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FACTORS AFFECTING ADOPTION OF SOIL AND WATER CONSERVATION TECHNOLOGIES IN MBWADZULU EXTENSION PLANNING AREA (EPA), MANGOCHI DISTRICT, MALAWI

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ABSTRACT

Land degradation is a serious problem that poses threats to sustainable agriculture production in Malawi. Despite several attempts by the government and non-governmental organizations promoting a variety of soil and water conservation technologies to minimise the effects of land degradation, adoption by small holder farmers remains low. The study was carried out to identify factors that affect adoption of soil and water conservation technologies. A survey was administered to 20 households coupled with three sessions of focus group discussions with 30 participants in the Mbwadzulu extension planning area, Mangochi District. The study could not find that socio-economic and demographic factors had a measurable impact on the adoption of SWC technologies. Furthermore, belonging to a farmer group, extension workers' visits to farmers and period of SWC practice showed no statistical significance on adoption of SWC technologies. The study, however, established that attending farmer trainings had a positive influence on adoption of SWC. Farmers who attended training were better able to adopt SWC and illustrated changes in knowledge, attitude and perceptions towards SWC. The results of the study further indicate that farmers primarily practice SWC to improve soil fertility and attain high yields, but inadequate inputs and bush fires present challenges. Suggested methods for increasing adoption of SWC are to address some major challenges such as bush fires and livestock management, establish an award system, provide support to farmer groups, and commence a trial for specific female farmer groups. The study also recommends for the government to continue to support a variety of SWC methods, support farmer exchange visits, and to apply a cluster approach to increase the adoption of SWC.

Key words: Land degradation, soil and water conservation, agriculture production, adoption, smallholder farmers

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ABBREVIATIONS

CA	Conservation Agriculture
EPA	Extension Planning Area
FFA	Food for Asset
FGD	Focus Group Discussion
FISP	Farm Input Subsidy Programme
GDP	Gross Domestic Product
LRCD	Land Resources Conservation Department
MASAF	Malawi Social Action Fund
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
NSO	National Statistical Office
SPSS	Statistical Package for Social Scientists
SWC	Soil and Water Conservation
VNRMC	Village Natural Resources Management Committee

1. INTRODUCTION

Malawi is a landlocked country in the south-eastern part of Africa bordered by Tanzania to the north, Zambia to the west and Mozambique to the south, south-west and east. Agriculture is the major driver of the country's economy with 30% of its Gross Domestic Product (GDP) derived from main cash crops such as tobacco, tea, cotton, ground nuts and coffee (Malawi Government 2016). The agriculture sector in the country plays an important role in ensuring food and nutrition security at household as well as national levels but also employs about 64% of its workforce. About 80% of Malawi's foreign exchange earnings are derived from agriculture (Malawi Government 2016).

However, the sector is facing a lot of challenges despite being a major source of the country's economy and food security. Soil erosion, nutrient deficiency, deforestation, loss of soil organic carbon and infertile soils are some of the challenges affecting agricultural production in Malawi (Mlamba 2012).

Land degradation and continuous environmental risks such as climate change and natural disasters have threatened implementation of sustainable development in the country and increased annual production losses. As indicated by Giertz et al. (2015), annual losses from agriculture amounted to US$149 million on average from its major crops between 1980 and 2012. With such agricultural losses, production risks have not only affected the smallholder farmers but also put severe pressure on government finances.

Land degradation is defined as the long-term loss in the value of the biophysical environment of the land, leading to a lowering or loss of its use in terms of expected functions and level of productivity that support development and society (Mlamba 2018). Land degradation is a serious problem for Malawi which has been accelerated by continuous inappropriate farming practices that include conventional tillage and the tradition of crop residue burning as a land preparation practice (Mloza-Banda & Nanthambwe 2010). Conventional ridge tillage involves making of fresh planting ridges in every cropping season, which increases oxidation and causes a decrease in microorganisms essential for plant growth and development. The excess water retained in the spaces between the ridges induces leaching of nutrients and results in soil erosion.

The rapid and frequent drops in agricultural production due to natural disasters and climate change have also adversely affected the government fiscal position as this implies that the government has forgone opportunities in tax revenues, exports, and increased recovery expenditures, as observed by Chatsika (2016). Further, Bockel and Smit (2009) argue that the understanding by smallholder farmers of the production risks and occurrence of floods and droughts is important. An important part of a resilience strategy for smallholder farmers is the adoption of a broad range of land management practices and technologies including soil and water conservation technologies (SWC).

Soil and water conservation technologies are effective in reducing run-off but also improving soil fertility and yield (Sidibé 2005). Lessening land degradation has a great influence in increasing agriculture production and several research studies have revealed a variety of SWC technologies favourable for smallholder farmers in Malawi (Barungi & Maonga 2011). Development of outreach mechanisms to increase farmers' usage of these techniques is vital and therefore the identification of the factors that affect the adoption of SWC technologies is crucial.

1.1 Problem statement

Land degradation has threatened agricultural production in many regions of Malawi and Mangochi district in the southern region of the country has not been spared. In response to the effects posed by land degradation, government and non-governmental development projects have focused on promoting a variety of soil and water conservation (SWC) technologies to prevent further effects. Since the 1990s, the Malawi government through the Ministry of Agriculture, Irrigation and Water development (MoAIWD) launched the campaign on Manure, Irrigation and Fodder preservation in an effort to enhance food production (Chatsika 2016). Amongst other activities is the promotion of SWC technologies to improve food security and control soil erosion. However, adoption of these technologies by farmers is still low in many parts of Mangochi District.

1.2 Justification

Understanding of the factors that affect adoption of soil and water conservation technologies is critical for planning and designing outreach programmes on improving food security and controlling soil erosion in the district as the country seeks ways to adapt to the effects of climate.

1.3 Objectives

The main objective of the study was to assess the factors that affect adoption of soil and water conservation in the study area.
Specifically, the study focused on:

1. Identifying different methods of SWC used by farmers in the study area.
2. Seeking understanding of the challenges faced during implementation of SWC technologies.
3. Determining measures that can be employed to increase adoption of SWC technologies.

1.4 Research questions

The following research questions and sub-questions were set forth for the research:

1. Which methods of SWC do farmers practice?
2. What factors affect the adoption of soil and water conservation technologies?
    - Do socio-economic characteristics of farmers affect adoption of SWC?
    - Is there a relationship between extension workers' visits to farmers and adoption of SWC technologies?
    - Which factors do farmers identify as the greatest challenges for the adoption of SWC?
3. What measures can be employed to increase the adoption of SWC technologies?
    - Does provision of incentives increase adoption of SWC technologies?
    - Are farmer trainings suitable tools for increasing adoption of SWC technologies?

2. METHODOLOGY

2.1 Context

Soil and water conservation technologies have proved to be effective in improving soil fertility and controlling soil erosion. The government of Malawi through the Land Resources Conservation Department (LRCD) promotes the implementation of such practices and through farmer training and demonstrations, these technologies are delivered to farmers. The farmers are either organised in groups or trained as individual farmers through extension workers.

