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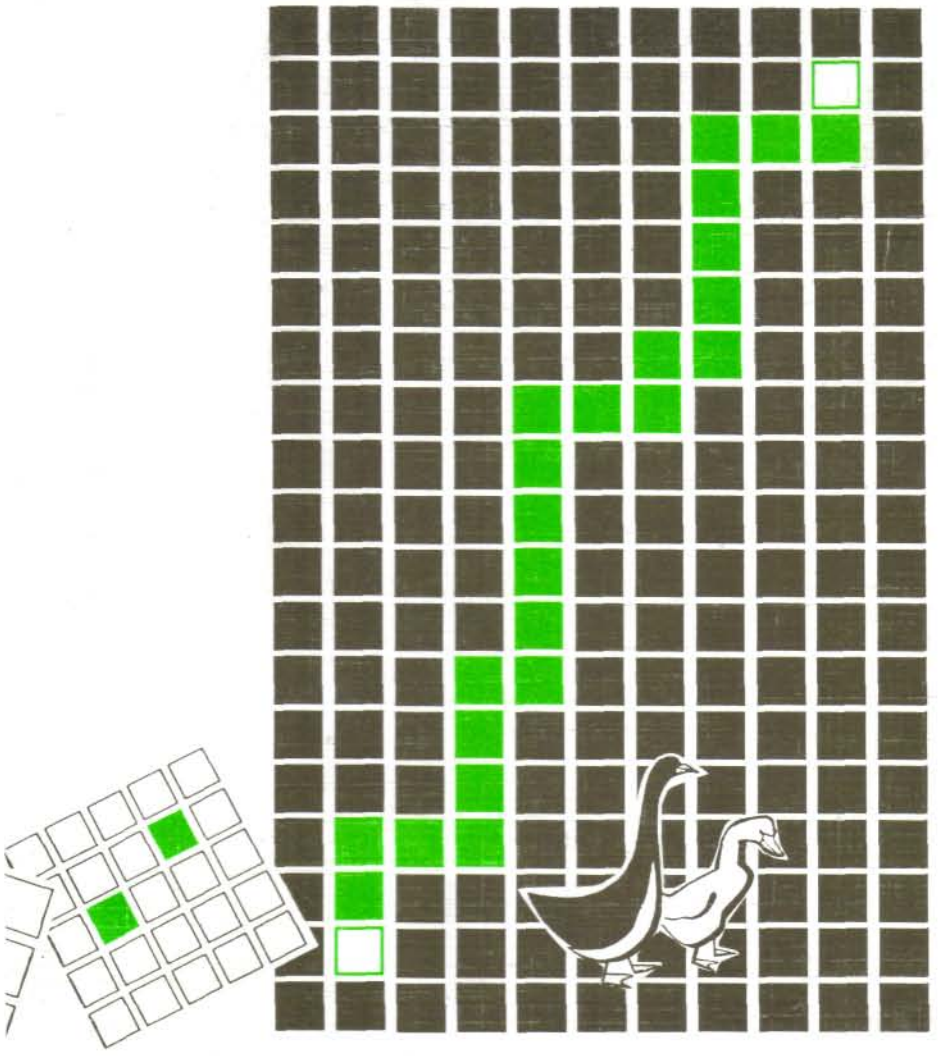

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Management of Soil Conservation Practices in Haiti: A Comparative Analysis of Alley Cropping and Rock Walls

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Abstract

Factors influencing the level of management of soil conservation practices for 139 Haitian farms are investigated using a two-stage multinomial logit model. Model results indicate that age is a significant factor in management of alley cropping. Older farmers, up to 51 years, are 1.27 times more likely to manage their alley cropping than younger ones, but beyond 51 years old, the management skill deteriorates. The probability that alley cropping structures are well managed increases 0.30 times if the farm operator is female. The level of management also decreases as the number of workers per hectare (ha) increases. Farm size, distance of plot from home, and the interaction between slope and distance influence management decisions.

For rock walls, as age increases, the probability that a particular plot is well managed decreases. The probability that the structures are well managed decreases 0.10 times with each "gourde" increase in per capita income. Farmers who participate in local organizations are three times more likely to manage the rock walls well than those who do not belong to groups. The interaction between age and per capita income has a coefficient of 1.46. The probability to better manage rock walls increases four times with the interaction of age and per capita income. The physical characteristic that influences management of rock walls is size of observed plot. For each hectare increase in the plot, the probability of management decreases by 0.63 times.

