Understanding Farmers: Explaining Soil and Water Conservation Behaviour in Small-Holder Farmers in Southern Zimbabwe

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Abstract

This study was initiated to understand farmers' soil and water conservation behaviour in Zaka district in order to improve insights into the land-management problems of small-holder farmers. Both qualitative and quantitative research methods were used to gather and analyse data. Research findings showed that farmers' behaviour regarding soil and water conservation is a result of the interplay among: physical, institutional factors, attitudinal and economic factors. The study also observed that there was lack of understanding of farmers' behaviour by the extension providers as regards soil and water conservation that was aggravated by the absence of a learning process that should complement a technical intervention. In view of this, it was recommended that the organization of the soil conservation programmes should be more participatory and based on adequate knowledge of the intended beneficiaries so that in the end the practices introduced are more suitable to the beneficiaries and higher levels of adoption are achieved.

Key words: Soil erosion, soil and water conservation, adoption, agricultural extension.

Introduction

Soil erosion is one of the most important threats to the sustainability of agricultural systems in the Third World (Eswaran, 1999). It is a common phenomenon in Zimbabwe where it causes widespread negative impact on agriculture and environment. Its severity particularly in Zimbabwe's communal lands is very high (Elwell, 1983, 1984; Stocking, 1972; Whitlow, 1979, 1980, 1985). As a result, government and other stakeholders have embarked on various soil conservation programmes in the past to try to contain it. However, concern for soil erosion is not new in Zimbabwe (Elliot, 1987). The country has a long and politically quite shaky history of soil conservation (Dreyer, 1997) stretching from the colonial period. During that era, the main conservation efforts in the country were based on the physical protection of arable lands through

a system of standardized contour ridges and drains to control water disposal and runoff rather than water retention, something that was priority of many farmers in low rainfall areas in Southern Zimbabwe (Scoones et al., 1996). However, government for decades enforced most of these practices and due to that, the whole idea of soil conservation became rather unpopular among communal farmers (Wilson 1988; Elliot, 1987; Hagmann and Murwira, 1996a). Even today, many years after independence, although perception and approaches are changing, the standard contour ridges are to some extent still predominant, despite that other practices in soil and water conservation have been introduced.

Kushinga Ward, where the study was done is found in Ndanga Communal Lands, Zaka district, in South Eastern Zimbabwe. The region is generally marginal for cropping with poor sandy soils and erratic rainfall (Hagmann and Murwira, 1966b). Crop production is mostly rain-fed and subsistence-oriented with the main crops grown being maize (*Zea mays*), groundnuts *(Arachis hypogea)*, sorghum (*Sorghum vulgare pers*), and finger millet *(Elucin corocana*), pearl millet *(Pennisetum glaucum*) among others. Cultivation is usually done year after year without fallow. The population density is about 65 persons/km^2, which is quite high for a mountainous area where subsistence farming is the main economic activity (Dreyer, 1997). The most common types of livestock in the area are cattle, donkeys, sheep and goats. Due to high increase in population, grazing land has considerably reduced in favour of cropping land. Also, there is massive overgrazing and decrease in the quality of grass cover of the small remaining pastureland. The average arable land holding size of farms under communal tenure in the area has been reduced through population pressure from approximately five ha in 1960 to approximately two ha at present (Hagmann, 1996).

Over two decades, soil and water conservation work has been done in the district with the support of different non-governmental and various government agencies to improve land husbandry and particularly soil and water conservation techniques. A variety of practices introduced in the programmes include vertiver grass *(Vertiveria zizianoides)* strips, construction of fanja-juus terraces, improved tillage techniques, agro-forestry, on-till tied-ridging and many others. The adoption and sustained use of these measures has had mixed results.

