain in many project areas, women appear to be at a disadvantage. When laborers often times do not bother to report for work, charge high prices and not give a full day's work, the male farmers can and do work themselves to fill in the inadequate areas. In many instances, however, the women are unable to do likewise.

It seems, therefore, that future sub-projects must, in planning for implementation, attempt to focus more on the needs of special groups. It is vitally important that baseline studies be completed prior to project design so that the needs of the target population can be identified and planned for wherever possible.

In particular, to improve and strengthen these activities, attention should be placed on areas in which women predominate. One area which could be looked at is marketing of produce. The marketing of cocoa and coffee are well established, and commodity boards also arrange for collection of these crops. HAP has encouraged and promoted the establishment and rehabilitation of other tree crops, such as ackee, breadfruit, mango, soursop, etc. All these crops are in great demand locally and in some instances overseas, but at times, they are difficult to market. Sub-projects therefore should seek to improve and strengthen or develop producers' marketing organizations.

One other way of increasing women's participation is for relevant sub-projects to include a cottage-industry component as part of their activities. Simple methods of canning and other preservation methods could be taught. This could enhance the utilization of fruits which might otherwise go to waste and also assist women to function more effectively in their role as homemaker.

E. Contribution to Mission's strategic objectives

According to the project paper, at least 33 percent of Jamaica's people reside and work in hillside areas. HAP is the only USAID project explicitly focussed on this important segment of the population. Since the objective of USAID assistance for Jamaica is achievement of broadly-based, sustainable economic growth, HAP and/or future projects designed to assist people in the hillside areas is indispensable.

The *Program Objectives Document FY 1993 to FY 1997*, dated May 1992, specifies three strategic objectives in which USAID has a comparative advantage. HAP contributes significantly to the first strategic objective, which is increased foreign- exchange earnings and employment. HAP stimulates production of coffee, cocoa and other export crops.

By promoting improved soil management, HAP also contributes to the second strategic objective, improved environmental management and protection. HAP enhances farmers' capacity to manage their hillside fields. The project demonstrates practical soil-conservation techniques and makes soil-conserving tree crops more profitable.

Information reported by government agencies and HAP can be used as indicators of achievement of these strategic objectives. Increases in tree-crop production in HAP-assisted areas can be compared with changes in the comparable national totals. Numbers of trees planted under HAP can be used as an indicator of investment, and, hence, future export-crop production, as well as soil-erosion control and watershed protection.

V. Funding, timing and geographic area of project

A. Amendment of project

The Hillside Agriculture Project officially began in February 1987. With an approved life-of-project of seven years, the project-assistance completion date (PACD) is February 1994. USAID obligations are authorized up to $10 million.

The USAID project authorization states that funding will be provided for sub-projects "primarily in the Rio Cobre and Rio Minho Watersheds." Almost all project activity to date has been confined to these two watersheds. Implementation Letter No. 64, dated November 25, 1991, states that only two sub-projects not strictly within the target watersheds -- UNITAS and St. Mary Cocoa Farmers Support -- have been approved. Both, however, straddle the boundaries.

The project should be amended to extend the PACD to February 1997 and explicitly revise the geographic restrictions with no change in authorized funding.

Extension of project life to ten years (the maximum allowed by USAID) is recommended for two reasons. (a) HAP has effectively utilized funds thus far and is likely to do so in the future. And (b) it is assumed that USAID wants to continue some form of assistance to hillside farmers until at least 1997. USAID could design a new project to begin in 1994 to aid hillside farmers. But that option is not desirable, considering the time and money typically spent in starting any new project. HAP has already incurred the inevitable start-up costs and can more efficiently provide services for the entire period, from February 1994 to February 1997.

No change is recommended in authorized funding at this time because only about half of the authorized $10 million has been committed during the first five years of the project. No need exists to change the

authorized level although USAID may want to consider an increase later, perhaps in 1994, if HAP continues to operate effectively and the expenditure rate accelerates.

Assistance to small hillside farmers in some new areas should be authorized, with the understanding that expansion will be gradual, so as to ensure manageability. New sub-projects should be similar to the old sub-projects in their basic design, i.e., they should provide intensive assistance to small farmers, located in relatively small, well defined areas, to improve their tree-crop production. HAP should not dilute its efforts by trying to provide extensive assistance or more superficial assistance to all farmers throughout Jamaica.

The Project Coordinating Committee (PCC), when considering specific proposals, is best able to judge where HAP resources will produce the greatest benefit. The PCC can make this judgement better than can the evaluation team or other observers trying to look five years into the future. However, the PCC, when considering sub-projects for new geographical areas, should give greater attention to possible conflicts with other projects.

If geographical restrictions are eliminated, the PCC may be pressured into undertaking too many new sub-projects in too many new areas. To guard against such pressures, the HAP project-agreement amendment should specify the number of new sub-projects to be undertaken and delineate new geographical areas. Recommendations on siting of new sub-projects and possible extension of existing ones are presented below in hope that they will be helpful in formulating the amendment.

While it has been suggested that the scope of HAP be expanded to address policy issues, HAP should not be involved in commodity-pricing issues. Pricing of cocoa and coffee, for example, are important to HAP's clientele, who are small, hillside farmers. Decisions, however, on how to price these two commodities should be made within a larger context, including the government's general approach to regulatory reform of internal and external trade, foreign exchange and monetary policy. USAID may wish to engage in a policy dialog along these lines, but HAP is not an appropriate vehicle.

However, HAP should be more actively involved in policy debates relating to the provision of technical assistance and other inputs to small farmers. HAP's experience is directly relevant to these issues, and the project is in a unique position to contribute in this area, as outlined in the "Sustainability" section of this report.

B. Extension of existing sub-projects

The existing life of sub-projects is sufficient for the implementation of many of the agricultural practices in the project. These practices include cleanup of weeds, renovation of existing plants of coffee and cocoa, planting of new fruit trees and timber trees, application of fertilizers, control of pests and diseases and installation of erosion-control measures.

In some cases, however, completion dates do not allow sufficient time for newly planted tree crops to reach their full yield potential. This limitation is in itself a good reason to extend selected sub-projects. While some of the improvements from the sub-projects are already evident, it would be well for farmers to see significant yield increases before the project is terminated.

The findings of this evaluation mission have shown that the sense of accomplishment of project management is justified by what has been achieved. With more than 80 percent of the target population

reached and more than 100 percent of acreage targeted, HAP can at this time be said to be making a real impact on hillside farming in the original areas.

This conclusion justifies the recommendation for relaxation on restrictions on geographic area. However, before extending to other areas, HAP should first seek to consolidate achievements in the original area by servicing remaining targeted beneficiaries and responding to the aspirations of those who wish to participate in the project.

In terms of extension of specific sub-projects, it is noted that three have already ended; eight are due for completion in 1992/'93, and the other nine in 1993/'94. Of the latter, two have just started, and at this stage, suggesting extension would be premature. JAS organizing, particularly for new areas in which HAP will extend, will be needed.

According to the evaluation of the Mango Topworking Sub-project, results were below expectations. HAP therefore needs to correct shortcomings outlined in the evaluation report and strengthen this sub-project in order to realize its full potential. The strategy of this sub-project - "to convert non-commercial mango trees to acceptable varieties for export" - is one which HAP should consider replicating in the new areas in which it will operate.