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INTRODUCTION

Soil erosion and its impacts on fertility of agricultural land are widely recognized as a serious problem facing the Haitian society today. Annual average soil losses in Haiti due to erosion have been estimated at 36.6 million tons per year (AID 1990). Concerns over the pace of such a problem have led governments and donor agencies to launch several soil conservation projects in an attempt to control or mitigate the environmental degradation in Haiti. Several soil conservation techniques, from mechanical structures to biological ones, have been diffused for decades throughout rural areas in Haiti. Rock walls are one of the techniques promoted among small-scale Haitian farmers to limit soil erosion on steep lands. Rock retention walls consist of stone structures built along the contour of the slope with the purpose of slowing down and diverting runoff, controlling erosion of steep lands, and forming a natural terrace over time (Toness et al. 1998). Some experts believe that mechanical structures such as rock walls should be promoted because they are more effective and more appropriate to the topographic conditions of the land in Haiti.

Other conservationists, while recognizing the effectiveness of rock walls, advocate the use of biological structures such as alley cropping because, not only such practices are effective soil erosion barriers, but also they provide nutrients to the soil via use of tree species that help improve crop yields. They also argue that investments in rock walls are beyond the reach of small-scale farmers. Alley cropping involves intercropping woody species and annual food crops that are grown separately on the same land (Kang and Shannon 2001). In this system, the hedgerows are composed of fast-growing trees, usually nitrogen fixing legumes such as *Leucaena*, *Gliricidia*, and *Cassia*. Both alley cropping and rock walls are actually used to some extent in Haiti. The expansion and localization of a particular technique depend on environmental and socio-economic conditions.

Previous research has extensively investigated farmers' attitudes toward adoption of soil conservation practices. Findings of such studies indicate that characteristics of the technology (Napier 1991; Ervin and Ervin 1985); socio-economic factors such as age, education, income, land tenure, and group membership (Anim 1999; Burton et al. 1999; Bultena and Hoiberg 1983; Featherstone and Goodwin 1993; Francis 1986; Gould et al. 1989); and physical factors such as farm size and degree of slope (Rahm and Huffman 1984; Huszar and Cochrane 1990) play a significant role in the adoption of soil conservation techniques.

An important aspect of the adoption process of soil conservation practices is the management of the implemented structures. Management consists of keeping the established structures in good condition in order to obtain optimum net benefits from their use. In the case of alley cropping for instance, management of the structures is a key to the success of this practice. Indeed, management of alley cropping consists of pruning the trees on a regular basis, not only to avoid shading of other crops, but also to improve soil fertility. Management of rock walls consists of repairing breaches in the walls and increasing the height when there is accumulation of soil.

Unlike the adoption process, factors influencing farmers' decisions to manage or maintain conservation structures have not been extensively studied. However, several reports point out the lack of management of soil

conservation structures (David 1995; Pierre et al. 1995). David (1995), for instance, noted that Kenyan farmers fail to manage properly the hedgerow intercropping structures established on their lands. Their attitudes, argued David (1995), are partly explained by the characteristics of the technology and other socio-economic factors. Similar observations are reported for contour hedgerows in Haiti (Pierre et al. 1995). Hence, the existing literature lacks information on factors affecting farmers' decisions to manage soil conservation structures on their plots. This study is an attempt to fill this gap by focusing on management of rock walls and alley cropping. The purpose of the study is to identify and examine the factors that are likely to influence management of rock walls and alley cropping in Haiti.

METHOD

Study Area

Management of alley cropping and rock walls was studied in two different regions in Haiti: Camp-Perrin, where farmers have adopted alley cropping, and Fort-Jacques, where rock walls represent the main soil erosion control in use (Figure 1). The first site located in southern Haiti was selected because of Pan American Development Foundation (PADF) promotion of leucaena hedgerows in this area for the last decade. Also, while the practice was being diffused, the Productive Land Use System (PLUS) project and the Soil Management Collaborative Research Support Program (SMCRSP) conducted research on tree species suitable for the conservation structures and on the effects of alley cropping on crop yields in this and neighboring areas.

This research site varies in elevation from 100 to 300 meters with steep slopes reaching more than 60%. The average annual rainfall is usually between 1,300 and 2,000 millimeters (mm). The rainy season is bimodal with rain occurring from February to May and from July to November. Agriculture, comprising of a mixture of subsistence crops and livestock, represents the economic base for the area. Major subsistence crops include sorghum, corn, beans, and cassava.