2.2 Area of study

The study was carried out in the Mangochi District (Fig. 1), which is in the southern region of Malawi and is under the Machinga Agriculture Development Division. The district has a total area of 6,273 square kilometres representing 6.7% of the whole country land area and it entirely surrounds the south-eastern tip of Lake Malawi. It has a population of 1,148,611persons where 505,500 are males and 603,111 are females, according to the Population and Housing Census conducted in 2018 (NSO 2018).

The district was chosen because government and many other organisations are promoting a lot of SWC programmes in the area, but adoption is still a challenge.

Figure 1. Map of Malawi and location of the Mangochi District with neighbouring districts and country boundaries. (Source: Map adopted from CIA (n.d.).

2.3 Data collection

Data was collected from Mbwadzulu EPA which is one of the EPAs in the Mangochi District under the Mangochi District Agriculture Office. The EPA has a total of 25,081 households

where 10,604 are male headed and 14,477 are female headed (NSO 2018). The EPA has 15 sections as sub-management units with one coordinator at its headquarters. The study site is characterised by tropical climate and vegetation with dominant sandy loam and clay loam soils. Livelihoods in the area are largely dependent on agriculture and fishing, as it is surrounded by Lake Malawi, and other non-skilled labour opportunities.

A questionnaire was administered to the sampled population for the farmer surveys whereas for focus group discussions (Fig. 2) a research and questions guide was prepared to probe into factors that required further evidence. The individual interview questionnaire is set forth in Appendix I, and the focus group discussion guide is set forth in Appendix II. Responses and discussions were coded on the questionnaire sheet but also recorded on a voice recorder and transcribed. The District staff as well as staff from the EPA collected the data through the identified tools. Local language (Chichewa) was used to collect data.

Figure 2. Data collection in focus group discussion. (Photos: Daudi Katoma, 31 June 2019).

2.4 Sampling procedure and research design

Respondents who participated in the study were systematically selected from the list of farmers in the area practicing SWC technologies in three sections of the EPA, where a randomised, stratified sampling method was applied. Twenty individual respondents were sampled, and the selection criterion for the stratification was threefold: persons currently practicing SWC; those who dropped out on the way; and those who have never practiced SWC technologies. This stratification intended to offer insight into motivations and factors for different groups that relate to the uptake of SWC practices.

Three focus group discussions were conducted. Each session enjoyed the presence of both males and females, five males and eight females from the Chigonele section, seven males and two females from Zimbayuda and four males and four females from Madzedze. Thus, the total number of focus group members was 30, 16 males and 14 females. The focus groups targeted key informants who practice agricultural activities in the area and were not respondents to the survey. Participants were contacted in advance and meetings scheduled at their convenient time. The questions and discussions for focus groups were partially dependent on the findings from the questionnaire as an exploratory design was used for the research. In line with Creswell's

(2014) classification of mixed research designs, the research design followed the design shown in Figure 3.

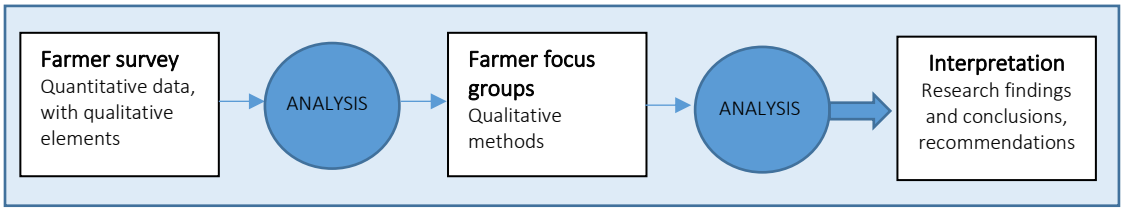

Figure 3. Research design showing phases carried out during the study.

The processes followed a design with two phases; of farmer surveys, followed by farmer focus group discussions, where the design and focus of the latter was informed by the former. Thus, the focus groups intended to offer further insights of factors of importance that emerged from the first phase and allow more in-depth discussions of relevant factors. The results from the surveys and discussions conjointly formed the basis for the researcher's conclusions and recommendations.

2.5 Data analysis

Data was analysed through mixed evaluation methods (both quantitative and qualitative methods) and the Statistical Package for Social Scientists (SPSS) was used to generate descriptive analyses in the form of tables, frequencies and percentages for quantitative data. Chi square was used to test for different relationships between variables. A significance level of p 0.05 was used.

Qualitative data was received as recordings and handwritten notes. The researcher familiarised herself with the data by repeatedly listening to the clips to obtain and interpret the data relevant to the research questions. The recordings were then transcribed and coded into thematic groups based on the categories of the research questions. Different themes were developed by merging similar codes.

3. RESULTS AND DISCUSSION

This section presents and discusses results from the farmer surveys and focus group discussions (FGDs) conducted in the study area.

3.1 Demographic data

3.1.1 Household size and gender of household head

The study revealed that 60% of the respondents live within the national average household size of five (NSO 2012). In the survey conducted, no significant differences were observed between size of household and factors affecting adoption of SWC technologies with a p-value of 0.76 (Table 1).

Table 1. Chi-square ($\chi 2$) analysis of household size and factors affecting adoption of soil and water conservation.

Number of people	Factors that affect adoption						Total	Percentage	p-value
	Extension workers visit	Participation in SWC training	Incentives (materials from FFA)	Other	None	1&2			
1-5	2	1	1	1	2	1	8	40%	
6-10	5	1	3	1	2	0	12	60%	
Total	**7**	**2**	**4**	**2**	**4**	**1**	**20**	**100**	0.76

Out of the 20 households selected in the farmer surveys, 80% of the respondents were from male headed households whereas 20% were from female headed households as illustrated in Table 2.

Table 2. Chi-square ($\chi 2$) analysis of gender of household head and factors affecting adoption of soil and water conservation.

Gender	Factors that affect adoption						Total	Percentage	p-value
	Extension worker visit	Participation in SWC training	Incentives (materials from FFA)	Other	None	1 & 2			
Males	6	2	3	1	3	1	16	80%	
Female	1	0	1	1	1	0	4	20%	
Total	**7**	**2**	**4**	**2**	**4**	**1**	**20**	**100**	0.82

The study did not establish a relationship between gender of household head and factors that affect adoption of SWC. The small sample size renders it difficult to reject the zero hypothesis regarding gender and other factors that affect adoption of SWC technologies.

Focus group discussions (FGDs) also enjoyed participation from males and females although the number of male participants was slightly higher than females with a ratio of 16 males to 14 females. It should be noted that the area of study has more females than males according to the population statistics of the area provided by the EPA. In addition, more men spend their time pursuing other sources of livelihood such as fishing in the study area as it is bordered by Lake Malawi than doing farm work. As the focus groups were open for attendance by both males and females, it was expected that women were better represented in the focus groups and this discrepancy might represent some selection bias. Plausible reasons are that women felt shy to attend the discussions because they fail to express their voices in the presence of men as they feel inferior to them and that men are regarded as decision makers. A common conception is that whatever men say is regarded as the final decision rather than a voice from a woman. This calls for a further study to better understand women's perceptions in land management practices.