The UNITAS and St. Mary Cocoa Cooperative Sub-Projects, although well on the way to achieving targets, have had tremendous impact on residents in their area. As suggested above, more time is needed to completely satisfy demand created by the "spin off" effect of HAP. The North Clarendon Processing Company, to be truly effective, needs to install additional lines of equipment in order to cope with the different types of crops being produced by farmers. The Rural Physical Planning Division sub-project should also be extended in order to obtain the physical capability maps for the proposed new areas.

C. Priorities for new sub-projects

The flexibility which HAP enjoys has not been available to other projects, and it would be beneficial if this experience could be repeated in other watershed areas. Three new sub-projects for early consideration are the following: (1) extension to the Wag Water watershed, particularly in the Nutfield/Junction area of St. Mary, with a focus on the planting of fruit trees and road bank stabilization; (2) extension to the Yallahs watershed, with a focus on fruit trees: (3) a sub-project in the Hope area with a focus on both fruit trees and beverage crops.

The emphasis in this first phase of HAP has been on production of coffee and cocoa although a variety of miscellaneous fruit trees have been encouraged. In areas where appropriate, new sub-projects should continue to encourage the two major crops since they are high earners of foreign exchange. New planting of coffee and rehabilitation of cocoa should be emphasized. In addition, the establishment/rehabilitation of economic fruit trees, such as mangoes, guava, passion fruit, ackee, breadfruit, naseberry, soursop and sweetsop should be considered.

Sub-projects should also attempt to establish processing facilities for excess fruit, which cannot be absorbed by local or export markets. Alternately, linkages should be developed with established processing plants for absorption of excess fruit.

Sub-projects have been implemented by cocoa and coffee boards, by an international organization (IICA), by private firms, such as North Clarendon Processing Company and Agro-Socio-Economic-Research, Ltd., by non-government organizations such as UNITAS and FISH with JAS assistance. All types of

implementing agencies have performed satisfactorily, and no reason exists to exclude any for consideration in future sub-projects. The choice of implementing agency will depend upon local conditions and the capability and experience of organizations in those communities.

HAP has been successful in designing appropriate-technology packages and providing guidance and training for sub-project implementors. The success of new sub-projects will depend upon continuing technical support of the PMU.

VI. Conclusions and recommendations

A. Lessons learned

1. Sub-projects should have clear objectives and progress indicators, but implementation should remain flexible.

2. Needs of the clients, who are small tree-crop farmers, are paramount in the design and execution of effective sub-projects.

3. Introduce new technologies only when client farmers are able to adopt and effectively use them.

4. Use proven, effective techniques to teach recommended production practices. Use of demonstration plots to show the effect of fertilizer on cocoa production is a good example.

5. Sub-projects must be relatively small and manageable to ensure large production increases on participating farmers' fields.

6. Accountability of sub-project implementors can and should be ensured by a combination of required, periodic reports and site visits by HAP managers.

7. While the average age of participating farmers is greater than 60, involving youth in sub-projects is still possible, and UNITAS provides a good example.

8. Farmers of all ages will participate in sub-projects if they are convinced of the profitability of technical packages.

B. Recommendations

1. Extend the PACD of HAP to February 1997, with no change in authorized funding.

2. USAID should authorize HAP to assist hillside farmers in some new geographical areas, but the PCC should give greater attention to possible conflicts with other projects.

3. The PMU should consider development of new sub-projects in the Wag Water and Yallahs watersheds, but not short change the Rio Cobre and Rio Minho watersheds.

4. While cocoa and coffee will probably continue to be important, the PMU should consider devoting more resources to economic fruit trees and associated processing facilities.

5. The PCC and PMU should focus more on topics of interest to women, particularly marketing, processing and cottage industry.

6. HAP should lead a cooperative effort to institute a permanent, self-sustaining system to provide technical assistance and possibly capital infusions to small tree-crop farmers.

7. HAP should be more actively involved in policy debates relating to the provision of technical assistance and other inputs to small farmers, but not involved in commodity-pricing issues.

8. Because socioeconomic data collection and analysis have lagged, the PMU should make a special effort to bring them up to speed.

9. The PMU also should as soon as possible develop and implement a systematic, comprehensive and up-to-date management-information system.

C. Conclusions

HAP, working through its sub-projects, has improved the well being of many hillside farmers by enabling them to improve their cocoa and coffee plantations and thereby ensure higher levels of income for many years to come. This accomplishment is the result of providing technical advice that is responsive to farmers' needs and supplying appropriate physical inputs.

A need will continue for technical advice tailored to the needs of hillside tree-crop farmers, and this advice will not be adequately forthcoming from existing extension services. Furthermore, capital in the form of seedlings, fertilizer and pesticides for the first year or two after planting should be provided to small tree-crop farmers. To perform these functions on a continuing basis, HAP would, in essence, evolve from a successful, but impermanent, donor-financed project into a permanent, self-sustaining system, dedicated to the support of hillside tree-crop farmers.

If HAP is extended, as recommended, it will have nearly five years to extend assistance to more farmers and refine its delivery systems. But at the same time, if it is to evolve into a permanent institution, HAP must do a much better job of analyzing, evaluating and disseminating information to the wider community of scholars, administrators and decision makers.

Appendix A: Sub-project characteristics

1. Title: WINDSOR JAS COCOA AND COFFEE
Implementor: Windsor JAS branch
HAP Grant: $J 444,056.
Duration: 3 years.
Commencement date: July 18, 1988.
Termination date: October 31, 1992.
Extended: One month
Expended as of April 7, 1992: $J 443,123.
Beneficiaries: 200; attained 250.
Acres Rehabilitated: 60 cocoa; 30 coffee.
Acres, new plantings: 12 cocoa; 5 coffee.
Anti-erosion training: Yes
Primary outputs: rise in production, increase in income, increase in JAS membership, soil accretion.
Secondary outputs: manager collects baseline data on farm characteristics.
Notes: to terminate this F-Y.
Cocoa: 7,200 seedlings provided.
58,000 trees resuscitated.
Coffee: 3,500 seedlings provided.
28,000 resuscitated.
Fruit trees: 250
Timber trees: 1,500
Coconut trees: 2,000.

2. Title: BLACKWOODS JAS
Implementor: Blackwoods JAS Branch
HAP Grant: $J 389,417.
Duration: 3 years.
Commencement date: August 24, 1988.
Termination date: October 31, 1991.
Extended: One month.
Expended as of April 7, 1992: $J 388,483.
Beneficiaries: 200 farmers; 260 achieved.
Acres Rehabilitated: 50 cocoa; 40 coffee.
Acres, new plantings: 10 cocoa; 10 coffee.
Anti-erosion training: yes.
Primary outputs: control soil erosion, increase income.
Notes: to terminate this F-Y.
Cocoa: 9,983 seedlings distributed.
24,000 resuscitated.
Fruit Trees: 500.
Timber Trees: 900
Coconut Trees: 4,000.