Although it is recognized that soil and water conservation practices can sustainably contribute to reversing land degradation, the performance of past and on going programmes have in most cases been disappointing in terms of success and implementation in many countries (Hudson and Cheatle, 1993). Zimbabwe is not an exception to this. Efforts put towards the promotion of soil conservation have generally not been matched by sustained use and widespread adoption of

the introduced practices in some areas of the country, particularly in the communal areas. Given the scenario of the land redistribution in Zimbabwe today, whereby some of the communal farmers are getting land to cultivate in the resettlement schemes, there is need to find ways to prevent the appearance of communal land-type of degradation in the resettlement areas. One of these ways is to try to better understand the reasons for the limited success or slow adoption of measures meant to prevent and reduce land degradation by looking at the factors that encourage or discourage their adoption and sustained use. The main objective of this study was to understand farmers' soil and water conservation behaviour in order to improve insights into soil conservation technology adoption and land-management problems in the district.

Materials and Methods

Sampling procedure

The district in which the study was done was purposefully selected because of its long history of soil and water conservation programmes. Within that district one ward, Kushinga was selected randomly from the list of wards in the district. The selected ward comprises of six Villages Development Committees (VIDCOs) each with between 60 and 80 households. The research was conducted in VIDCOs, 2, 3 and 4. Thirty nine households were randomly selected from VIDCO 2, forty one from VIDCO 3 and forty two from VIDCO 4 to make a total of 122 households studied.

Data collection

The research design was quasi-experimental and data collection involved both primary and secondary sources. Primary data were collected from the sampled households during the 2003-2004 agricultural season, using structured questionnaires. Also, transects walks were carried out in the company of different groups of farmers to familiarize with some of the soil erosion problems and conservation work undertaken. To complement the questionnaire and to have a deeper insight into soil conservation practices in the area, focus group discussions covering different topics with agricultural experts and farmers were also conducted. Secondary sources included published and unpublished information about the study area, agricultural production and soil conservation activities. The secondary information was collected from ward and district level offices of the department of Agricultural Extension (AREX) and Department of Natural Resources.

In this study, the farmers were classified into adopters and non-adopters depending on their adoption behaviour of soil conservation practices. Adopters were those farmers who put into practice given conservation strategies introduced in their community and used them in a

sustained basis. Non-adopters were those who chose not to put into practice most of the strategies or did so but later abandoned them.

The factors studied were: characteristics of the household head like age, educational attainment, gender and family size (personal factors); farm size (physical factor); access to training about soil conservation through extension officers, (institutional factors); perception of the causes and severity of soil erosion (attitudinal factors) and off-farm income and livestock ownership (economic factors)

Data analysis

The data analysis techniques used included independent t-test to detect differences in the mean of one variable between two groups of respondents. The Chi-square hypothesis test was run to detect any systematic association between the dependent variable of interest and specific household characteristics. Descriptive statistics through frequency, means and percentages were calculated for different variables.

Results and Discussion

Family size and age structure of households

The family size in the study area ranged from 2 to 10 persons with an average of 7 persons per household. The number of children per family ranged from 2 to 9 with an average of about 4. If family size is considered focusing on the economically active groups, that is, members whose ages were between 15 and 64 and can contribute labour to the household, on average, there were about 3 economically active members per family. With reference to levels of adoption, it was found out that the average household size of adopters was 6.7 persons and 6.9 for non-adopters as shown in table 1.

Table 1. Characteristics sampled households.

Characteristic	Non-adopters N=37		Adopters N=85	
	Mean	Standard deviation	Mean	Standard deviation
Age of the farmer	45.4	10.3	45.9	11.9
Family size	6.9	1.6	6.7	2.4
Number of economically active members	3.0	0.95	3.3	1.1
Number of dependents in the family	2.2	1.7	2.3	1.8
The ratio of consumer to the worker in the household	0.73	0.60	0.70	0.62

As observed by Bekele and Holden (1998), the effect of family size on the retention of conservation practices may be either positive or negative. Larger households are able to provide the labour that is required for establishing and maintaining selected conservation structures and smaller ones may face labour problems which may hinder adoption and sustained use of certain practices. However, this relation was not linear. In a study done in the Ethiopian highlands Demeke (2003) found out that if a family is bigger, there will be more demand for land to meet subsistence needs. Hence, members may not adopt those soil and water conservation measures such as physical structures that may reduce the amount of available cultivable land. The study noted no significant difference in the family size of adopters versus non-adopters of conservation practices.