3.1.2 Age and marital status

The farmer surveys show that thirty percent of the household heads targeted in the study were above 30 years of age (Table 3). This reflects the fact that more young individuals explore other non-farm activities in the area whilst older individuals invest in farming.

Table 3. Chi-square ($\chi 2$) analysis of age categories and factors affecting adoption of SWC technologies.

Age category	Factors that affect adoption						Total	Percentage	p-value
	Extension worker visit	Participation in SWC training	Incentives (materials from FFA)	Other	None	1 & 2			
20-29 years	0	0	0	1	1	0	2	10%	
30-39 years	2	0	2	0	1	1	6	30%	
40-49 years	1	1	1	0	2	0	5	25%	
50-59 years	2	0	0	1	0	0	3	15%	
60 and above	2	1	0	0	0	0	3	15%	
Don't know	0	0	1	0	0	0	1	5%	
Total	**7**	**2**	**4**	**2**	**4**	**1**	**20**	**100**	0.53

It is important to understand the demographics of the users of extension services in order to be better able to tailor the services to the needs of the respective age groups. In probing further on influence of age on adoption of SWC through FGDs, participants expressed that age does not affect adoption as it is to them "just a number". One of the participants shared his opinion in the following way:

> *One can be young or old, that does not matter. As far as you have a mission at the end you follow ways to achieve the mission. Much as old farmers find it hard to adopt SWC because they are laborious, but they can hire out others to do the work. To us that means the person has adopted SWC.*

Contrary to a similar study by Chomba (2004) showing that age affects adoption, this study has indicated that age does not influence adoption, and no difference in opinions based on age-related factors was detected in the FGDs. The study also indicated that there was no statistically significant difference between age and adoption of SWC technologies. This corresponds to results found by Barungi and Maonga (2011) that suggested that age of household heads does not influence adoption of SWC technologies. In the case of Malawi, this gives an indication that extension service delivery should focus on both the young and old farmers as they have equal chances of practising SWC.

Farmer surveys revealed that 90% of the respondents were married while 10% were divorced. However, there was no relationship between marital status and factors that contribute to adoption of SWC technologies ($p=0.82$) (see table 4).

Table 4. Chi-square ($\chi 2$) analysis of marital status of respondents and factors affecting adoption of SWC.

Marital status	Factors that affect adoption						Total	Percentage	p-value
	Extension worker visit	Participation in SWC training	Incentives (materials from FFA)	Other	None	1 & 2			
Married	6	2	3	2	4	1	18	90%	
Divorced	1	0	1	0	0	0	2	10%	
Total	**7**	**2**	**4**	**2**	**4**	**1**	**20**	**100**	0.82

3.1.3 Educational levels for household heads

The study also measured education level as the highest level of education respondents have ever attended. Out of the sampled population during farmer surveys, it was found that 80% of the respondents attended primary education, 15% attended secondary education, 5% were illiterate, and the majority of FGD participants also attended primary education. Formal education was considered important in the study as it may improve an individual's capacity to gain knowledge and skills in extension service delivery. The study further attempted to examine the relationship between education level and factors affecting adoption as various studies have indicated that educational levels influence adoption of SWC technologies. In contrast, this study found that there was no significant difference between education level and factors affecting adoption of SWC technologies with a p-value greater than 0.05 (Table 5). But these results should be interpreted in light of the small sample size.

Table 5. Chi-square ($\chi 2$) analysis of education level of household head and factors affecting adoption of SWC technologies.

Educational level of respondent	Factors that affect adoption						Total	Percentage	p-value
	Extension worker visit	Participation in SWC training	Incentives (materials from FFA)	Other	None	1 & 2			
Illiterate	0	0	0	0	1	0	1	5%	
Primary	6	1	3	2	3	1	16	80%	
Secondary	1	1	1	0	0	0	3	15%	
Total	**7**	**2**	**4**	**2**	**4**	**1**	**20**	**100**	0.68

These results are also in line with those found in the FGDs conducted. Participants described that education is not a factor that determines adoption despite any hypotheses that educated farmers better adopt land management practices. One participant expressed these opinions on the matter:

> *I attended the first classes of primary school and I can read and write. That does not guarantee me that I can adopt SWC. It is just a matter of dedication and knowing what you want to achieve. Similarly, we have others in our community that did not even attend any form of education, but they are able to construct swales and incorporate residues. Does it mean that they needed to go to school to learn how to handle a hoe or lay mulch?*

> *The current trends of climate are the ones sending messages to us that we need to adapt to new technologies. Is it that only educated people are the ones seeing the trends?*

This insight suggests that the environmental stress and threats to livelihoods are well understood by farmers of all educational backgrounds. Thus, the study suggests all farmers should be targeted for extension services regardless of their level of education and any preconceived notions of farmers' abilities to learn.

3.2 Soil and water conservation and participation in farmer groups

3.2.1 Participation in farmer groups

The findings of the study revealed that most of the respondents belonged to a farmer group in their community (Table 6). Thirty-five percent belonged to village savings and loans groups and 25% to soil and water conservation committees, whilst 5% belong to other groups such as nutritional groups and Village Natural Resources Management Committees (VNRMC).

Table 6. Farmer groups identified in the study.

Group type	Frequency	Percentage %
Livestock group	1	5
Soil and water conservation group	5	25
Village savings and loans	7	35
Other	1	5
None	6	30
Total	**20**	**100**

It was also noted that 30% of the respondents did not belong to any group, citing reasons as not being interested and not knowing that the groups existed, but some also made deliberate choices of not participating in any groups.

Farmer groups are important as they facilitate farmers' access to inputs, credits, technical messages and improve coordination within the agriculture sector. Through MoAIWD, farmers are encouraged to work in groups so that they have easy access to different sustainable agriculture technologies messages and other extension services. During FGDs, participants argued that belonging to a group is ideal but does not guarantee that you can adopt a technology.

> *There are other people who just belong to a group just to seek company and the benefits of being in the group*", one participant explained, referring to a free-rider risk.

3.2.2 Period of SWC practice

Sixty-five percent of the farmer survey respondents have been practicing SWC and been active practitioners for more than two years (Table 7). However, the FGDs revealed that despite practising SWC for a long period, land holding size is smaller as farmers on average practice on 0.4 ha. Justifiably, one focus group participant pointed out that it was redundant to make comparisons with the past as land holding patterns are quickly changing and will foreseeably continue to do so:

> *Land holding size nowadays is not comparable to that which we had in the past. Moreover, our soils are degraded and still we grow more crops on the same piece of land every season. Yes, we have been practicing SWC for more than two years, but we cannot compare. In the past we used to have more land and do other forms of SWC such as improved furrows where we could leave the land and farm on the next piece of land. Today with growing number of people the same land is divided among our children.*

Despite long periods of SWC, farmers in the study area have forgone opportunities to practice traditional soil and water conservation practices due to land holding size. With the results from the survey, there is insufficient evidence to conclude that practicing SWC affects adoption of SWC technologies as the study showed a significance level of 0.07.

Table 7. Chi-square ($\chi 2$) analysis of years of practicing SWC and adoption.