3. Title: ELGIN JAS
Implementor: Elgin JAS Branch
HAP Grant: $J 360,500.
Duration: 3 years.
Commencement date: August 24, 1988.
Termination date: August 23, 1992.
Extended: no.
Expended as of April 7, 1992: $J 359,144.
Beneficiaries: 200 farmers; 255 achieved.
Acres Rehabilitated: 80 cocoa; 40 coffee.
Acres, new plantings: 10 cocoa; 4 coffee.
Anti-erosion training: not indicated.
Primary outputs: increase productivity and production of cocoa and coffee; expand rural employment opportunities.
Secondary outputs: training in record-keeping, improve paths to roads, field days and training.
Evaluation: MOA at EOP.
Notes: to expire this F-Y.
Cocoa: 5,717 seedlings distributed.
66,000 resuscitated.
Coffee: 1,500 seedlings.
23,500 resuscitated.
Timber Trees: 900.
Fruit Trees: 700.
Coconut Trees: 2,600.

4. Title: MANGO TOP-WORKING
Implementor: JAS - Jamaica Agricultural Society
HAP Grant: $J 50,000 + $J 24,000, + $J 26,000 = $J 100,000.
Duration: 2 years.
Commencement date: August 24, 1988.
Termination date: August 23, 1990.
Extended: December 31, 1992.
Expended as of April 7, 1992: $J 50,135.
Beneficiaries: not stated, estimated at 80 farmers.
Acres Rehabilitated: n/a.
Acres, new plantings: n/a.
Anti-erosion training: no.
Primary outputs: 1,000 non-commercial mango trees grafted to produce commercial export fruit; actual achieved 469 trees with productivity lower than anticipated.
Secondary outputs: farmers trained in pruning and care of trees.
Evaluated: by HAP, October 1990.
Note: to terminate this F-Y.3. Project less than 1/2 of outputs anticipated. Questionable as to logic of continued support.

This approach has good potential, but care of new grafts for 2 years or more is very important because of disease problems, competition from non-grafted shoots, etc.

5. Title: RIO MINHO COCOA EXPANSION PROJECT
Implementor: Cocoa Industry Board
HAP Grant: $J 6,486,280;
increased: $J 10,216,036.
Expended as of April 7, 1992: $J 6,468,914.
Duration: 4 years.
Commencement date: September 30, 1988.
Termination date: September 30, 1992.
Extended: December 31, 1992 (March 31,1994 requested).
Beneficiaries: 1,200 farmers in 10 districts; (actual 1,500 farms rehabilitated). Beneficiaries increased to 2,000.
Acres Rehabilitated: 2,995 cocoa
Acres, new plantings: 37,775 new plants (cocoa, coconut, coffee, ackee,etc).
Anti-erosion training: 472 chains of gullies treated.
Primary outputs: Crop development - 100% increase in cocoa production to approx 100,000 (200,000 actual) boxes/10 years; increase average farm output from 8 to 20 boxes; increase farm cocoa income from $J 600 to $J 1,500; double density of cocoa trees. Institutional strengthening - establish revolving crop-lien fund; reactivate and develop cocoa cooperatives within 5 years. Agricultural extension education; support services development.
Evaluation: external HAP mid-term.
Cocoa: 120,200 seedlings distributed.
684,000 resuscitated.
Coffee: 400 seedlings distributed.
Fruit Trees: 2,575 distributed.
Timber Trees: 3,000.
Coconut Trees: 23,000.

6. Title: IICA / MINAG FARMING SYSTEMS PROJECT
Implementors: Ministry of Agriculture & IICA.
HAP Grant: $J 6,989,627.
Duration: 5 years.
Commencement date: November 15, 1988.
Termination date: December 31, 1993.
Expended as of April 7, 1992: $J 4,335,503.
Beneficiaries: HAP/ and 168 farmers; 170 achieved,
Anti-erosion training: yes.
Primary outputs: (1) Economically efficient tree crop-based farming systems. (2) Improved watershed management practices. (3) Farmer organizations which support production and marketing activities of individual farmers. (4) Recommendations on improved marketing systems. (5) Recommendations for research, extension, and agricultural policy to increase productivity and expand acreage of perennial crops. (6) Farming systems methodology institutionalized within MINAG R&D Division.
Notes: Sub-project concludes 12/31/93.
Cocoa: 7,088 seedlings distributed.
6,223 resuscitated.
Coffee: 5,499 seedlings distributed.
2,795 resuscitated.
Fruit Trees: 10,795.
Coconut Trees: 3,861.

7. Title: ABOVE ROCKS FISH / JAS SUB-PROJECT
Implementors: FISH - Foundation for International Self Help
JAS - Jamaica Agricultural Society
HAP Grant: $J 498,245
Duration: 3 years.
Commencement date: March 8, 1989.
Termination date: September 30, 1992.
Extended: 6 months.
Expended as of April 7, 1992: $J 495,535.
Beneficiaries: 200 farmers; 185 achieved.
Acres Rehabilitated: 60 cocoa; 30 coffee
Acres, new plantings: 20 cocoa; 5 acres coffee
Anti-erosion training: demonstrate trees/soil conservation
Primary outputs: rehabilitate, plant tree crops; test soil conservation techniques on 3.2 acre demonstration farm; introduce forestry systems producing fodder, fence posts; fuel wood, lumber.
Secondary outputs: baseline survey; assistance in marketing.
Notes: to terminate this F-Y.
Cocoa: 24,050 seedlings; 6,050 resuscitated.
Coffee: 13,350 seedlings; 4,850 resuscitated.
Timber: 4,000; Coconut: 7,000.
Project Manager favors food crops.

8. Title: MANCHESTER RADA SUB-PROJECT
Implementor: RADA / Manchester Land Authority.
HAP Grant: $J 446,027.
Duration: 3 years.
Commencement date: April 18, 1989.
Termination date: December 31, 1993.
Extended: no.
Expended as of April 7, 1992: $J 463,083.
Beneficiaries: 200; 127 achieved.
Acres Rehabilitated: 35 coffee; 10 various fruit/timber.
Acres, new plantings: 25 coffee.
Anti-erosion training: yes.
Primary outputs: Anti-erosion training: stone barriers 15 acres; grass barriers 45 acres; waterways 40 chains; 900 basins. Improved delivery of extension service; strengthen JAS Branch activities; introduce appropriate technology for development and conservation of hillside lands.
Evaluation: EOP.
Coffee: 17,000 seedlings; 12,000 resuscitated.
Timber trees: 600.

9. Title: UNITAS OF JAMAICA SUB-PROJECT
Implementor: UNITAS
HAP Grant: $J 600,055.
Duration: 3 years.
Commencement date: June 21, 1989.
Termination date: December 31, 1992.
Extended: no.
Expended as of April 7, 1992: $J 580,439.
Beneficiaries: 250; 254 achieved.
Acres Rehabilitated: 80 coffee; 10 cocoa.
Acres, new plantings: 10 coffee; 5 cocoa.
Anti-erosion training: yes. Maintenance of anti-erosion structures.
Primary outputs: improve level of income; assist with inputs, organize cooperatives; teach cultural practices; motivate young men and women.
Notes: To terminate this F-Y.
Cocoa: 7,300 seedlings; 3,927 resuscitated.
Coffee: 56,700 seedlings; 37,496 resuscitated.
Fruit trees: 3,200
Timber: 3,670
Coconut: 10.