The second research site is located about 30 miles Southeast of Port-au-Prince, the capital of Haiti. The area was selected because of farmers' use of rock walls for decades. By choosing this site we also assume that its proximity to a relatively important market for agricultural commodities may positively influence farmers' attitudes toward soil conservation technologies. The elevation of the zone varies from 900 to 1,400 meters above sea level, and the annual temperature averages about 22ºC. The area has a reduced vegetative cover with an abundance of rocks distributed over the landscape, with slopes ranging from 10% to 60%. The average annual rainfall is about 2000 mm distributed in a bimodal pattern with rain occurring from February to May, and from August to November.

Due to the agro-ecological conditions of the zone, farmers produce a variety of crops including vegetables (cabbage, carrots, tomatoes, potatoes, onions, beans, lettuce, leek, and other vine and leaf vegetables), grain (corn), and tubers (sweet potatoes). The farming system in the area is highly intensive with a fallow period that lasts only from one to three months. Hence, the maintenance of soil fertility is ensured through the use of chemical fertilizers. Farmers also use pesticides to limit damage caused by insects and other pests.

Data Collection

Data were collected in both areas on 139 farms (71 farms in Camp-Perrin and 68 in Fort-Jacques) during the period from October to December 1999. The surveys evaluate the level of management of alley cropping and rock wall structures established on farmers' plots. Prior to the evaluation of management, information was collected on the adoption of each particular technique, on farm household situation, and on farmers' characteristics. From each farm previously studied, a plot with conservation structures was chosen for the evaluation of the level of management.

Management of established structures was determined in three different ways. First, the farmers were asked to state if the structures on their plots were poorly, fairly, or well managed. It is assumed that farmers' own evaluations may provide a clear vision of long-term use of the technique as a soil conservation measure. Second, the management of structures implemented on the selected plots was evaluated based on criteria defined by conservationists. The criteria used for the evaluation of management include observations on general conditions of the structures and on surface erosion in the treated plot, importance of gaps in rows, and the regularity of damage repair. Additional criteria such as maintenance of hedgerows and utilization of prunings were considered in the case of alley cropping (Table 1). A score of 3, 6, and 9 was given to each parameter evaluated if the condition was judged poor, average, and good, respectively. Then the level of management of each plot was determined on the basis of the overall total score. A value of 1 was considered if management was poor, 2 if average, and 3 if management was good.

A technical agent with experience in soil conservation practices carried out a third evaluation. This specialist visited all the plots already evaluated and categorized the level of management into poor, average, and good, based upon his observations. For each evaluation, dummy variables are used to indicate the management levels of the structures. An average management score by the three evaluators was considered in modeling the behavior of farm households.

Model Specification

Management of soil conservation practices can be analyzed with qualitative choice models. The two techniques commonly used are the logit and probit models because they yield consistent estimates (Maddala 1983; Amemiya 1981). In this study, management of each practice was studied with a polytomous logit model using a two-stage procedure. The general form of the multinomial logit model of each stage is defined in equation 1.

$$Prob(Y_i = j) = \exp(\beta_j X_{ij}) / \sum \exp(\beta_j X_{ij}) \quad \ldots \quad (1)$$

where in the first stage j is equal to 1 if management is poor, 2 if average, and 3 if management is good; β_j represents the coefficient of the parameters, and X a vector of explanatory variables for plot i with j level of management. The independent variables used in this stage are age, age squared, gender, marital status, education level, group membership, training in soil conservation practices, size of household, off-farm activity, labor availability, per capita income, and crop dependency.

In the second stage, the physical factors that influence the farmer's capacity to manage the conservation structures are evaluated. To

undertake this analysis, predicted values of the first stage were divided into three categories and used as a dependent variable of the multinomial logistic regression model. The explanatory variables were those related to farm and plot characteristics including size of farm, size and tenure of evaluated plots, slope and distance of the plots from farmer's home, and the interaction between slope and distance. Variables used in the study are defined in Table 2.