Years of practicing SWC	Factors that affect adoption						Frequency	p-value
	Extension worker visit	Participation in SWC training	Incentives (materials from FFA)	Other	None	1 & 2		
One year	0	0	1	0	0	0	1 (5%)	
Two years	0	0	1	0	0	0	1 (5%)	
More than two years	6	2	2	2	0	1	13 (65%)	
None	1	0	0	0	4	0	5 (25%)	
Total	**7**	**2**	**4**	**2**	**4**	**1**	**20 (100%)**	0.07

The ever-increasing pressure caused by decreased land holding size is a challenge which in itself cannot be addressed by MoAIWD, but is an important factor to note, as the need to use every method available to improve soil fertility will be more dire with every passing year and generation.

3.2.3 Extension workers' visits to farmers

Extension visits are important in influencing the probability and intensity of adopting SWC technologies (Anley et al. 2007). The study revealed that extension workers visit the farmers more than twice a month (Table 8) to deliver different SWC technical messages and mount SWC demonstrations, as indicated by this FDG participant:

> *We have a strong relationship between us and the extension workers from government and others from NGOs in our community, especially with the government one. She comes to us almost three times a month to see us but also sometimes she comes with messages from the office. Whenever we need support, especially on construction of swales, as you know, need proper measurements, we can call our extension worker to come and advise us.*

From the observation, it entails that extension service delivery is strong in the area but not necessarily possible to conclude that it is effective. There is still a need to establish more insights from other groups left out from the study. In determining the relationship between number of extension workers' visits and factors affecting adoption of SWC, it was found that there is not enough evidence to statistically establish that extension workers' visits to farmers

affect adoption of SWC as the p-value was above 0.05. This cannot be a generalised statement for the whole district as the sample is too small. However, based on the FGDs, it is evident that some users enjoy good services and that they are content with the quality of the advisory service and its accessibility.

Table 8. Chi-square ($\chi 2$) analysis of extension workers visit to farmers and adoption of soil and water conservation technologies.

Number of visits	Factors that affect adoption						Frequency	p- value
	Extension worker visit	Participation in SWC training	Incentives (materials from FFA)	Other	None	1 & 2		
Doesn't visit	0	0	1	0	2	0	3 (15%)	
Once a month	2	0	1	1	0	0	4 (20%)	
Twice a month	2	0	1	0	1	1	5 (25%)	
More than a month	3	2	1	1	1	0	8 (40%)	
Total	**7**	**2**	**4**	**2**	**4**	**1**	**20 (100)**	0.53

3.2.4 Sources of farmers' knowledge and skills

Fifty percent of the respondents claim to have acquired knowledge and skills in SWC from extension workers (see Table 9). The results from the individual interviews are in line with findings from the focus group discussions where participants expressed their opinions that extension workers play a vital role in delivering knowledge and skills through demonstrations and provision of technical messages in SWC, as described by one participant:

> *Today there are a lot of mediums for delivering extension messages even on radios and TVs. But for me I trust the extension worker who comes to us and advises us what to do. I am able to see what he is demonstrating and trust that it will work, and I try it out.*

These observations support results by Chisenga (2015), who found that women farmers in Balaka District adopted Conservation Agriculture (CA) through meetings organised by extension workers in a study on socio-economic factors affecting CA adoption in the Balaka District. Chomba (2004) also observed that contact between extension services and farmers can increase the adoption of soil and water conservation practices, as farmers tend to adopt land management practices that have been communicated to them by extension agents. However, 15% of farmers also indicated through surveys that involvement in community activities like Food for Asset programmes (FFA) help them acquire knowledge in SWC technologies. It was further observed that the contact between farmers and the extension workers facilitated adoption of SWC as most participants expressed that they got the message from the extension workers.

Table 9. Sources of knowledge and skills by farmers.

Source	Frequency	Percentage (%)
Involvement in community activities	3	15
Field days and SWC campaigns	2	10
Extension worker	10	50
Other sources	3	15
None	2	10
Total	**20**	**100**

3.2.5 Farmer trainings

Extension training plays a great role in bringing a change in farmers' knowledge, attitudes and perceptions according to Tesfay et al. (2018). This study therefore attempted to shed more light on the role of farmer training in influencing adoption of SWC technologies. It was found that 70% of the respondents have had training in SWC technologies whilst 30% had never attended any form of training. Similarly, the majority of participants in the FGDs attended different forms of training on SWC technologies. The topics cited to be covered during the trainings were contour ridging (30%), vetiver glass planting (10%), box ridging (10%), while 15% had other forms of SWC training such as manure making and application as well as swale construction. It was noted that the mentioned topics in individual interviews were also cited as methods of SWC practiced by focus group participants. Examples of participant descriptions are set forth in Table 10.

It was interesting to note that there are several methods of SWC practiced in the area and participants were able to practice one of the different forms of SWC technologies. This shows that given chances and continued support farmers around the area can be able to adopt a variety of SWC methods. These activities are in line with the FAO (1994) publication on the SWC methods to improve soil fertility and reduce erosion.

However, the study showed that there is enough evidence to statistically establish that attending trainings affects adoption of soil and water conservation technologies at the 95% confidence interval, with p-value 0.009 (Table 11).

Table 10. Methods of soil and water conservation practices in the study area (texts in italics are direct citations of participant statements).

What methods of SWC are practiced?	**How frequently are the methods practiced?**
Compost and crop residue incorporation *In our community we practice crop residue incorporation where maize stalks are left in the field after harvesting and mixed with the soil when making ridges, we also make compost manure as advised by the extension worker as well as contour ridging and swale construction. We had a training on how to make compost by our extension worker and I was a participant.* (Participant from the Madzedze section).	Almost in all growing seasons, one of these technologies is adopted. Some are permanent structures such as swales that need maintenance.
Contour ridging *I do contour ridging where all my ridges follow a contour line. When time for making ridges comes I use an A-frame which I constructed with the help of the extension worker. I prefer use of a line level because it is easier and faster but due to low income, I cannot afford to get one.* (Participant from the Chigonere section)	All growing seasons
Box ridging *I had a problem with wash aways in my field. When the extension worker came to visit us some time, I asked how to control these wash aways. He advised me to construct box ridges so that I can be able to retain the water within the farm to increase infiltration. Since then I practice box ridging.* (Participant from the Chigonele section)	All growing seasons
Vetiver grass planting *Vetiver grass is planted on contour lines to form a thin but dense hedge line to control run-off and improve moisture retention. Vetiver grass is a scarce resource in our community but with the help of the agriculture office, we managed to raise a vetiver nursery where we get the planting materials*. (Participant from Zimbayuda) .	A permanent action but once we see gaps we replant.
Swale construction is a form of harvesting rainwater and reducing run off. Participants expressed that they construct swales to improve moisture required for crop development.	Once constructed, structures are permanent, but require maintenance and stabilization.

Table 11. Chi-square ($\chi 2$) analysis of attendance of SWC trainings and factors affecting adoption of soil and water conservation.