With reference to the mean ages of adopters and non-adopters, the values were 45.4 and 45.9 years, respectively. There was no significant difference between these values and hence age was not found to influence adoption decisions in Kushinga Ward. However, a study by Young and Shortle (1984), found that age had influence on adoption and retention decisions of farmers. With age, a farmer may get experience about his or her farm and can react in favour of the retention of soil conservation practices while on the contrary; younger farmers are more likely to reject conservation practices. This study however, showed that there was no statistically significant difference in age between the two groups and hence this factor does not have a pronounced effect on adoption in the area studied.

Gender of farmers

Most household heads in the study area, about 80.3%, were male while about 19.7 % were female. However, only 9.0 % of the later were permanently female headed. With reference to adoption, three of the adopters and two of the non-adopters were female heads of families. The statistical analysis showed that the difference was not significant and hence the factor was considered to have not much influence. However, on the impact of the gender of household head on conservation decisions, Demeke (2003) found that female-headed or male-headed households had different conservation behaviour.

Level of education of farmers

Exposure to education can increase the farmers' management capacity and reflect a better understanding of the benefits and constraints of soil conservation. Also, education increases the capacity and ability to obtain and apply relevant information concerning the use of soil conservation practices. In both groups, that is, adopters and non-adopters, it was found that the majority of the farmers had basic literacy.. However, sometimes it is not the "book literacy" that

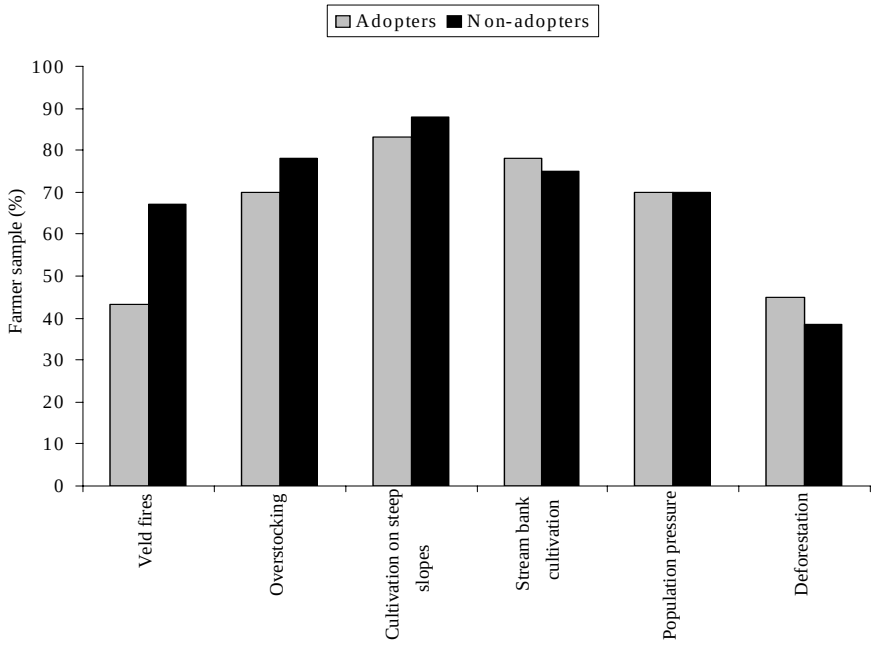
may be important in farmer's adoption decisions but what Hagmann, Chuma and Gundani (1997) referred to as "land literacy". These authors found in a study in Southern Zimbabwe that those farmers who understood the dynamics of their environment better were more effective in their soil conservation and water management strategies.

A Chi-square analysis of the data on literacy showed no systematic association between the literacy status and the adoption of conservation practices. Studies by Ervin and Ervin (1982) in Monroe County, Missouri, USA, indicated that the number of conservation practices applied by farmers was significantly influenced by two major factors: education and perception of the degree of erosion problem. In fact, the former may influence very much the later. Similar results were obtained by Demeke (2003) in a study of the factors that influenced adoption of soil conservation practices in Ethiopia.