10.Title: BASELINE SURVEY
Implementor: Agro-Socio-Economic Research Ltd.
HAP Grant: $J 541,475
Duration: 1 year.
Commencement date: October 16, 1990.
Termination date: October 15, 1991.
Extended: June, 1992.
Expended as of April 7, 1992: $J 216,590.
Beneficiaries: 11 Sub-projects:

Blackwoods/Elgin/Windsor JAS.
UNITAS
Above Rocks JAS
Manchester Land Authority
St Mary Cocoa Farmers Support
Guys Hill Coffee Cooperative
Agro-forestry Promotion
North St Catherine Coffee Coop
North Clarendon Development Co

Acres Rehabilitated: n/a
Acres, new plantings: n/a
Anti-erosion training: n/a
Primary outputs: status at outset of each sub-project with information on demographic, social, and economic data on farm households, including the following;

- land tenure and use
- production, income, expenditure and marketing;
- farm labor utilization;
- agricultural practices;
- tree crop production & soil conservation;
- pest and disease control & technology use;
- farming constraints;
- credit generation and use / formal and informal savings, pensions;
- gender consideration;
- environmental impact;
- decision-making, perception and motivation, attitudes to farming, research and group participation;
- soil data, slopes and land capability;
- extension and other sources of information;
- membership in farmer organizations;
- any other data necessary to access the performance of the project.

Notes: Very little data and no analyses provided to date. This contract appears problematical.

11. Title: JAS ORGANIZING.
Implementor: JAS
HAP Grant: $J 60,000.
Duration: 3 years.
Commencement date: March 31, 1989.
Termination date: March 31, 1993.
Extended: no.
Expended as of April 7, 1992: $J 37,435.
Beneficiaries: JAS personnel
Primary outputs: Travel support for JAS organizers.

12. AGRO-FORESTRY PROMOTION (Rio M. and Rio C.)
Implementor: Forestry & Soil Conservation Dept. MOA.
HAP Grant: $J 1,416,250 and $US 55,550.
Duration: 3 years.
Commencement date: April 27, 1990
Termination date: October 24, 1993
Extended: no.
Expended as of April 7, 1992: $J 633,270.
Beneficiaries: 600 farmers; 712 achieved.
Acres, new plantings: 300 acres.
Anti-erosion training: yes.
Primary outputs: sensitize farmers; train 6 agro-forestry technicians; increase cover/decrease erosion; develop cost-benefit information for future use, forge links with community/farmers. Increase income by introduction of new crops: cauliflower, passion fruit and increasing production of coffee, cocoa, yam, cabbage and sugarcane.
Evaluation: mid-term at 18 months; final at EOP.
Cocoa: 3,411 seedlings distributed.
Fruit trees: 111
Timber: 4,400
Coconut: 1,268

13. Title: GUYS HILL COFFEE CO-OPERATIVE
Implementor: CIDCo. - Coffee Industry Development Company
HAP Grant: $J 1,596,595.
Duration: 3 years.
Commencement date: June 18, 1990.
Termination date: June 30, 1993.
Extended: no.
Expended as of April 7, 1992: $J 511,380.
Beneficiaries: 300 farmers; 200 achieved.
Acres Rehabilitated: 200 acres of old coffee.
Anti-erosion training: yes.
Primary outputs: raise productivity from 15 to 60 boxes/ acre; increase income; increase foreign exchange earnings; create employment; reduce soil erosion; strengthen community organizations; encourage environmental preservation.
Secondary outputs: farmer training.
Coffee: 11,550 seedlings
Coconuts: 1,760.

14. Title: NORTH-WEST ST. CATHERINE SUB-PROJECT
Implementor: CIDCo. - Coffee Industry Development Company
HAP Grant: $J 2,228,215.
Duration: 3 years.
Commencement date: June 18, 1990.
Termination date: June 30, 1993.
Extended: no.
Expended as of April 7, 1992: $J 573,117.
Beneficiaries: 500 farmers; 200 achieved.
Acres Rehabilitated: 300 acres of old coffee.
Anti-erosion training: yes.
Primary outputs: raise productivity from 15 to 60 boxes / acre; increase income; reduce soil erosion; increase foreign exchange earnings; strengthen community organizations; encourage environmental preservation.
Secondary outputs: training.
Coffee: 11,815 seedlings; 27,636 resuscitated
Coconut: 1,780.

15. Title: ST. MARY COCOA GROWERS SUPPORT SUB-PROJECT
Implementor: Cocoa Industry Board
HAP Grant: $J 1,953,864 and $US 22,000.
Duration: 3 years.
Commencement date: July 26, 1990.
Termination date: December 31, 1993.
Extended: no.
Expended as of April 7, 1992: $J 1,411,976.
Beneficiaries: 800 farmers; 247 achieved.
Acres Rehabilitated: 500 cocoa
Acres, new plantings: 5,000 fruit and 5,000 shade trees.
Anti-erosion training: yes.
Primary outputs: Raise productivity from 6 to 50 boxes/acre on participant farms; raise production by 500% over 1986-87 levels. Assist farmers in selecting crop mix, encourage savings, develop local organization/capacity; demonstrate trees ideal for hillside farming, conservation practices.
Secondary outputs: stem urban drift, improve economy and quality of farms.
Evaluation: external at mid-term at 18 months; EOP.
Cocoa: 34,795 seedlings
Fruit trees: 1,674
Timber: 60
Coconut: 1,225.

16. Title: WATERSHED INVENTORY PROJECT
Implementor: Ministry of Agriculture/Physical Planning
HAP Grant: $J 1,426,800 and $US 135,752
Duration: 3 years
Commencement date: November 16, 1990
Termination date: December 31, 1993
Extended: no.
Expended as of April 7, 1992: $J 346,302.
Beneficiaries: HAP
Acres Rehabilitated: n/a
Acres, new plantings: n/a
Anti-erosion training: n/a
Primary outputs: Resource Atlases - 13 physical data base and crop suitability maps; location and extent of sub-project areas; land cover/land use analyses and maps; topographical maps scale 1:12,500; hydrology to fifth order and watershed acreage calculations; physographical differentiation; physiognomic-lithomorphic soils map; soil map depicting soil series, acreage and percentages of soil series, descriptions and physical/chemical characteristics; agro-climatic zone differentiation; soil erosion hazard map; land suitability/evaluation; population density, social and demographic aspects; farm size, distribution, number of farmers per extension area.
Secondary outputs: expanded database; upgraded JAMGIS hardware environment; full integration of Jamaica Physical Land Evaluation System (JAMPLES) into JAMGIS; staff training.

17. Title: NORTH CLARENDON PROCESSING COMPANY
Implementor: N.C.P. Co.
HAP Grant: $J 1,019,700 and $US 167,475.
Duration: 4 years.
Commencement date: January, 1991.
Termination date: December, 1993.
Extended: no.
Expended as of April 7, 1992: $J 334,860.
Beneficiaries: 1000 farmers and NCPCo (processing plant).
Acres Rehabilitated: n/a.
Acres, new plantings: 500 acres new fruit in year one.
900 acres by end of project.
Anti-erosion training: yes.
Primary outputs: increase fruit production and processing capacity. Expand variety of fruits for processing; increase number of farmers producing fruit from 300 to 1,000; develop extension arm to resuscitate and establish 900 acres of new plants: mango, passion fruit, nutmeg, guava, and soursop.
Secondary outputs: increase employment at processing factory. Farmer training; 1 extension officer.
Evaluation: end of year 1 and EOP.
Notes: Installation of machinery behind schedule.