SWC training	Factors that affect adoption						Frequency	p-value
	Extension worker visit	Participation in SWC training	Incentives (materials from FFA)	Other	None	1 & 2		
Had training	7	2	2	2	0	1	14 (70%)	
No training	0	0	2	0	4	0	6 (30%)	
Total	**7**	**2**	**4**	**2**	**4**	**1**	**20 (100)**	0.009

3.3 Soil and water conservation benefits and challenges

3.3.1 Reasons for practicing soil and water conservation technologies

The study found that 40% of the respondents practice SWC in order to increase soil fertility as shown in Table 12.

Table 12. Reasons for practicing soil and water conservation by farmers.

Possible reasons	Frequency	Percentage (%)
Soil erosion	4	20
Improve soil fertility	8	40
1 & 2	3	15
Other specify	3	15
None	2	10
Total	**20**	**100**

This is not surprising as the area of study is prone to floods and droughts hence most of the fields lack essential nutrients for crop development. However, soil erosion and other reasons such as moisture retention also play a role in incentivising farmers to practice SWC technologies. Inputs from FGD participants were in line with the results derived from the farmer surveys underlining that the soils in the area are very eroded, as explained by one of the farmers:

> *Our soils are very eroded and lack nutrients for crop development. If we apply manure, we see a difference in our fields.*

They further added that not everyone in the community can afford to buy inorganic fertilizers or benefit from the government project of the Farm Input Subsidy Programme (FISP), which provides agriculture inputs to farmers at a subsidised price. For the low-income level farmers, the view was that "*the only way to improve soil fertility is to practice SWC"*, as described by one of the farmers. These results also correspond to a study by Maonga and Maharjan (2003) in the Sangadzi area that indicated that farmers' decisions to adopt SWC technologies were based on soil fertility improvement and moisture retention during ridge realignment following contour ridging technologies.

3.3.2 Benefits of practicing soil and water conservation

The study sought opinions on the benefits of practicing SWC. Results from farmer surveys indicated that 55% of the respondents interviewed cited increased yield as the major benefit that they attained in practicing SWC (Table 13).

Table 13. Common benefits of soil and water conservation identified during the study.

Benefits	Frequency	Percentage (%)
Increased yield	11	55
Acquired materials/funds	1	5
Moisture retention	1	5
None	7	35
Total	**20**	**100**

This compliments the results found in a study by Herweg and Ludi (1999) that production is farmers' priority in practicing soil and water conservation technologies. Similarly, the FGDs concurred with the results. Participants explained that physical structures enhance moisture required for crop development but also control erosion. This renders the crop fertile conditions for growth and hence bumper yield. Apart from increased yield, some have benefited with materials such as building houses with burnt bricks and purchase of livestock that supply dung for manure. This is as a result of high yield obtained and they were able to raise funds to acquire the properties.

It was also noted that some have not benefited yet from practice, and according to the study, this was due to reasons that they have just started the practice and are in the first years of SWC. Some pointed out that they practice on a small piece of land less than 0.4 ha hence they cannot see the real benefits. This is not surprising as land holding size in the area is low.

The study came across an interesting success story of one of the participants, an older and very experienced farmer, who has benefited from SWC practice. This is his story:

> *If they say that wealth is in the soil, believe you me, they say the truth. I used to think aloud on what this statement means as it usually expressed in our local language "chuma chilimthaka". I later realised when I joined [X] farm to work as a manager, our work involved promoting good agriculture practices to farmers so that they get wealth from the benefits of the soil …*

Today, with the skills and experience gained from the farm, he is one of the prominent farmers in the area but also a member of the village Agriculture Committee. He has participated in a lot of trainings that have helped strengthen coordination amongst service providers in the agriculture sector.

> *Being a lead farmer, I have to stand out in demonstrating the skills that I know but also learnt from the extension workers.*

He said he has been practicing SWC for more than 2 years and has benefited a lot from his farming:

> *During the first years of my practice my fellow farmers used to mock me that after all years of work I come to the village and dig pits in my farm. "Is he not aware that what he is doing in his farm is reducing the size of the plot to cultivate*?" *one of my fellow farmers would say.*

He persisted, however, and the following year there was a dry spell that hit the area, but his farm was not affected because with the SWC structures he was able to harvest moisture that was enough to support growth of the crops. Today this farmer has been able to construct a house with burnt bricks, has acquired livestock that supply him dung for manure, and he experiences a high yield. He really agrees that wealth is in the soil.

3.3.3 Challenges during implementation of soil and water conservation technologies

The study sought opinions on challenges affecting adoption of SWC and it has revealed that inadequate farm implements or inputs, bush fires, labour intensive practices and livestock competition are the major challenges that hinder practicing of SWC (Table 14).

Table 14. Challenges faced during implementation of soil and water conservation technologies.

Challenges	**Frequency**	**Percentage %**
Inadequate farm implements/inputs	8	40
Bush fires	5	25
Labour intensive & takes time to get benefits	3	15
Other	1	5
None	3	15
Total	**20**	**100**

This was evident both from individual interviews and the FGDs. Participants explained that lack of inputs affects implementation as some forms of SWC require inputs such as vetiver grass, hoes and picks as some working tools but that they have challenges in accessing them. An FGD participant was lamenting the lack of resources and said while laughing:

> *Construction of swales requires adequate materials like picks and rakes, for example, but for us we do not have such materials as we cannot afford to purchase them. We were depending on the MASAF 4 program which could help us with tools like these but you people from the office have taken away from us. They were buying tools for us but now you have stopped it.*

This supports a study by Wetengere (2010) that suggests that inadequate inputs affect adoption of conservation technologies.

The frequency of bush fires (see Fig. 4) also hinders implementation and adoption of SWC in the study area.

Figure 4. Bush burning in the Chigonele section; a common challenge in Malawi. (Photo: Katoma, 2019).

Participants mentioned that as a result of weak by-laws in the area, people set fire carelessly and even burn crop residues meant for land management technologies. One of the FGD participants in the Chigonele section even witnessed a bushfire on the way to the FGD session:

> *In our community, bush burning is a common problem that we are facing despite having by-laws by the community leaders. As I was coming, I have seen a fire and was talking to myself that the laws are not working despite being in place.*

Participants explained that they are discouraged from adopting some other technologies like CA because once they gather crop residues for mulch, the risk is that other people will come and set it on fire. While bushfires are a common challenge in Malawi, this calls for joint efforts by extension workers, farmers and local leaders to enact and enforce the existing by-laws.

Livestock competition is another challenge that was raised during the discussions. This is a result of the free-range system of grazing practiced in the area. Animals are just left out without proper management and end up damaging other people's crops and crop residues. Participants expressed that after gathering residues for mulch, livestock damage the mulch, hence rendering them helpless, and could discourage the practice in the long-term. One female participant described:

> *This make us feel bad because it means all efforts are in vain.*

Farmers are advised to use crop residues for mulch and incorporation, and preferably the mulch collected from the same field rather than importing it from other fields. This practice reduces incidences of diseases as well as pest infestation. However, once the mulch is damaged by the livestock, they are not able to replace it, which also makes them abandon other forms of SWC technologies. The participants called out to leaders of the community and owners of livestock to be strict with by-laws and put them to practice, as stressed by one of the FGD participants:

> *Enforcement is what is needed, and stiff fines for those who violate the laws.*

Further, participants pointed out that some SWC technologies are laborious. Participants argued that construction of physical structures like swales, deep trenches and check dams require a lot of labour and in some cases they do not have such means. With this, they are forced to hire external labour which is expensive and puts the households with lower incomes at a disadvantage.