Farmers' perception of the causes and severity soil erosion.

Farmers' perception of soil erosion and recognizing it as a problem is an important factor that influences the application of erosion controlling practices. Also, the perception of technology attributes by the farmer plays a very important role on whether or not the technology is adopted (Rogers, 1983). The findings in figure 1 showed no significant differences between the level of perception of the causes of erosion between adopters and non-adopters save only on the influence of veld fires on which 43 % of the non-adopters and 77% of the adopters considered it as an important factor in soil erosion. In the other factors, there were no significant differences meaning that both groups generally agreed on the major causes of erosion in the area.

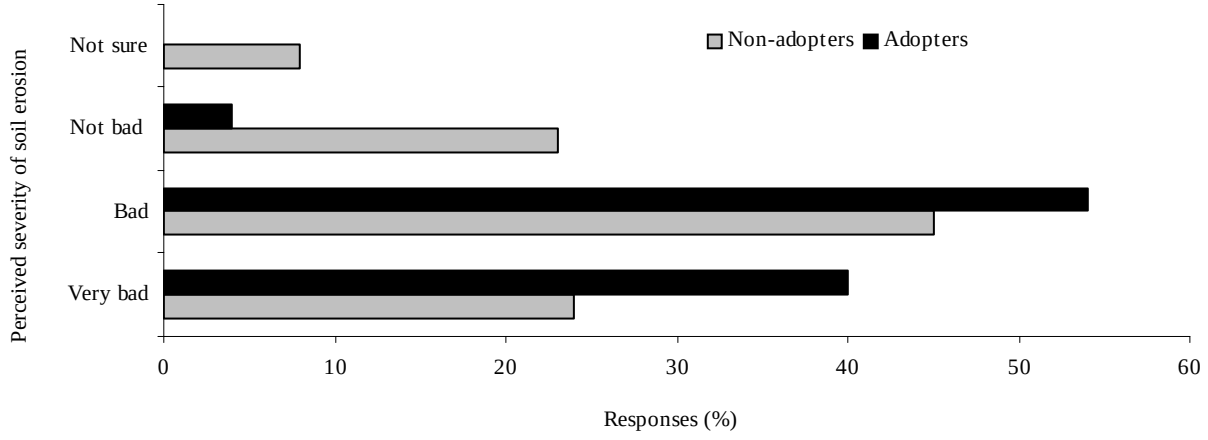
Figure. 1. Comparison of the perception of the causes of soil erosion by adopters and non-adopters



The major causes of erosion identified by the farmers were: the cultivation of steep slopes, stream bank cultivation, population pressure on available land resources and overgrazing. These results showed that the people were very aware of the major causes as their views coincided with the results of the field observations done by the researcher and the views of agricultural extension and natural resources specialists of the district. The large population density of the district and shortage of land had forced the people to cultivate on hillsides and stream banks. The later was related to the issue of food security as revealed in Scoones *et al.,* (1996)

Although no significant difference was found on the perception of the causes of soil erosion between the two groups, however, their perception of its severity was observed to be different. Figure 2 shows that 24 % of non-adopters regarded the severity of soil erosion to be on the "very bad" category as compared to 40 % for adopters. On the "bad" category the results were 45% and 54 % for non-adopters and adopters, respectively. Adopters were found to be more aware of the severity of the process of soil erosion and its impact in their areas and it seemed this level of awareness influenced positively in their adoption decisions. These results concur with what was found on the relationship between perception of erosion and adoption of conservation practices by Ervin and Ervin (1982) and Makoha *et al.,* (1999). The higher level of awareness of the severity of erosion by the adopters may have influenced their decisions to adopt and sustain the use of the introduced measures.