18. Title: BERMADDY AREA RIO COBRE SUB-PROJECT
Implementor: RADA St Catherine.
HAP Grant: $J 930,105 & $US 21,400.
Duration: 2 years.
Commencement date: August 27, 1991.
Termination date: December 31, 1993.
Extended: no.
Expended as of April 7, 1992: $J 333,085.
Beneficiaries: 500 farmers.
Acres rehabilitated: 200 acres.
Acres, new plantings: included in above.
Anti-erosion training: yes.
Primary outputs: plant tree crops to protect watershed; increase production of trees; increase employment potential; improve income; develop sustainable farmer mobilization effort; establish youth leadership and training groups in 5 districts; train at least 25 youth members in leadership, soil conservation, tree crop development, and watershed management; increase acreage of cocoa by 45; coffee by 45; avocado by 5; ackee by 10; mango by 30 timber by 5; and soursop by 20.
Evaluation: 1st at 6 months to one year; final.

19. Title: GIBLATORE / BERMADDY SUB-PROJECT
Implementor: RADA St Catherine
HAP Grant: $J 715,660 and $US 4,400.
Duration: 2 years.
Commencement date: September 23, 1991.
Termination date: December 31, 1993
Extended: no.
Expended as of April 7, 1992: $J 140,012.
Beneficiaries: 300.
Acres Rehabilitated: 50.
Acres, new plantings: 250.
Anti-erosion training: yes.
Primary outputs: protect watershed, increase production, increase employment potential; improve income generation. Mobilize farmers; establish youth leadership and training groups in 5 locales; train at least 25 youths in agricultural leadership, cultural practices, soil conservation, tree crop development and watershed development. Increase acreage of coffee by 60; ackee by 30; avocado by 30; coconut by 40; pimento by 30; timber by 10; papaya by 20.
Evaluation: external 6 months to 1 year; EOP.

20. Title: CROFTS HILL KELLITS COCOA DEVELOPMENT
Implementor: RADA, Clarendon supported by IICA.
HAP Grant: $J 1,319,953 and $US 20,600.
Duration: 2 years.
Commencement date: January 6, 1992.
Termination date: January 31, 1994.
Extended: no.
Expended as of April 7, 1992: $J 13,393.
Beneficiaries: 700 farmers
Acres Rehabilitated: 700
Anti-erosion training: yes.
Primary outputs: raise cocoa output from 6,300 boxes to 23,800; improved services and institutional strengthening of RADA and cooperatives; improvement in farm income; improved land-use strategies, improved soil and water conservation.

21. Title: DIMS - SHORT-TERM INTENSIVE TREE CROP DEV.
Implementor: Development Implementation and Management Services.
HAP Grant: $J 1,313,046.
Termination date: October 31, 1993.
Note: Project cancelled, implementor failed to commence work.

Appendix B:
Enterprise budgets for selected tree crops

Notes and assumptions

The budgets are developed using information collected from the Ministry of Agriculture, the Hillside Agricultural Sub-project documents, the Cocoa Industry Board, the Coffee Industry Board and the Inter-American Institute for the Corporation on Agriculture. These budgets were used for comparison with budgets in the original project document. Trends in the changes in line items were calculated. These trends form the basis for the calculation of costs and projected returns. Returns were calculated using only revenues from the primary crops and not the economic shade crops.

On the output side, farm gate prices rose (1988/89-90/91) from Ja$78/box to Ja$146/box for coffee and Ja$65/box to Ja$77/box for cocoa. Newly planted coffee will commence bearing after three years and one year for resuscitated coffee, with yields estimated at 50 boxes/acre after three years and over 60-100 boxes/acre after five years. Newly planted cocoa will commence bearing after three years, while rehabilitated fields will commence after 18 months, with yields estimated at 40 boxes/acre after three years and 50-70 boxes/acre after 5 years.

Taking the above assumptions into consideration, the following crop enterprise budgets are developed showing expenditures and returns on a per-acre basis in constant 1990/91 prices (Tables 1-4). That is prices paid to farmers in the fall of 1990 through the spring of 1991 for cocoa and the July-December of 1990 for coffee. Average exchange rate over the period is US$12.50 to Ja$1.00

Narrative of the crop budgets

Table 1 shows estimated costs and returns to establish one acre of cocoa or 435 trees. Based on 1990/91 prices, taking into account only variable costs, estimated cost of production is Ja$6820.60. Assuming annual maintenance at constant 1990/91 prices, this is estimated at Ja$3052.60. These orchards will come into full bearing in year three. If the estimated yield ranges from 40-70 boxes/acre, expected net returns will be negative in the first two years and slightly above cost in year three. Expected net returns will increase in year four from a low of Ja$1567.40 to a high of Ja$2337.40.

Table 2 highlights the costs and returns for one acre of rehabilitated cocoa. The estimated cost of production is Ja$6657.87 at constant 1990/91 prices. The annual maintenance cost is estimated at Ja$2781.62 at constant 1990/91 prices. Given the expected yields, the expected net returns will just about cover maintenance costs in the third year and will show positive returns ranging from a low of Ja$1838.38 to a high Ja$2068.82 at constant 1990/91 prices and varying yields of 40-70 boxes.

Estimated costs and returns of an acre of newly planted coffee are presented in Table 3. Estimated cost of production is Ja$8737.63 at constant 1990/91 prices. Annual maintenance cost is Ja$2586.13. The average national yield is reported as 50 boxes/acre which is used in the calculation of net returns. However, reports have indicated that yields of more than 100 boxes/acre are attainable under good conditions. As expected, net returns are negative in the first two years and will then increase to Ja$4713.96 per acre.

Table 4 shows the estimated costs and returns associated with one acre of resuscitated coffee. Estimated costs of production is Ja$6141.52, the annual maintenance is estimated at Ja$2523.52. Expected net returns increase from year two to a high of Ja$4776.48 per acre at 1990/91 constant prices.

Analyses

Comparing enterprises, while production cost of coffee is higher than cocoa for a newly planted acre of each, based on the net returns and the lower maintenance for coffee, this enterprise would be selected. Using 1990/91 constant prices, the stream of income for coffee is higher. Because of labor constraints and the advanced age of the farmers, expansion in cocoa has been observed to be higher. However, if the gap between farm gate prices for cocoa and coffee continues to increase with all other factors remaining constant, then HAP may want to encourage younger farmers to invest in coffee production. Calculations have revealed that as of December 1991, for new planting, the project farmers have planted 517 acres of cocoa and 163 acres of coffee at a rate of 435 trees/acre and 872/acre trees respectively.

Comparison between enterprises of rehabilitated cocoa and resuscitated coffee reveal that costs for cocoa are higher than coffee. Also, the maintenance costs for cocoa are higher than coffee. Per-acre net returns for coffee are higher. However, acreage for rehabilitated cocoa is higher than acreage of resuscitated coffee. These are 1949 acres and 232 acres respectively, as of December 1991. This could be a result of project areas selected and the type enterprises that dominate these watersheds.

In summary, total new plantings and resuscitated coffee and cocoa amounted to the following: new plantings of cocoa, 18 percent; new plantings of coffee, 6 percent; rehabilitated cocoa, 68 percent; and resuscitated coffee, 8 percent.