3.3.4 Measures to deal with the challenges and increase adoption of SWC

The study found that respondents of farmer surveys and participants of FGDs suggest that use of extension messages, sensitisation by local leaders, hiring of labour, formation of clusters, intensification of trainings and provision of incentives are the proper measures to deal with the challenges connected with SWC and to increase adoption. Table 15 presents the frequency and percentage of respondents to farmer surveys on measures to deal with challenges during implementation of soil and water conservation.

Table 15. Measures in dealing with SWC challenges identified during farmer surveys.

Measures to deal with challenges	**Frequency**	**Percentage (%)**
Use of available resources and extension messages	7	35
Sensitizations by local leaders	4	20
Hiring labour	1	5
Other	8	40
Total	**20**	**100**

In understanding the measures to increase adoption, participants in the FGDs expressed that training is an important factor in motivating farmers to adopt SWC as explained by one participant:

> *Farmers who are trained have a better understanding of the technology but also their attitude toward the technology is changed; this can help one adopt.*

In agreement, another participant elaborated and called for community transformation through training:

> *We appeal to the agriculture office and all who provide agriculture services in this area to continue supporting us with trainings. We can be glad if all of us in the community can attend SWC trainings so that our community transforms.*

The area had been receiving training on SWC from both the government and NGOs, but only selected farmers were targeted and trained with the intent for them to train other farmers. This approach was taken as a result of inadequate resources to offer training to all farmers. This study has, however, shown that intensification of these trainings could play a vital role in adoption of SWC and to encourage that the learning be efficiently passed on to other farmers. The farmers' attitudes above reflect a certain marginalisation, and the study suggests that a critical mass needs to be reached in order for the uptake of the practices to be more common; for the community to transform. This needs to be taken into consideration and that a variety of groups be targeted in a more systematic fashion.

Incentives motivate farmers to adopt a variety of land management practices. The study has revealed that farmers still depend on incentives to be inspired to adopt a technology. Provision of food items and cash are some of the incentives mentioned by farmers in the study. Farmers expressed that they get motivated to do land management practices if they see an incentive attached. As one participant said, laughing:

> *You know how hard construction of swales is, should we just work without anything?*

Farmers felt that if there are incentives attached, the government would not have issues in promoting SWC. People would just do it without being told. They also expressed satisfaction with the FFA collaboration with the World Food Programme. People work for 12 days and at the end of the period get food or cash to improve their livelihood. Regarding the impact of the FFA program, participants explained that the programme is just benefiting those who participate as it targets only a few people in the community. They further indicated that a change is evident in those who participate in the programme. It was also mentioned that incentives may not be only cash or food, but that the government can put in place some programmes such as

revolving funds to boost farmers' income and morale in adoption of SWC but also rewarding those who are doing well.

A cluster approach was another measure that was suggested by participants to increase adoption. Farmers suggested that working in groups may lessen the burden of hiring labour as was indicated in the farmer surveys. They cited the approach FFA is using of working as teams on fields upon agreement by the owner. They added that teamwork is easier but also saves time. These teams can be based on local arrangements within the communities and improve networking and coordination.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Mixed methods were applied in this study, which combined quantitative and qualitative techniques to address the core research questions. In light of the small sample size which inevitably has methodological implications for study generalizability, the statistical results should be interpreted with care, particularly to avoid type II errors. However, the combined methods were useful in jointly informing the study and forming conclusions.

The study was conducted to firstly identify different methods of SWC used by farmers in the study area. Based on the individual interviews and FGDs, the study has shown that farmers in the study area practice a variety of technologies, including contour ridging, box ridging, vetiver grass planting, manure making and application as well as residue incorporation. These activities were done at the individual level but also as community works. In understanding the reasons for practicing SWC, the study has indicated that the primary reason for practicing SWC is to improve soil fertility. This is not surprising because the area of study is prone to floods and drought and hence a lot of nutrients are washed away during the floods. Soil erosion and moisture retention were also some of the reasons cited for practicing SWC. Respondents also identified an increasing need to practice SWCs as land holding rights are decreasing, which will continue to be a challenge with the foreseeable population pressure.

Secondly, the study sought understanding on the factors that affect the adoption of soil and water conservation technologies. It is of vital importance to understand such factors after several attempts by government and non-governmental organizations promoting a variety of SWC technologies in the study area.

Based on the survey results, it was revealed that socio-economic and demographic factors such as educational level, age of the household head, household size, and marital status were found not to have any statistically significant relationship with factors that affect adoption of SWC technologies. Literature on the educational level of household heads mostly indicate that to a large extent literacy levels influence the adoption of conservation technologies as it helps farmers to understand technical messages. It was interesting therefore to note that participants in the focus groups expressed opinions that adoption of SWC conversely does not require formal education, and that the urgency and environmental stress also functioned as external incentives for adoption. Achieving the intended results is what farmers prioritize and may help adoption despite the educational level. These results indicate that extension service providers should target all farmers regardless of their level of education.

The study could not establish that age of household head corresponded to farmers' adoption of soil and water conservation technologies, nor did the number of people per household. It was, however, surprising to note that farmers expressed an attitude regarding age as "just being a number" and having no influence on adoption of SWC. This was contrary to the researcher's assumptions that older people adopt SWC technologies more easily than young people since they are more likely to own land and do most investments in agriculture whereas young people explore options for other non-agriculture works.

The study has also shown that most of the respondents belonged to a farmer group, e.g. soil and water conservation groups, village savings and loans groups, and VNRMCs. Although being in a group facilitates collaboration and easy access to loans and technical messages, the study indicated that it has limited impact on the adoption of SWC technologies. Study participants expressed the views that some farmers belong to a group only to enjoy the benefits attached to the group but not to adopt the SWC technologies.

In the study, it was tested if extension workers' visits to farmers would have any impact on the adoption of SWC technologies. The results indicated that extension workers visit farmers more than twice a month to mount demonstrations but also to deliver other extension services. Participants indicated that there is a strong relationship between the farmers and extension workers which denotes that the extension system in the area is strong. However, there is not enough evidence generated from the study to clearly verify that the visits have a specific impact on the adoption of SWC technologies. Farmer trainings play a great role in changing farmers' knowledge, attitudes and perceptions. The study revealed that participants have received training in different SWC technologies, but it was noted that there is a sense of marginalization of those who attend the trainings and practice SWC. Evidence indicate that the farmers who had had training were able to adopt SWC technologies and practice on their own, but those practitioners called for a more wide-ranging training to bring about community sensitization.

Regarding the challenges that affect adoption, the study has shown that inadequate farm inputs are one of the major challenges that farmers face. Despite having land, farmers are unable to do some activities, such as manure making, because they do not have livestock. They only rely on other types of manure, but it is their wish to do composting. Access to vetiver grass and hoes for swale construction and other physical structures have proven to be inadequate and some farmers lack working tools. Severity of bush fires, livestock competition and the fact that activities are labour intensive are also some of the challenges identified in the study. Bush fires and livestock competition are the most common challenges in Malawi in general. Participants expressed worry that if no actions are taken, this may discourage some forms of SWC such as residue incorporation and CA in the long-term.