Figure 2. Comparison of the perception of the severity of soil erosion by adopters and non-adopters



Size of cultivable land

The quality and quantity of land available for farm households largely determine the amount of production in most developing countries. This factor has been known to affect the rate of adoption of soil conservation technologies. Usually, small pieces of land may lead to dissatisfaction and a general negative attitude towards adoption of improved soil management technologies (Semgalawe, 1998), as the benefits of doing may be not very evident. As observability of the benefits of a technology is very important in adoption decisions (Rogers, 1983), this can influence whether or not the technology is adopted.

The average size of the cultivated land for adopters in Kushinga Ward was 1.73 ha and 0.91 ha for non-adopters. The Pearson correlation between farm size and adoption was significant at the 10% level of significance and it is 20.1%. It was evident that the size of the landholdings of those who adopted most of the introduced soil conservation practices was bigger than that of non-adopters. However, the land holdings in both cases were very fragmented making it sometimes difficult and unsound to design some physical structures if the costs and benefits in the form of labour and the farmers' perceived benefits from such practices are considered. Similar results were found by Okoye (1998) cited by Demeke (2003:56) in Nigeria where he found that soil erosion controlling practices adoption responded to farm size positively and significantly, meaning that adoption tend to increase as farm size increases.

Livestock ownership of sampled households

Livestock is an important component of the farming system in Kushinga Ward as it is in many communal lands in Zimbabwe. The size of livestock owned indicates the wealth status of the household and it is an important source of the much-needed draught power. The sampled households included in this survey owned cattle, donkeys, sheep and goats not to mention fowls and smaller ruminants which were sold for cash to augment family income at times of need. Table 2 shows the mean number of livestock holding of respondents. The mean number of animals per household was 4.3 cattle, 6.2 goats, 2.2 sheep and 1.3 donkeys. However, 11.0 % and 21.0 % of all the households did not own either cattle or donkeys, respectively.

Table 2. Livestock ownership of sampled households

Livestock type	Non-adopters N=37		Adopters N=85	
	Mean	Standard deviation	Mean	Standard deviation
Cows	3.1	0.56	4.8	0.43
Goats	6.3	0.21	6.2	0.11
Sheep	2.3	0.33	2.1	0.23
Donkeys	1.2	0.42	1.4	0.11

The findings showed that there was a difference between the two groups particularly on the ownership of cattle which was the most important source of draught power in the area. Adopters owned more cattle than non-adopters. Draught power is greatly needed in soil management and conservation practices such as contour and winter ploughing, construction of fanja-juus terraces and many other practices and its unavailability may act as a limitation to adoption. Nyagumbo (1993) found similar results on studies on factors affecting the potential adoption of no-till tied ridges in four communal areas in Zimbabwe. According to the findings, adopters were besides being better resourced, had more draught power, labour and implements.

Access to extension services.

The importance of well designed and participatory extension service in the adoption of conservation practices cannot be underestimated, especially in communities where soil conservation programmes were forced on farmers in the past. The way extension officers diffuse innovations impact positively or negatively on adoption rates and unless there is an adequate mechanism for transmitting information, the adoption would not be successful. In the study area, the most important sources of information about agricultural innovations including soil and water conservation practices cited by the farmers were through communication with neighbours, NGOs and the government's mainstream agricultural extension programme. The later was pointed out as the most important one. When asked to evaluate their access to extension services both groups indicated that it was from average to poor. However, most of the adopters, about 45 %, were of the opinion that it was average indicating that they possibly had more access to it than non-adopters. Most non-adopters, about 53 %, regarded it as poor. However, what did not