The variables used in this study largely cover those considered in the existing literature on adoption of soil conservation technologies. It is assumed that those factors will have the same effects on management as adoption. Therefore, age is expected to have a negative effect on management of alley cropping and rock walls. As age increases, a farmer's willingness to manage established structures is expected to decrease. Membership in local organizations and training in soil conservation techniques are expected to have positive effects. Indeed, participation in local organizations increases the availability of information and provides a leadership for the diffusion of soil conservation practices. Education usually has a positive effect on the use and management of soil conservation practices. In subsistence farming, however, it is likely that educated people will be less interested in farming. Education as denoted by schooling provides many rural Haitians an escape from farming. Thus, a negative effect is hypothesized for education. The effect of gender, marital status, and off-farm income can be either positive or negative. More stable land tenancy, more dependence on crops, and higher per capita income are expected to have positive effects on management of soil conservation practices. Finally, size of farm, slope, and distance of treated plots are expected to negatively affect management of soil conservation structures.

RESULTS

Farm Household Characteristics

Descriptive statistics of some household characteristics are presented in Table 3. The average age of farmers interviewed was about 50 years, varying from 18 to 84. Forty-eight percent of the respondents are between 18 and 50 years old. The majority of heads of households interviewed (88%) were males. Marriage is the most common form of family union among the respondents. Fifty percent of the farmers are married, while respondents with status of single and common law union represent 28% and 22%, respectively. However, a significant difference in the distribution of marital status exists between regions. With 39% of the respondents, common law relationship is the most frequent family union in Camp-Perrin, whereas 70% of farmers in Fort-Jacques declared they are married. Out of the total of 139 farmers interviewed, 55% declared that they have no formal education, while 45% attended at least primary school. The percentage of farmers with some level of education is 42% in Camp-Perrin and 47% in Fort-Jacques. The average family size was five persons. Fifty-four percent of the households have more than five family members. Family members participate in farm activities and usually have off-farm jobs that bring some earnings to the household.

Farms and the Farming System

Haitian farms are often composed of numerous plots distributed in different micro-agro-ecological zones. While such a system appears rational, allowing farmers to grow a large range of crops and minimize farming risks, it is believed to

represent a limiting factor in the adoption of environmentally sound agricultural practices. The farmers interviewed operate an average of three plots within a range of one to six. The small average size of holding (1.07 ha) is typical of farming in Haiti. Fifty-seven percent of the households operate less than 1 ha of land. Pressure on lands is more pronounced in Fort-Jacques than Camp-Perrin. The average farm size in Fort-Jacques is 0.62 ha, compared to 1.5 ha in Camp-Perrin.

Despite the small size of these holdings, farm operators are usually involved in a set of tenancy relationships that prevent them from carrying out important long-term investments on the land. The survey results reveal numerous types of land tenure relationships, including direct ownership, rent, inheritance, and sharecropping. For each farm, a security index was defined to indicate the degree to which farmers control land resources. This index is calculated by dividing the number of hectares directly owned by the farmers by the total of land operated. The average index of land security calculated for the farmers interviewed is 0.31. The index calculated for each region is 0.40 and 0.19 for Camp-Perrin and Fort-Jacques, respectively. This indicates that, on average, farmers have limited control over the land they operate.

In Camp-Perrin, where alley cropping is adopted, the farmers produce a large number of crops through intercropping, with a predominance of subsistence food crops. The food crops include maize, sorghum, cassava, and beans. On some farms, small quantities of coffee and plantain are produced. No chemical fertilizer is used on the hilly degraded plots in Camp-Perrin. In the traditional farming system, fallowing and animal waste remain the only means for regenerating soil fertility. Animal production is also an important activity associated with crop production. During fallow periods, which vary from one to three years in the Camp-Perrin area, animals are constantly grazed on plots with or without conservation structures. However, feed shortage remains a serious problem for livestock production in the region.

Unlike Camp-Perrin, the farming system in Fort-Jacques is characterized by intensive vegetable production. Production of high-value crops is the base of the economy in Fort-Jacques. Within a year, farmers produce several parcels of cabbage, carrots, potatoes, and lettuce with the use of chemical fertilizers. Some farmers also have an animal production component, pig farming being the most common form of animal husbandry in the area. The level of per capita income is relatively low in both areas. The average per capita income is 1,924 and 2,251 "gourdes" in Camp-Perrin and Fort-Jacques, respectively.

Management of Soil Conservation Practices

An important number of farmers in the Camp-Perrin area have established alley cropping structures with leucaena trees on their plots. In the Fort-Jacques area, the use of rock walls is more common than any other soil erosion barriers. Management of alley cropping structures requires many more activities than that of rock walls. According to conservationists who promote alley cropping, farmers are advised to weed the hedgerows and repair the breaches every two or three months. Experiment results also suggest that hedgerows should be pruned six times a year to obtain maximum benefit to the crops. They are also required to prune the leucaena trees and shrubs at an average height of fifty centimeters and apply leaves and stems to the soil between rows after each pruning. With

regards to rock walls, two major operations are required to maintain the structures: repair of breaches by arranging rocks in the walls and increase in the height of the walls when there is over-accumulation of soil behind the walls. Considering the mechanical nature of this soil conservation practice, it is not necessary to maintain the structures frequently.