Lastly, the study sought measures that can be employed to deal with the challenges faced during implementation of SWC and increase adoption. Farmer's frequent contact with extension workers for guidance and coordination, community sensitizations by local chiefs, incentives, training and working as clusters were the suggested solutions that might affect adoption of SWC technologies. Farmers pointed out that incentives boost farmers' morale and have the potential of increasing the adoption of SWC.

At the heart of the research lies this poetic quote from one of the participants: "*If they say that wealth is in the soil, believe you me, they say the truth*." This reflects the fact that many of the farmers who participated in the study have gained a solid understanding of the vital value of soil and water conservation for farmers in the region. However, they also face multiple

challenges, and some targeted actions are required to use resources more effectively, to reach more farmers and to instigate a mind-set shift in the communities to address the challenges of present times and the future to come. Some measures to deal with challenges are discussed in more detail in the following section where recommendations are set forth.

4.2 Recommendations

A number of useful lessons and recommendations can be derived from the study. Based on the findings, the researcher recommends the following:

1. Addressing some major challenges such as bush fires and livestock management is imperative for adoption and continuity of SWC practices. Such challenges may continue hindering adoption of SWC and abandoning the practices in the long-term. By-laws are in place to address such challenges, but the enforcement is lacking. This requires extension workers and community leaders to work together for a common goal. It is recommended that the LRCD sets up meetings with community leaders and subsequently with the communities to jointly identify suitable ways to properly enforce the respective by-laws. This inevitably needs to be coupled with community sensitization. LRCD should follow up with a publicity and awareness campaign to follow up with actions by community leaders and to advocate for support by the community and bring about behaviour change.

2. Introduce awards for best implementers of SWC in the area to boost morale of farmers and increase adoption. Awards are a low-cost, yet very effective way to incentivize farmers to take up SWC technologies. It can also offer successful lessons that serve as an inspiration for others. An example of a success story was set forth in the study. Further, such a system can serve well to encourage farmers to participate in peer learning efforts, and as a factor for a holistic "community transformation" which serves all and decreases the marginalization sensed by SWC practitioners, as was called for by the participants in the study.

3. Farmer groups are essential mediums for easy communication. Organized farmer groups make it easier for extension service delivery as more farmers are reached with extension services. The study therefore recommends that farmer organizations make efforts to acknowledge and understand the needs of all the members in the group, promote peer-to-peer contact within the group so that all members share knowledge and ideas between and amongst each other. There were some issues of free-rider problems, where certain members were inactive and contributed little, but enjoyed the benefits. This signifies the risk of efforts and resources be spent on farmers who do not contribute their share. Clearer goal setting for farmer groups and commitments, coupled with more open communication, and if needed, stratification of groups into sub-groups might be considered to address such problems, as well as very focused reward systems that benefit and incentivize those who participate and contribute, and thus addresses the free-rider problem associated with farmer groups.

4. Establish specific female farmer groups. Women play a great role in production, but their voices on land management are marginalized due to their lack of empowerment and their weak voices when compared to men in decision making processes. Lessons from a variety of sectors indicate that specific measures may be needed for female farmers to fully enjoy the benefits of SWC extension services. It is therefore

recommended that special female farmer groups be established within the EPA for female headed households as a trial for two years, and that the results from the work be closely monitored in order to determine the feasibility of female farmer groups as an established approach in SWC technology adoption. Such a trial could then be expanded into a separate program if deemed feasible. Female farmers face different challenges, and separate groups for female headed households might serve well to ensure that such challenges are addressed, and lessons shared. Further, understanding the perceptions and needs of female farmers is imperative for sustainability. The study therefore also recommends that a study be conducted to understand the perceptions of female farmers on land management practices and challenges they face during implementation of land management practices. A deeper understanding would allow staff to employ a tailored approach for female farmers.

5. Support cluster approaches. The study found that farmers have challenges in terms of labour and working tools for successful implementation of SWC. It is therefore recommended that farmers should be organized in groups (clusters) so that the workload is shared amongst group members and use the available materials to implement SWC. This also encourages farmers' coordination and sharing of knowledge for community transformation.

6. Intensification of trainings and farmer exchange visits to successful SWC implementers may boost morale for farmers to adopt SWC. Exchange visits are vital as they provide concreate examples of SWC methods that farmers apply to their own circumstances. It also fosters change in behavior and attitudes amongst farmers.

7. The Government continues to support a variety of SWC methods. The study has identified a variety of SWC methods that are practiced in the area, and there was little indication that one method was more successful than the other; farmers face different challenges, live in different environments and have different means of applying SWC methods. It is recommended that the government should continue to support the farmers whenever necessary and feasible for higher achievement, and seek to contextualize training to meet the needs of individual farmers.

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APPENDICES

APPENDIX I

Individual interview questionnaire

FACTORS AFFECTING ADOPTIPON OF SOIL AND WATER CONSERVATION TECHNOLOGIES

Date and Start Time_____
01. District Name: _____
02. EPA Name: _____
03. T/A: _____
04. GVH: _____
05. Village: _____
06. Questionnaire Number _____
07. Enumerator Name: _____
08. Date of Interview: _____
09. Name of Household Head: _____
10. Sex of the household Head_____
11. Name of Respondent_____

INTRODUCTION:

My name is……. I am an extension worker who has been sent by the District Land Resources Conservation Officer to carry out a survey on adoption of soil and water conservation (SWC) technologies in this area and your household has been chosen to participate in the survey. The aim of the survey is to know more about the implementation of soil and water conservation activities in this area and I also seek your own opinion on the implementation of the activity. The duration of our conversation will probably be 40 minutes. What will transpire here will be treated with confidentiality and you are free to stop the survey. Are you willing to take part in the survey? (Yes/No)

Dzina langa ndine …….ndine mlangizi wa boma ndipo ndatumidwa ndi alangizi akulu owona za nthaka kudzapanga kafukufuku wa ntchito yoteteza nthaka mmudzi muno, ndipo khomo lanu lino lasankhidwa kutenga nawo mbali mukafukufukuyu. Ndili ndi mafunso amene ndikufuna tikambilane. Cholinga cha kafukufuku ameneyu ndi kufuna kudziwa mene ntchito yoteteza nthaka ikuyendera komanso momwe inuyo mukuwonera ntchitoyi. Kucheza kwathu kutitengela pafupifupi mphindi…….. Zomwe titakambilane pakhomo pano zikhala zachinsinsi ndipo muli wololedwa kusiya kuchezaku .