Table 1.
Crop Enterprise Budget and Projected Returns
Cocoa: Estimated costs to establish one acre

Labor Description	Unit	Quantity	Price	Years 1	2	3	4	5	6	7	8	9	10
Land clearing	acre	1.00	585.00	585.00									
Lining peg prep	m/day	2.00	50.00	100.00									
Lining	m/day	4.00	50.00	200.00									
Hole-Digging	hole	435.00	1.00	435.00									
Manure/mould	hole	435.00	1.00	435.00									
Planting	m/day	3.20	50.00	160.00									
Fertilizer appl.	m/day	2.00	50.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Weeding	acre	1.00	869.00	869.00	869.00	869.00	869.00	869.00	869.00	869.00	869.00	869.00	869.00
Herbicide appl.	m/day	1.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Replace Seedlings	m/day	2.00	50.00	100.00									
Lining (Shade)	m/day	3.00	50.00	150.00									
Hole-Digging/Shade	m/day	228.00	1.00	228.00									
Prep/Plant Temp. Shade	m/day	5.40	50.00	270.00									
Plant Perm. Shade	m/day	2.00	50.00	100.00									
Total Labor Costs				3782.00	1019.00	1019.00	1019.00	1019.00	1019.00	1019.00	1019.00	1019.00	1019.00
Inputs													
Cocoa Seedlings	each	435.00	1.25	543.00									
Coconut Suckers	each	80.00	1.50	120.00									
Plantain Sucker	each	228.00	1.50	342.00									
N.P.K 10-5-20 Fert.	bag	1.00	42.65	42.65	42.65	42.65	42.65	42.65	42.65	42.65	42.65	42.65	42.65
N.P.K. 12-24-12 Fert.	bag	4.00	61.89	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08
N.P.K. 16-9-18 Fert.	bag	1.40	77.24	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00
N.P.K. 6-18-27 Fert.	Bag	1.50	47.50	71.25	71.25	71.25	71.25	71.25	71.25	71.25	71.25	71.25	71.25
Biogenic Fert.	bag	39.00	24.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00
Rat Bait	lb	2.00	2.50	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Daconate herbicide	gal	1.00	221.13	221.13	221.13	221.13	221.13	221.13	221.13	221.13	221.13	221.13	221.13
Furadan Insecticide	lb	21.30	27.30	581.49	581.49	581.49	581.49	581.49	581.49	581.49	581.49	581.49	581.49
Total Input Costs				3038.60	2033.60	2033.60	2033.60	2033.60	2033.60	2033.60	2033.60	2033.60	2033.60
Total Variable Costs				6820.60	3052.60	3052.60	3052.60	3052.60	3052.60	3052.60	3052.60	3052.60	3052.60

Estimated Returns per acre at constant 1990/91 price and various yields combinations

Year	1	2	3	4	5	6	7	8	9	10
Yield (boxes)			40.00	60.00	65.00	70.00	70.00	70.00	70.00	70.00
Returns ($/box)			77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00
Total Returns			3080.00	4620.00	5005.00	5390.00	5390.00	5390.00	5390.00	5390.00
Total var. costs	6820.60	3052.60	3052.60	3052.60	3052.60	3052.60	3052.60	3052.60	3052.60	3052.60
Net Returns	-6820.06	-3052.60	27.40	1567.40	1952.40	2337.40	2337.40	2337.40	2337.40	2337.40

Table 2.
Crop Enterprise Budget and Projected Returns
Cocoa: Estimated costs to Rehabilitate one acre

Labor Description	Unit	Quantity	Price	Years 1	2	3	4	5	6	7	8	9	10
Land clearing	acre	1.00	478.20	478.20									
Lining peg prep	m/day	2.00	50.00	100.00									
Lining	m/day	4.00	50.00	200.00									
Hole-Digging	hole	268.00	1.00	268.00									
Manure/mould	hole	268.00	1.00	268.00									
Planting	m/day	3.00	50.00	150.00									
Fertilizer appl.	m/day	2.00	50.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Weeding	acre	1.00	522.20	522.20	522.20	522.20	522.20	522.20	522.20	522.20	522.20	522.20	522.20
Herbicide appl.	m/day	2.00	50.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Replace Seedlings	m/day	1.00	50.00	50.00									
Pruning	m/day	4.60	50.00	230.00									
Construction of Ditches	m/day	2.50	50.00	125.00									
Lining (Shade)	m/day	1.00	50.00	50.00									
Hole-Digging/Shade	m/day	151.00	1.00	151.00									
Prep/Plant Temp. Shade	m/day	4.20	50.00	210.00									
Plant live barriers	m/day	16.70	50.00	835.00									
Estab. Rat Bait stations	m/day	0.50	50.00	25.00									
Plant Perm Shade	m/day	1.00	50.00	50.00									
Total Labor Costs				3912.40	722.20	722.20	722.20	722.20	722.20	722.20	722.20	722.20	722.20
Inputs													
Cocoa Seedlings	each	272.00	1.25	340.00									
Coconut Suckers	each	80.00	1.50	120.00									
Plantain Sucker	each	151.00	1.50	226.05									
N.P.K 10-5-20 Fert.	bag	0.80	42.65	34.12	34.12	34.12	34.12	34.12	34.12	34.12	34.12	34.12	34.12
N.P.K. 6-18-27 Fert.	bag	0.70	44.31	31.02	31.02	31.02	31.02	31.02	31.02	31.02	31.02	31.02	31.02
N.P.K. 7-14-14 Fert.	bag	0.50	49.60	24.80	24.80	24.80	24.80	24.80	24.80	24.80	4.80	24.80	24.80
N.P.K. 6-8-18 Fert.	Bag	2.20	77.24	169.00	169.00	169.00	169.00	169.00	169.00	169.00	169.00	169.00	169.00
Ammon. Sul. Fertilizer	bag	0.80	71.08	56.86	56.86	56.86	56.86	56.86	56.86	56.86	56.86	56.86	56.86
Bioganic Fert.	bag	39.00	24.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00
Rat Bait	lb	2.00	2.50	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Daconate herbicide	gal	1.00	221.13	221.13	221.13	221.13	221.13	221.13	221.13	221.13	221.13	221.13	221.13
Furadan Insecticide	lb	21.30	27.30	581.49	581.49	581.49	581.49	581.49	581.49	581.49	581.49	581.49	581.49
Total Input Costs				2745.47	2059.42	2059.42	2059.42	2059.42	2059.42	2059.42	2059.42	2059.42	2059.42
Total Variable Costs				6657.87	2781.62	2781.62	2781.62	2781.62	2781.62	2781.62	2781.62	2781.62	2781.62

Estimated Returns per acre at constant 1990/91 price and various yields combinations

Year	1	2	3	4	5	6	7	8	9	10
Yield (boxes)		40.00	40.00	60.00	65.00	70.00	70.00	70.00	70.00	70.00
Returns ($/box)		77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00
Total Returns		3080.00	3080.00	4620.00	5005.00	5390.00	5390.00	5390.00	5390.00	5390.00
Total var. costs	6657.87	2781.62	2781.62	2781.62	2781.62	2781.62	2781.62	2781.62	2781.62	2781.62
Net Returns	-6657.87	298.38	298.38	1838.38	2223.38	2608.38	2608.38	2608.38	2608.38	2608.38

Table 3.
Crop Enterprise Budget and Projected Returns
Coffee: Estimated costs to establish one acre