Observations and interviews with farmers reveal that farmers have not totally followed the technical recommendations of conservationists. There exists a real gap between technical requirements and farmers' activities. With respect to alley cropping 69% of respondents declared they have received instructions on how and when to prune hedgerows. Those who have not formally been trained in hedgerow management have learned from other farmers in the community. Ninety-two percent of the adopters of alley cropping declare that they continue to maintain the structures on their plots. More than 60% of the treated plots are maintained once or twice a year generally at the beginning of the cropping season. Forty percent of alley cropping adopters repair breaches and only 9% weed them. When asked whether or not they prune the hedgerows, almost all farmers answered yes. They also stated that they applied the prunings to the soil. Prunings are spread either within the alleys as recommended by technical agents (39%) or applied to the up-hill side of the hedgerows (61%).

While it is crucial to improve soil fertility in the area, the importance of animal production in the local economy reduces the amount of dry matter applied to the soil considerably. In fact, livestock plays an important role in the farming system as means of transport and source of earnings for many households; but fodder shortage remains a serious constraint in the area. Leucaena leaves are considered high quality fodder for cattle and goats. All farmers surveyed use the leaves to feed their animals either by placing the animals on plots with alley cropping structures during fallow periods, or by occasionally cutting the stems and carrying them to feed the animals outside the plot during cropping seasons. They also use the large branches of *Leucaena* for firewood. In such conditions, the amount of leaves applied to soil after the pruning is relatively low. Thus, there is a trade-off between the use of leucaena leaves for animal feed, and their use for soil fertility improvement.

In the Fort-Jacques area, 70% of the farmers interviewed declare they manage the rock wall structures established on their plots once a year. They mainly repair the breaches by putting stones in the gaps. However, observations during the survey period reveal a lack of maintenance of the structures on several plots. In a number of cases, the walls are broken down and the rocks are scattered on plots, limiting the space available to grow crops. A common practice observed in the zone is that some farmers let the soil accumulate on the wall, then rebuild the structures a little farther down the slope until they create a relatively flat surface to grow vegetables.

In short, soil conservation structures established on farmers' plots are managed differently from one plot to another within each zone. As reported in Table 4, the three methods of evaluation generate slightly different outcomes. Farmers tend to see their management as good, while the other evaluators who used a more technical approach mostly classify the management into average and poor. A mean score of the three methods of evaluation is used to examine factors influencing management of alley cropping and rock walls. On

average, 29% of alley cropping structures are well managed, 38% fairly managed, and 33% are poorly managed. For rock wall structures, 34% of the treated plots are well managed, 46% fairly well, and 20% poorly managed.

DETERMINANTS OF THE MANAGEMENT OF SOIL CONSERVATION PRACTICES

Alley Cropping

Results of the logit models are presented in Table 5 for the management of alley cropping. The results indicate that four variables are significant in determining management ability of adopters of alley cropping. The first stage regression model correctly predicts management decisions 70% of the time. Age is a significant factor in management of alley cropping. Up to 51 years of age, the chance of developing good management skills for alley cropping increases. The coefficient of age is 0.24, meaning that the probability of management of structures is positively affected by age. Older farmers are more likely to manage the hedgerows better than younger ones. The odds ratio obtained for age is 1.27, implying that the likelihood of good management increases 1.27 times for each year increase in age. However, the age for good management peaks at 51 years, and the probability that farmers above this age manage alley cropping structures well decreases approximately by a factor of 1.0 as indicated by the negative sign of the coefficient of age-squared.

Gender and number of workers per hectare, have negative signs, and significant. The coefficient of the variable gender is -1.1741, implying that female farmers are more likely to manage the structures than their male counterparts. The probability that alley cropping structures are well managed increases 0.30 times if the farm operator is female. The coefficient of the number of workers per hectare available on the farm is -0.4001. This factor has a significant, but negative effect on the probability that alley cropping structures are well managed in the Camp-Perrin area. The level of management decreases approximately by a factor of 1 as the number of workers per hectare increases. This may be the result of over supply of workers, given the limited space.

