



## Factors Affecting Farmer's Adoption of Soil and Water Conservation Practice in Case of Gode District, Shebelle Zone, Somali Region, Ethiopia

Kurbad Mahamed Sahal<sup>1\*</sup>, Zewde Alemayehu Tilahun<sup>2</sup>

<sup>1</sup>Department of Natural Resource Management (Specialization in Soil Science)

<sup>2</sup>Department of Natural Resource Management, College of Dry-land Agriculture, Kebri Dehar University

**Corresponding Author:** Kurbad Mahamed Sahal

[kurbadmahamed440@gmail.com](mailto:kurbadmahamed440@gmail.com)

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### ABSTRACT

Data for this study were gathered through focus groups, questionnaires, and interviews with family heads, district agricultural offices, and development agents (DAs). The most significant and positive factors that positively and significantly influenced the outcome of the logistic regression model were age, sex, the slope of the farm land, the intention of the household heads to sustain farming, training, and extension services. Furthermore, household heads who had access to training and extension services were 2.619 and 5.674 times more likely to adopt SWC structures than those who had no access to these services, respectively. The household heads who had the intention to sustain the activities of farming and People who farmed on steep slopes had a 1.996 and 6.116 times higher likelihood of implementing SWC structures than those who did not have these characteristics, respectively. Inversely, increasing accessibility to finance services, farming extent, and involvement in non-farm pursuits reduced by (-1.371), (-1.390), and (-4.132) times the probability of adopting SWC structures. According to the study's findings, age, sex, slope, motive, travel distance, training outside of farming activities, and the availability of extension services were the main determinants of farmers' adoption of SWC methods. Hence, in order to successfully address the challenges of adoption of SWC practices in the study area, it is advised that non-governmental organisations, the district agricultural office, and other stakeholders take into consideration the obstacles that prevent farmers from adopting SWC practices

## **INTRODUCTION**

Soil and water conservation techniques aim to reduce the effects of various land-use activities in order to preserve, improve, and safeguard natural environmental conditions. One of the most important environmental concerns confronting the globe today is soil deterioration, which is being prevented by the planning and use of procedures in these conservation initiatives. Loss of water and soil has an impact on human and property safety as well as the natural environment. Consequently, improving environmental conditions and reducing soil loss are necessary for sustainable growth (Xiaoqian, 2020). Even so, 5 to 6 million hectares of land in Africa are affected by eroding soil every year. Daniel (2017). As a result, the continent's natural resource base is being degraded due to an annual population growth rate of 2 to 4%, frequent droughts, and an increasing dependence on food aid and imported grains to address food insecurity. Despite increased financial investments in agricultural research in Africa over the past two decades, there have been no significant breakthroughs or improvements in agricultural productivity (Massamba Diop, 2022). Therefore, the continent's lands are particularly vulnerable and threatened by soil degradation and low water availability. Human and environmental causes contribute to the decline of land that results from improper techniques for conserving water and soil. Land degradation is a result of natural processes such as powerful leaching in humid regions, frequent flooding, high winds, heavy rain, steep slopes, and drought conditions in desert regions (Karuku, 2018). In Ethiopia, agriculture is the main economic sector, accounting for almost 80% of employment, 52% of GDP, and 90% of export earnings (World Bank, 2000). However, the country faces alarmingly high levels of soil erosion, with severe erosion affecting about 25% of the highland areas. Nearly 4% of these areas have suffered such extensive erosion that they are unlikely to be productive again (Addisu, 2015). To address this problem, various SWC measures have been introduced on farmlands through food-for-work programmes, such as the construction of bunds, soil bunds, terraces, ploughing, plantations, cut-off drains, etc. However, despite this huge effort, farmers have shown low adoption of SWC practices, and whenever there were no incentives, the constructions were frequently demolished. They believed that the conservation measures took up a lot of space and affected their use of pasture (Birhanu, 2016). Farmers usually view conservation efforts as routine tasks on their property, although there are still numerous obstacles to overcome. Agriculture is vital for Ethiopia's food security and economic development. However, land degradation, including soil erosion and nutrient reduction, has severely reduced agricultural productivity and made it difficult to alleviate poverty and food insecurity in the country. This highlights the urgent need to address the issue of land degradation through effective SWC practices (Belachew, 2020). Despite the government's promotion of massive SWC activities, adoption practices among the farming community remain a challenge. (Birhanu, 2016), Most SWC initiatives are carried out in campaigns with only partial support from crop producers and livestock, which reduces their effectiveness. Institutional, demographic, economic, and physical factors all play a role in farmers' decisions to adopt agricultural technologies