Labor				Years									
Description	Unit	Quantity	Price	1	2	3	4	5	6	7	8	9	10
Land clearing	acre	1.00	668.00	668.00									
Lining peg prep	m/day	2.00	50.00	100.00									
Lining	m/day	6.00	50.00	300.00									
Hole-Digging	hole	872.00	1.00	872.00									
Manure/mould	hole	872.00	1.00	872.00									
Planting	m/day	7.00	50.00	350.00									
Fertilizer appl.	m/day	2.00	50.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Weeding	acre	1.00	668.00	668.00	668.00	668.00	668.00	668.00	668.00	668.00	668.00	668.00	668.00
Herbicide appl.	m/day	10.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Replace Seedlings	m/day	2.00	50.00	100.00									
Lining (Shade)	m/day	2.50	50.00	125.00									
Hole-Digging/Shade	m/day	2.00	50.00	100.00									
Prep/Plant Temp. Shade	m/day	4.00	50.00	200.00									
Plant Perm. Shade	m/day	1.00	50.00	50.00									
Total Labor Costs				4555.00	818.00	818.00	818.00	818.00	818.00	818.00	818.00	818.00	818.00
Inputs													
Coffee Seedlings	each	872.00	2.00	1744.00									
Coconut Suckers	each	30.00	1.50	45.00									
Plantain Sucker	each	435.00	1.50	625.50									
N.P.K 10-5-20 Fert.	bag	2.70	42.65	115.92	115.92	115.92	115.92	115.92	115.92	115.92	115.92	115.92	115.92
N.P.K. 12-24-12 Fert.	bag	1.10	61.89	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08
N.P.K. 16-9-18 Fert.	bag	4.30	77.24	332.13	332.13	332.13	332.13	332.13	332.13	332.13	332.13	332.13	332.13
Ammon. Sul. Fert.	bag	4.30	71.08	305.64	305.64	305.64	305.64	305.64	305.64	305.64	305.64	305.64	305.64
Urea Fert.	bag	0.50	49.00	22.31	22.31	22.31	22.31	22.31	22.31	22.31	22.31	22.31	22.31
Bioganic Fert.	bag	31.10	24.00	746.40	746.40	746.40	746.40	746.40	746.40	746.40	746.40	746.40	746.40
Poultry Manure	bag	12.00	5.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
Daconate herbicide	gal	0.50	221.13	110.56	110.56	110.56	110.56	110.56	110.56	110.56	110.56	110.56	110.56
Mocap Nematocide	lb	0.30	23.64	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09		
Total Input Costs				4182.63	1768.13	1768.13	1768.13	1768.13	1768.13	1768.13	1768.13	1761.04	1761.04
Total Variable Costs				8737.63	2586.13	2586.13	2586.13	2586.13	2586.13	2586.13	2586.13	2579.04	2579.04
Estimated Returns per acre at constant 1990/91 price and average national yield combination													
Year				1	2	3	4	5	6	7	8	9	10
Yield (boxes)						50.00	50.00	50.00	50.00	50.00	50.00	50.00	60.00
Returns ($/box)						146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00
Total Returns						7300.00	7300.00	7300.00	7300.00	7300.00	7300.00	7300.00	8760.00
Total var. costs				8737.63	2586.13	2586.13	2586.13	2586.13	2586.13	2586.13	2586.13	2579.04	2579.04
Net Returns				-8737.63	-2586.13	4713.87	4713.87	4713.87	4713.87	4713.87	4713.87	4720.96	6180.96

Table 4.
Crop Enterprise Budget and Projected Returns
Coffee: Estimated costs to resuscitate one acre

Labor				Years									
Description	Unit	Quantity	Price	1	2	3	4	5	6	7	8	9	10
Land clearing	acre	1.00	530.00	530.00									
Lining peg prep	m/day	2.00	50.00	100.00									
Lining	m/day	3.20	50.00	160.00									
Hole-Digging	hole	530.00	1.00	530.00									
Manure/mould	hole	530.00	1.00	530.00									
Planting	m/day	6.20	50.00	310.00									
Fertilizer appl.	m/day	2.00	50.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Weeding	acre	1.00	519.00	519.00	519.00	519.00	519.00	519.00	519.00	519.00	519.00	519.00	519.00
Herbicide appl.	m/day	1.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Replace Seedlings	m/day	0.50	50.00	25.00									
Shoot selection	m/day	5.00	50.00	250.00									
Cut-back operations	m/day	3.30	37.46	123.00									
Total Labor Costs				3227.00	669.00	669.00	669.00	669.00	669.00	669.00	669.00	669.00	669.00
Inputs													
Coffee Seedlings	each	530.00	2.00	1060.00									
N.P.K 10-5-20 Fert.	bag	1.00	42.65	42.65	42.65	42.65	42.65	42.65	42.65	42.65	42.65	42.65	42.65
N.P.K. 12-24-12 Fert.	bag	1.10	61.89	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08
N.P.K. 16-18-27 Fert.	bag	0.40	44.31	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62	16.62
Ammon. Sul. Fert.	bag	1.00	71.08	71.08	71.08	71.08	71.08	71.08	71.08	71.08	71.08	71.08	71.08
Urea Fert.	bag	2.40	49.00	116.00	116.00	116.00	116.00	116.00	116.00	116.00	116.00	116.00	116.00
Bioganic Fert.	bag	54.00	24.00	1312.00	1312.00	1312.00	1312.00	1312.00	1312.00	1312.00	1312.00	1312.00	1312.00
Daconate herbicide	gal	1.00	221.13	221.00	221.00	221.00	221.00	221.00	221.00	221.00	221.00	221.00	221.00
Mocap Nematocide	lb	0.30	23.64	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09
Total Input Costs				2914.52	1854.52	1854.52	1854.52	1854.52	1854.52	1854.52	1854.52	1854.52	1854.52
Total Variable Costs				6141.52	2523.52	2523.52	2523.52	2523.52	2523.52	2523.52	2523.52	2523.52	2523.52

Estimated Returns per acre at constant 1990/91 price and average national yield combination

Year	1	2	3	4	5	6	7	8	9	10
Yield (boxes)		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Returns ($/box)		146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00
Total Returns		7300.00	7300.00	7300.00	7300.00	7300.00	7300.00	7300.00	7300.00	7300.00
Total var. costs	6141.52	2523.52	2523.52	2523.52	2523.52	2523.52	2523.52	2523.52	2523.52	2523.52
Net Returns	-6141.52	4776.48	4776.48	4776.48	4776.48	4776.48	4776.48	4776.48	4776.48	4776.48

Appendix C:
Environmental improvement measures

I. General remarks
Many measures are emphasized in the HAP Sub-Projects to protect the environment from degradation and to improve environmental conditions in the sub-project areas. These measures may be classified into two categories, physical or "engineering" methods and agronomic, or biological methods.

II. Methods to reduce soil erosion

A. Physical or engineering methods
Because of failures of some engineering methods in the past (e.g. large-scale terracing and concrete waterways) these methods are not being emphasized in this project. Nevertheless, simple methods like construction of stone barriers to control runoff of rain water and digging of small "pocket" basins for planting of trees on steep hillsides are being used in many of the sub-projects and are proving to be simple and effective.

B. Agronomic or biological methods

1. Barriers
Farmers are encouraged to establish barriers of living plants, especially grasses, to reduce rapid runoff of rainwater and erosion of soil. As an alternative, barriers of plant debris (weeds, pruned branches and leaves) are established for the same purpose. The evaluation team observed many examples of these in the field. In some cases, use of barriers is augmented by construction of simple waterways to help control of water flow.