Kodi muli okonzeka kutenga nawo mbali mukafukufuku ameneyu? (EYA/AYI)

SECTION A: HOUSEHOLD HEAD CHARACTERISTICS

A1	Relationship of respondent to household head *Ubale wa inu ndi oyankha mafunso ndimutu wa banja lino ndi otani?*	*1= self 2=spouse 3=child 4=other*
A2	Gender of respondent *Oyankha mafunso ndi wa mwamuna kapena wa nkazi?*	*1= male 2= female*

A3	Age of household head *Zaka za mutu wa banja lino ndi zingati?*	Let them say their age and record the number
A4	Marital status of household head *Mutu wa banja lino ndi okwatira/okwatiwa?*	*1=married; 2=widowed; 3=divorced; 4=single*
A5	Educational level of household head *Mutu wa banja sukulu analekeza kalasi yanji?*	*0=illiterate;1= Primary;2= secondary, 3=tertiary;4=other specify*
A6	Household size ***(total)*** *Khomo lino lili ndi anathu angati?*	Let them say how many and record the number
A7	Position of household head in the community ***(circle all that apply)*** *Mutu wa banja lino ali ndi udindo wina uli onse mudzi muno?*	*1=ordinary citizen 2= Village head 3=religious leader 4=teacher (primary or secondary);5=health worker 6=extension worker; 7=other(specify)*

SECTION B: INVOLVEMENT IN SOIL AND WATER CONSERVATION TECHNOLOGIES

B1	Do you belong to any farmer group? *muli pa gulu lililonse lopanga za ulimi*	Yes……..1 No……2	
B2	If yes in question B1, which group? *Ngati muli pagulu la zaulimi, gulu lake mumapanga chani*	Irrigation group……1 Livestock group……2 Soil and water conservation group……3 Agroforestry group……4 Village savings and loans……..5 Others (Specify)_____	
B3	If no in B1, why don't you belong to any farmer group? *Ngati simuli pagulu, chifukwa chiyani simuli pagulu*	Not interested……1 There is no farmer group……2 The group disbanded ……..3 Can't afford membership fee……..4 Others (specify) _____ B4	
B4	Do you have an extension worker in this area? *Muli ndi mulangizi wa zaulimi mu dela lino?*	Yes……...1 No……2	
B5	If yes to B4, which organization does the extension worker belong to?	Min of Agriculture……1 NGO……2 Farmer group ……..3 Others (specify) _____	

	Ngati mulangizi alipo, amachokera ku bungwe liti?		
B6	How frequent does an extension worker visit *Kodi mulangizi amabwera kangati kuno pamwezi?*	Doesn't visit ……..1 Once a month …….2 Twice a month ……3 More than twice a month……4	
B7	Have you ever been trained in SWC? *Kodi munaphuzitsidwapo za kubwezeretsa nthaka?*	Yes……1 No…….……..2	
B8	If yes to question B7, What were the topics covered? *Ngati munaphuzitsidwapo, munaphuzira chiyani?*	Contour ridging……...1 Gully reclamation…….2 Vetiva grass planting…….3 Box ridging……...4 Others (specify)_____	
B9	Does your household practice any form of SWC? *Kodi khomo lino limagwila nawo ntchito zoteteza nthaka?*	Yes……1 No but for the village/ community....……2 No it doesn't……3	
B 10	If yes on B9, for how long have you been practicing SWC? *Mwakhala mukuteteza nthaka kwa zaka zingati?*	One year.....1 Two years.....2 More than 2years……..….....3	
B 11	On how many hectares/acres have you implemented SWC so far? *Padalkali pano muli ndi malo okula bwanji omwe mukuwateteza?*	Less than 0.4ha.....1 0.4 ha…….....2 More than 0.4 ha……..….....3	
B 12	From where did you first acquire knowledge and skills in SWC? *Ndikuti koyamba kumene munapeza upangili woteteza nthaka?*	Involvement in community activities…...1 Field days & SWC campaigns…….....2 Extension Worker.....3 Farmer to Farmer.....4 Radio.....5 Pamphlets.....6 Newspaper……....7 Other Sources.....8	

B 13	What drove/ inspired you to start practicing SWC? *Ndichani chomwe chinakukopani kuti muyambe kuteteza nthaka?* *(Multiple responses possible. Please Probe)*	The erosion of soil due to run off…..…….1 To improve soil fertility……2 Other specify…….……..…….....3	
B 14	From where did you get assistance and what kind of assistance? Kodi mumalandila thandizo lililonse pa nkhani zoteteza nthaka? Ndipo ndi thandizo lanji?	Ministry of Agriculture…….1 NGOs ……..……..2 None ……..3	
B 15	What major challenges are you facing in the course of implementing SWC? *Ndi mabvuto anji amene mwakhala mukumana nawo pa ntchito yoteteza nthaka?*	Allow them to explain and probe more	
B 16	How are you dealing with these challenges? *Mabvuto amenewa mumathana nawo bwanji?*	Allow them to explain and probe more	
B 17	What benefits have your household so far obtained from implementing SWC? *Mwapindulapo chani ndi ntchito imeniyi pa khomo lino?* *(Multiple responses possible. Please Probe)*	Allow them to explain and probe more	
B 18	What factors contributed to adoption of SWC technologies? Inu mukuona ngati ndi chiyani chimene chinapangitsa kuti mutenge nawo gawo pa kuteteza nthaka?	Extension worker's visit……1 Participation in SWC trainings…….2 Incentives (materials from FFA)……..3 Others Specify……..4	

B 19	What measures have you put in place to continue practicing SWC? *Ndi njira ziti zomwe mwakhazikitsa kuti mupitilize kuteteza nthaka?*	Allow them to explain and probe more	

C. Can you share with us examples or stories of your successes and challenges with practicing SWC?
Mungatigawileko ena mwa mavuto komanso zomwe mwakwanilitsa pa nkhani yoteteza nthaka?
_____
_____
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D. What advice can you give to government in its implementation of the soil and water conservation program?
Ndimalangizo anji omwe mungawapase aboma pa ntchito ya kuteteza nthaka?
_____
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FINALLY, THANK THE RESPONDENT FOR THE TIME SPENT

End Time_____

APPENDIX II

Focus group discussion guide

RESEARCH GUIDE FOR FOCUS GROUP DISCUSSIONS ON FACTORS AFFECTING ADOPTION OF SOIL AND WATER CONSERVATION TECHNOLOGIES

Date and Start Time_____
01. District Name: _____
02. EPA Name: _____
03. T/A: _____
04. GVH: _____
05. Village: _____
0.6 Enumerator Name: _____

1. What do you understand by soil and water conservation technologies?
   Kodi mungamasulire bwanji nkhani yosamala nthaka ndi kuteteza madzi?

2. What soil and water conservation practices do you practice in this area?
   Kodi ndi njira ziti zoteteza nthaka zomwe mumachita kudera lino?

3. What challenges do you face when implementing soil and water conservation technologies in this area?
   Ndi mavuto anji omwe mumakumana nawo poteteza nthaka mudera lino?

4. What measures do you take to deal with these challenges?
   Ndi njira ziti zomwe mumatsata pothana ndi mavuto amenewa?

5. How is your relationship with the extension workers in this area?
   Ubale wanu ndi alangizi kudera lino ndiotani?

6. What factors do you feel can contribute to the adoption of SWC?
   Ndi zinthu ziti zomwe mukuona kuti zitha kuthandiza kuti alimi azigwila nthcito yoteteza nthaka?

7. What can you suggest to the government on implementation of SWC?
   Mungakonde bola litachitapo chani pa nkhani yoteteza nthaka?

END TIME _____