(Belete, 2017; Berhanu et al., 2016; Damtew, Husen, & Demeku, 2015; Daniel & Mulugeta, 2017;; Mohammed et al., 2018;; Yitayal & Adam, 2014; Zemenu & Minale, 2014). But little research has been done in Gode district on smallholders' SWC practices, which is crucial since it will help in the development of strategies and policies (Belachew et al., 2020). However, the purpose of this study is to investigate the key variables influencing farmers' acceptance of recently introduced SWC structures in the research area and seek to suggest potential methods for appropriate technology usage. Additionally, obtaining an in-depth comprehension of the effects of eroding the soil is advantageous for farmers. , Gode District is located in the Somali region, which has experienced several droughts in the past few years, resulting in a shortage of livestock and agricultural output. The district is facing a significant issue with the soil worsening. The Gode District Agricultural Office reports that erosion has a significant impact on the whole land area and that over 59% of agricultural land is vulnerable to floods, deforestation, strong winds, low soil nutrients, and centuries of continuous cultivation. Such a problem not only reduces agricultural productivity and income but also poses a threat to household food security in the study area. Therefore, it is common to suggest different SWC procedures as a way to enhance productivity. However, the adoption of SWC practices has remained an issue despite the long duration of SWC interventions.

## **LITERATURE REVIEW**

According to Gode district SWC expert staff, the landowners stopped maintaining and strengthening the structures after SWC techniques were implemented in the study area. After the crop production season, the conservation structures' preserved grasses and trees were utilised for feeding purposes. Moreover, they used the shrubs and grasses planted to enhance the conservation structures to feed their domestic animals. As a result, the study area implements new techniques for conserving soil and water every year. Although the government implemented various conservation measures, their rate of adoption was very low. The conservation efforts achieved little to alleviate the issue. Therefore, evaluating the elements influencing farmers' adoption of SWC technology is crucial. It also makes an effort to explain which variables are linked to farmers' adoption of these The goal of soil and water conservation techniques is to mitigate the impacts of different land-use activities so as to protect, enhance, and maintain natural environmental conditions.

## METHODOLOGY

### 1 Description of Study Area

Gode District in Ethiopia's specially Somali Regional State served as the study's location. The Shebelle River divides Gode District from Adadle on the south. Imeyberi borders the district from the north and west; Danan borders it from the north and east; Koraha Zone borders it from the northeast; and Kelafo borders it from the southeast. Gode is situated 300 metres above sea level, roughly 580 kilometres south of Jigjiga, the Somali Regional State's capital. According to Ayele (2005), it lies between 5°46' and 6°27' N latitudes and 43°2' and 43°50' E longitudes