2. Mulching
Much emphasis is placed on the use of plant debris for mulching of the soil surface. Mulching aids in reducing soil erosion, conserving moisture, increasing organic- matter content of the soil and recycling mineral elements from crop plants and weeds back into the soil. Mulching reduces the need for tillage of the soil also, and minimum tillage is a good way to reduce soil erosion.

3. Plant cover
Maintaining good coverage of the soil with canopies of trees and other plants is advantageous. An obvious benefit is the erosion-reducing effect on plant root systems. Less obvious is the benefit of shading the soil. Shade reduces evaporation of water from the soil surface and lowers the soil temperature on sunny days, thus reducing oxidation of organic matter in the soil. Plant cover is being increased in the sub-projects by distribution of young plants of various species. Emphasis is on cocoa and coffee, but plants of timber trees, shade trees and many other fruit crops are included (ackee, avocado, breadfruit, passion fruit, coconut, guava, jackfruit, nutmeg, pawpaw, soursop, sweetsop and pineapple).

Another point which should be made is that of the plant cover on "ruinate" land. Much of the land in that category is covered with weeds and does not appear to be subject to significant erosion as it stands. If such land is to be cleared for farming, it must be managed carefully to avoid severe soil erosion before bew crops are established.

III. Methods for reduction of environmental pollution with chemicals

A. Weed management

Some use of herbicide (gramoxone) in the sub-project will control difficult weeds, such as grasses, but much emphasis is placed on control of weeds by hand with machetes or hoes. Hand weed control should continue to be encouraged in the sub-projects because it produces no environmental pollution.

B. Pest and disease management

Emphasis has been placed on use of non-chemical methods for control of pests and diseases, and training has been done accordingly. Farm sanitation is very important in reducing infestation by insects like the coffee berry borer and infection by diseases, like black pod of cocoa. Relatively good control of scale insects in coffee and other crops can be accomplished by destruction of ant nests (by hand) and use of sticky bands on tree trunks to reduce the populations of ants, which nurture the scale insects.

Improvements in farm sanitation, such as weed control and removal of diseased plant material, are important accomplishments of the Hillside Agricultural Project. Farmers in the project areas should continue to use pesticides, but they should be trained to use them in a careful, well-planned manner.

C. Fertilizer usage

Remarks applied to pesticide usage can be applied equally to the use of fertilizers, which should be applied in such a manner that they will not be washed away by rains and contaminate streams an rivers significantly.

Appendix D:
Persons contacted

Hillside Agriculture Project staff
Joseph Suah, Project Manager and Member PCC
A. C. Allen, Deputy Project Manager and Member PCC

USAID Mission to Jamaica
Robert Queener, Mission Director
Stephen Szadek, Agriculture Office Director
Mark Nolan, HAP Project Coordinator and Member PCC
Denise Rollins, Program Officer
Chris Brown, Program Officer

HAP Sub-project staff
Rio Minho Cocoa Expansion Sub-project
Larry Chung, Coordinator
Winsome Arscott-Levy, General Manager, Cooperative
Artnel Garrick, Cooperative Development Supervisor
Castel Brown, Extension Supervisor

MINAG/IICA Sub-project
Charles Reid, Technical Coordinator
Marlene Lewis, Sociologist
Shaun-Marie Grant, Economist
Clarence Osbourne, Field Coordinator
Zithroy Annakie, Agronomist
Eulitt Pinnock, Agronomist
Edgar Stone, Agronomist
Ralden Petrie, Assistant Agronomist

S. O'Connor, North Clarendon Processing Company
Carl Parks, Field Assistant, Manchester RADA Sub-project
A. E. Thompson, Manager, Above Rocks Sub-project
Gloria Kerr, Field Assistant, Above Rocks Sub-project
Vernal Taylor, Former sub-project manager, JAS/Blackwoods

Other persons contacted
Clarence Franklin, Permanent Secretary, Ministry of Agriculture, and Chairman PCC
Marie Strachan, Director of Policy and Planning, Ministry of Agriculture, and Member PCC
William Morgan, Secretary, Jamaica Agricultural Society, and Member PCC
R. Baker, Director, Research and Development, Ministry of Agriculture
Derrick Sinclair, Parish Agricultural Manager, Manchester RADA
Neville Henry, Senior Extension Officer, Manchester RADA
Tomas Mulleady, Agricultural Economist, IICA
Dudley Irving, Deputy Executive Director, RADA
Michelle McIntosh, Auditor, Coopers & Lybrand
Alford Williams, Project Coordinator, CIDCo

Hugh Duncan, Regional Supervisor, CIDCo
Andrew Dunbar, Project Manager, IFAD
Ronald Latouche, Field Assistant, CIDCo
Clement Hurlock, Field Assistant, CIDCo
Vivienne Wright, Secretary/Manager, Cocoa Industry Board
Clinton Gordon, Administrative Assistant, Cocoa Industry Board
Roy Russel, President, Agro-Socio-Economic Research, Ltd.
Ann Bockarie, Forestry Department, University of Florida
Brad Williams, Forestry Department, University of Florida
Stanley Kukowski, Peace Corps Volunteer, Above Rocks

Appendix E:
Resuscitation
(Sometimes called renovation or rehabilitation)

1) **Clearing out weeds from crop area.** These include herbaceous plants (grasses and broad-leaved plants), vines, woody shrubs and trees. In the majority of cases, these plants are cut by hand with a machete or hoe. In some cases, especially with robust grasses, herbicides are used because of the difficulty of removing them by hand.

2) **Pruning.** The trees are cut back with power saws or hand saws. In the case of coffee the trees are cut back to stumps. The cuts are covered with waterproof paint. Follow-up care is needed to remove unwanted shoots, select desirable shoots, and prune them further to encourage development of fruitful lateral shoots. Cocoa trees are cut back less severely, the objectives being mainly to reduce the height of the trees and to reduce crowding of the lateral branches.

3) **Shade management.** Where shade is excessive, whole trees are removed or some large limbs are removed to allow for more light to reach the crop plants beneath the trees. Where banana or plantain are used for shade, some of the trees are removed.

4) **Fertilizer application.** Various materials are used, including mixed inorganic fertilizers, "bio-organic" fertilizer, and animal manures.

5) **Pest and disease control.** Warfarin bait is used to reduce rat populations in cocoa. Endosulfan (and probably other insecticides) are applied by sprayer to control berry borer of coffee. In some instances, copper fungicides are used to control diseases like black pod disease of cocoa and coffee rust disease.

6) **"Optimizing" plant density.** Many seedling plants of coffee, cocoa and other tree crops have been distributed for planting among existing trees. The purpose is to increase the number of trees per acre, and hence the yield per unit of land area.

7) **Soil conservation measures.** These include installation of barriers of stone, living plants, or plant debris to reduce soil erosion, establishment of trenches to control run-off of rain water, digging of "mini-basins" for tree planting on steep hillsides, and mulching of the soil surface with leaves and other plant debris.

Appendix F:
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Giblatore Area Rio Cobre Sub-project
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Manchester Rural Agriculture Development Authority (RADA)
St. Mary's Cocoa Farmer Support Project
North Clarendon Processing Comp