With respect to the physical factors that influence management of alley cropping, the second stage model predicts 64% of the probability of management outcomes. Three variables - namely size of farm, distance of plot from home, and the interaction between slope and distance- are significant as shown in Table 5. Size of farm has a coefficient of 0.09, meaning that the larger the farm, the greater the probability of managing the structures. The probability that alley cropping structures are well managed increases 1.7 times for one unit increase in size of farm.

A surprising result obtained for alley cropping is the positive sign of the coefficient for distance of treated plot from home. This variable has a coefficient of 0.090, implying that the farther plots are the more likely they are to be better managed. As distance increases, the probability that the structures are well managed increases 1.09 times. One explanation for this result may be in the role attributed to back yard plots in the Haitian agricultural economy. Haitian farmers usually bring their animals on plots near the house during the night. It is well documented (Centre de Salagnac 1979) that this system allows farmers to transfer nutrients from less secure lands to owned land near the house. Crop residues brought in from distant plots and

domestic wastes are used to feed animals. Farmers may have neglected the management of structures on such plots since their level of fertility is usually higher than it is on more distant plots.

The interaction between slope and distance of the plot from the home is also a significant factor influencing management of alley cropping. The coefficient of the variable is -0.0017, indicating a negative effect on the management of alley cropping. This means, if the elevation and distance increase simultaneously, farmers are less likely to manage the structures. The probability that the structures will be well managed decreases by a factor of 1 as both distance and slope increase.

In short, several categories of variables including farmer characteristics, farm structure, and environmental factors are found to have a significant relationship with management of alley cropping in Camp-Perrin. Nevertheless, management of such structures may not be a priority for farmers. Some of them acknowledge that alley cropping has not increased the land value. This factor may be important because incentives to adopt and manage a soil conservation structure may result from the internalization of the investment in the land value.

Rock Walls

Table 6 shows the results of the multinomial model of factors leading to a farmer's ability to manage rock wall structures established on their plots. Four variables in the model appear to have a significant influence on a farmer's ability to manage rock walls. The model correctly predicts 72% of the outcomes. The variable age has a coefficient of -6.47, suggesting that ability to develop a good management skill is negatively related to age of the farmer. As age increases, the probability that a particular plot is well managed decreases 0.002 times. This is particularly true since farmers cannot provide necessary energies to repair and maintain the rock wall structures.

Per capita income also has a negative sign. The coefficient of this variable is -2.28, implying that good management is negatively related to per capita income. As per capita income increases, farmers seem to invest less in management of rock walls. The probability that the structures are well managed decreases 0.10 times with each gourde increase in per capita income. Farmers with higher levels of per capita income feel less pressure to maintain the structures than the less fortunate ones.

Two other factors significantly influence a farmer's ability to manage rock walls. They are participation in local groups and the interaction between per capita income and age. The coefficient for group membership is 1.13, indicating a positive influence of this factor on the probability of management of rock walls. Farmers who participate in local organizations are three times more likely to manage rock wall structures well than those who do not belong to groups. Also, the interaction between age and per capita income has a coefficient of 1.46. When both variables increase simultaneously, the probability to better manage rock walls increases four times.

The second stage logistic regression model investigates the physical characteristics of farms that affect management of rock walls. The results show that only the size of the treated plot is significant (Table 6). Roughly 57% of the probabilities are correctly predicted. The coefficient of size of plot is -0.46 indicating that small plots are more likely to be better managed than the large ones. For each hectare increase in size of treated plots, the probability that the

structures are well managed decreases 0.63 times. The amount of work required for rock wall maintenance increases with size of the plots. Therefore, it is less labor demanding when the size of the plot is small. In Fort-Jacques, the most important thing is how to keep growing vegetable crops without losing the fertilizers due to leaching and soil loss. Hence, establishment of rock wall structures on plots seems to be crucial for small-scale farmers in this area. Tenure arrangement of the treated plots does not appear to play an important role in all instances in farmers' decisions to manage soil conservation structures. However, it may be important in particular cases.

CONCLUSIONS

The objective of this study was to shed light on factors that are likely to influence management of soil conservation practices in Haiti. Two different soil conservation measures, namely alley cropping and rock walls, were analyzed in two regions. Rock walls require important initial investment, but few operations for the management of established structures. In an environment where small-scale farmers make significant investments in the production of high-value crops on steep lands, implementation and maintenance of rock walls are important. Alley cropping needs low initial investment, but more intensive management operations. Management of this technique is crucial not only to limit run-off on the plot, but also to improve soil fertility.