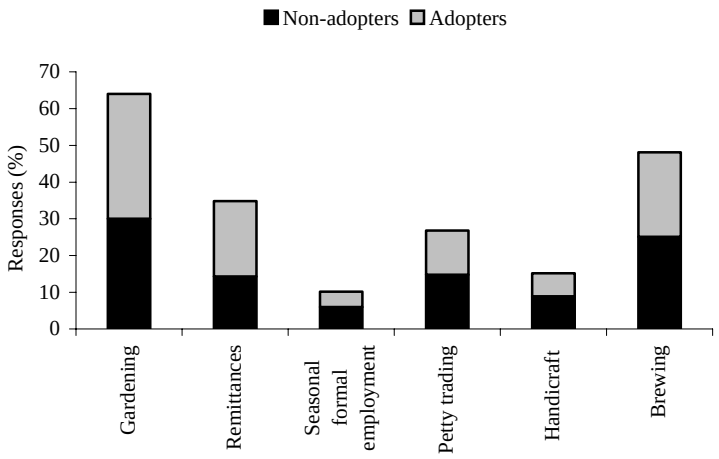
emerge clearly from this study was the manner in which information was disseminated to the farmers. But the analyses of different studies (Hagmann, Chuma, and Gundani, 1997, Hagmann and Murwira, 1996a, 1996b and Scoones *et al.,* 1996) have revealed that traditionally, weak communication structures in technology development and transfer existed in the area. The policy to base extension programmes on diagnostic surveys and top-down approaches that lead to the promotion of 'blanket' extension recommendations to farmers in very different physical environments have been cited.

Access to off-farm income and credit

The major source of income of the farmers sampled was farming. Nevertheless, when asked if they had other sources of income other than agriculture, the results were 65.5 % for adopters and 64.8 % of the non-adopters. However, 34.5 % of the adopters and 35.2 % of non-adopters had no other sources of off-farm income. A t-test performed revealed that there was no significant difference between the two groups. However, the analysis of the availability of remittances showed that there were more adopters who had access to remittances from relatives in urban areas than non-adopters. It could be assumed that this bolstered their financial status and influenced positively in investment in soil conservation.

The findings also revealed that non-adopters were involved more in off-farm activities to earn income than adopters as shown on figure 3. Studies on the relationship between farmers' involvement in off-farm employment and adoption of conservation practices have been found to be either positive or negative. Gould et al. (1989) in USA reported that increasing involvement in off-farm employment for income generation seems to restrain the incentive for land conservation. Demeke (2003) in a study conducted in Ethiopia found out that most of off-farm income was generated in the slack season when many thought it was the most suitable time for farmers to undertake construction and maintenance of soil conservation structures. Hence, off-farm activities competed for the labour resource the farmer uses for conservation and maintenance of conservation structures. As a result, farmers who were involved in off-farm income generating activities were likely to put less effort in maintenance of conservation structures and may even abandon them. This seems to agree with the findings shown in figure 3. On the other hand, Demeke (2003:57) citing, Pender and Kerr (1998) reported that the probability of adoption of indigenous soil conservation practices in semi-arid India increased with increasing farmer involvement in off-farm employment. This was attributed to the fact that income generated through off-farm involvement eased the liquidity constraint needed for soil conservation investments or purchase of fertility enhancing inputs.

Figure 3. Sources of off-farm income for the farmers



On access to credit, most of the farmers in both groups indicated that they had no access to credit for soil conservation practices per se but through input schemes for the growing of cotton and other crops. However, it was noted from interviews with both farmers and agricultural development officials that NGOs and government institutions like the District Development Fund (DDF) in the past assisted with resources for soil and water conservation in the form of inputs, implements and hard cash.

Conclusions

The findings of the analysis of the factors influencing adoption of soil conservation practices in Kushinga Ward indicated that farmers' behaviour regarding soil and water conservation is a result of the interplay among: physical, institutional factors, attitudinal and economic factors. Farm size, farmers' perception of the causes and severity of soil erosion, involvement in off-farm employment, availability of draught power and access to extension services had a significant impact on farmers' adoption behaviour. Although farmers' characteristics such as age, sex and level of education had been found by other studies to influence the adoption of soil conservation practices, in this study there was no clear-cut relation. The study also observed that there was lack of understanding of farmers' behaviour regarding soil and water conservation that was aggravated by the absence of a learning process that should complement a technical intervention. In view of this, it was recommended that the organization of the soil conservation programmes should be more participatory and based on adequate knowledge of the intended beneficiaries so that in the end the practices introduced are more suitable to the beneficiaries and higher levels of adoption are achieved.

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