A number of economic, farm and household characteristics, and environment related variables were found to be associated with management of soil conservation structures in Haiti. Comparing alley cropping to rock walls, the study shows only age has a common effect on both techniques. These findings imply that efforts to increase long-term use of soil conservation practices in Haiti need to target younger farmers. Apart from age, adopters of each technique appear to be influenced by different factors. In Camp-Perrin, male farmers and labor availability negatively affect the probability of good management of alley cropping. In Fort-Jacques, per capita income is negatively associated with the ability to manage rock walls, while membership in local groups and the interaction between age and per capita income improve the probability of good management.

With respect to the physical factors that influence management of soil conservation practices, size of farm and distance of treated plots from the home play a significant and positive role in Camp-Perrin, whereas the interaction between slope and distance negatively affects management of alley cropping in the area. In Fort-Jacques, size of treated plots is found to negatively influence management of rock walls.

The significance of different categories of variables shows the complexity of the decision making process to manage soil conservation techniques. The findings suggest that promoters of soil conservation practices in Haiti need to focus not only on the intrinsic characteristics of a particular practice, but also on the socio-economic conditions of each setting in order to better identify the constraints facing farm operators and address the real problems.

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Figure 1. Study Area

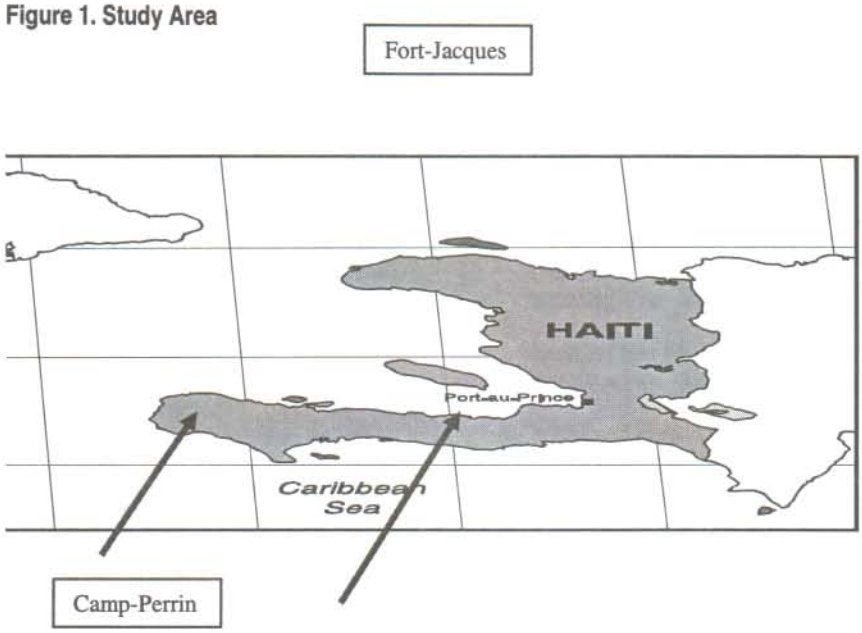

Table 1. Criteria Used to Evaluate Management of Soil Conservation Practices

Alley Cropping		Rock Walls	
Parameter	**Score scheme**	**Parameter**	**Score scheme**
Hedgerow conditions		*Rock wall conditions*	
Hedgerows well organized with robust trees in the entire row.	9	Wall height clearly higher than the soil level	9
		Rock walls partially covered with soil	6
Average organization and average number of trees in good condition	6	Rock walls extensively covered with soil	3
Poor organization with very few trees in good standing	3		
Observable erosion		*Observable erosion*	
Insignificant evidence of erosion	9	Insignificant evidence of erosion	9
Limited evidence of erosion	6	Limited evidence of erosion	6
Significant evidence of erosion	3	Significant evidence of erosion	3
Gaps in rows		*Length of breaches*	
1 gap causing little damages	9	Less than 10% of the wall length	9
2 to 3 gaps causing damages	6	10 to 50% of the wall length	6
More than 3 gaps with extensive damages	3	More than 50% of the wall length	3
Length of gaps		*Regularity of breach repair*	
Less than 10% of the row	9	Often	9
10 to 50% of the row	6	Sometimes	6
Over 50% of the row	3	Never	3
Repair of gaps			
Often	9		
Sometimes	6		
Rarely or never	3		
Number of prunings during calendar year			
3-4 times or more per year	9		
Twice a year	6		
Once a year or never	3		
Height of pruning			
Close to 50 centimeters	9		
50-75 centimeters	6		
100 centimeters or more	3		
Use of pruning for mulch			
Always	9		
Sometimes	6		
Never	3		

Table 2. Definition of Variables Used in the Management Model

Variable	Definition
Age	Number of years of the respondent
Gender	1 if respondent if male, and 0 if female
Marital status	1 if respondent if married, and 0 otherwise
Education level	1 if respondent has a formal education, 0 otherwise
Group membership	1 if respondent is member of a local group, 0 otherwise
	1 if farmer has a training in soil conservation, 0 otherwise
Soil conservation training	1 if farmer has an off-farm activity, 0 otherwise
	Number of people living in the household
Off-farm activity	Number of people working on the farm
Size of household	Annual per capita income of the household
Labor availability	Share of the crop revenues in total family income
Per capita income	Number of hectares of land operated
Crop dependency	Number of hectares
Size of farm	Share of owned land out of the total operated land
Size of treated plots	Percentage
Security of land tenure	Number of minutes
Slope of plot	
Distance of plot	

Table 3. Selected Characteristics of Farmers in the Studied Areas

Item	Unit	Camp-Perrin			Fort-Jacques		
		Mean	Min.	Max.	Mean	Max.	Min.
Age of farm operator	Yrs.	51	18	84	49	25	78
Size of household	No.	5.39	1	15	6.67	1	14
Size of farm	Ha.	1.5	0.40	4.75	0.62	0.04	2.80
No. of workers per ha.	No.	2.91	0.21	8.69	16	0.71	100
Annual per capita income	Gourdes[1]	1924	80	7895	2251	115	8530

US$1=20 gourdes

Table 4. Management Level (in %) of Soil Conservation Practices by Types of Evaluation

Level of Management	Good	Average	Poor
Alley Cropping:			
Farmer's evaluation	52	32	16
Enumerator's evaluation	8	48	44
Specialist's evaluation	27	35	38
Average	29	38	33
Rock Walls:			
Farmer's evaluation	41	48	10
Enumerator's evaluation	25	53	22
Specialist's evaluation	37	37	28
Average	34	46	20

Table 5. Multinomial Logistic Regression Results for Models of Management of Alley Cropping

1st Stage				2nd Stage			
Explanatory Variable	Co-efficient	Standard Error	Odd Ratio	Explanatory Variable	Co-efficient	Standard Error	Odd Ratio
Age	0.2414*	0.1236	1.27	Size of farm	0.0906*	0.1742	1.70
Age^2	-0.0025*	0.0012	1.00	Distance of plot from home	0.090*	0.0442	1.095
Gender	-1.1741+	0.6977	0.31	Slope* distance	-0.0017*	0.0009	1.00
Education	0.8147	0.54	2.26	Constant 1	-1.8823	0.3912	
Size of household	0.1095	0.0926	2.259	Constant 2	-4.2457	2.9478	
No. of workers/ ha	-0.40*	0.14	1.00				
Constant 1	-6.17	2.9875					
Constant 2	-4.25	2.9478					

**significant at $\alpha = 0.05$; + significant at $\alpha = 0.10$*

Table 6. Multinomial Logistic Regression Results of Models of Management of Rock Walls

1st Stage				2nd Stage			
Explanatory Variable	Co-efficient	Standard Error	Odd Ratio	Explanatory Variable	Co-efficient	Standard error	Odd Ratio
Age	-6.4753*	2.7309	0.002	Size of treated plot	-0.46*	0.2382	0.63
Age^2	0.8583	0.5906	2.36	Tenure of treated plot	0.3214	0.2462	0.19
Education	-0.6018	0.4067	0.55	Distance of treated plot	0.0322	0.2244	1.00
Training in SCP	-0.8767	0.6167	0.42	Constant 1	-0.9398	0.7335	
Group member-ship	1.1262+	0.657	3.08	Constant 2	0.888	0.7331	
Size of household	-0.5341	0.34	0.59				
Per capita income	-2.2818*	1.0718	0.10				
Age*per capita income	1.4588*	1.0718	4.3				
Constant 1	8.5146	4.0265					
Constant 2	10.5636	4.0265					

**significant at $\alpha = 0.05$; + significant at $\alpha = 0.10$*