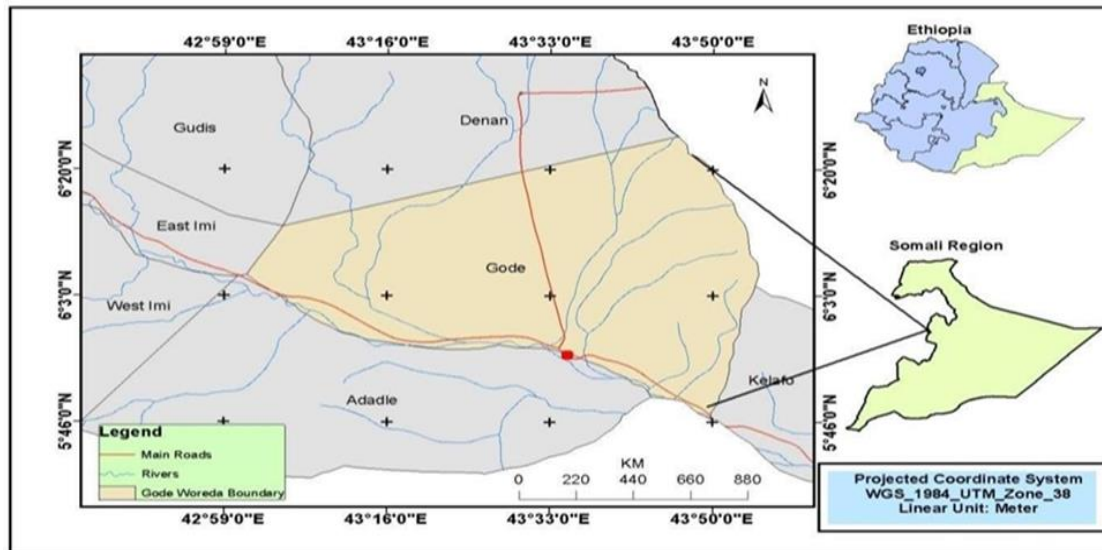


Figure 1. Map of the Study Area

### 2. Climate condition and Soils

Agro-ecological conditions in Gode range from semi-arid to dry, with farming for livestock being the primary industry. Farming is carried out on plains that get rainfall as well as along the Shebelle River's bank. The main rainy season (Gu), which runs from April to June, and the short rainy season (Deyr), which runs from October to December, define the patterns of rainfall. Rain-fed crops cannot be grown in this area due to the average annual rainfall of 150 to 340 mm. 35 oC is the average annual highest temperature, while 23.6 oC is the average annual lowest temperature. The soil texture of Gode varies from silt-loam to silt-clay loam at the surface to clay at deeper levels, according to the Shabele Zone Administration Office (SZAO, 2013). Malede (2013) states that Gode's moderate topography, gradual sloping terrain, and sizable flat area define it. The primary soil types include calcisols, gypsisols, leptosols, vertisols, and fluvisols, according to Ayele (2005).

Due to significant deforestation, the region is vulnerable to wind erosion and strong runoff. The riverbanks and upper slopes are home to natural vegetation. There is a mixture of deciduous bush and shrub land, with a variety of species dominating, including *amarixaphylla*, *calotropisprocera*, *parkinsonia aculeate*, *balanitesa egyptica*, *dodonaea angustifolia*, *rumexneurosus*, and *combretummolle* (Ayele, 2005). Shebelle has been used to grow crops like maize, vegetables like peppers, tomatoes, and carrots, as well as fruits like mangoes,

papayas, guavas, bananas, and lemons, despite Gode being mostly a desert region. Sorghum and maize are produced using the river's seasonal floods, and a small number of vegetables are grown farther away from the river in areas where small channels are made from the streams to the agricultural production areas. For the research district, agro-pastoralism is the major form of production (Worku 2018). The three main agricultural products are sorghum, maize, and sesame. Deals with Somaliland, Hargessa, and Mogadishu are more desirable. Urban traders in Gode town have huge market potential thanks to the popular cash crop known as chat, or *Chata edulis*, which is presently imported from Diredawa. Furthermore, the primary economic activities of rural communities, according to Worku and Garedew (2018), are the production of crops, cattle, and wood fuel (sales of fuel wood and charcoal). speed up.

### 3. Research Design

Descriptive research was conducted in this study to explore the variables influencing the adoption of water and soil conservation measures in the research locations. In order to evaluate the factors influencing the assumption of soil and water conservation techniques, the study randomly selected four kebeles. The research's specific objectives were to examine the physical and biological SWC techniques now in use and to pinpoint the factors impacting the water and soil conservation strategies used in the study region. The focus of this study was to provide a comprehensive understanding of the factors influencing the adoption of SWC methods, an issue that is essential to the preservation of natural resources and sustainable land management. To guarantee the legitimacy of the results, the selection of kebeles was made at random. Land use type, slope, soil texture, and population density are among the physical and demographic aspects that were looked at. Additionally, the research examined the physical and biological SWC techniques that are currently in use in the study region, including terracing, contour farming, ploughing, soil testing, plantation cover, etc. The effect of variables including financial availability, extension services, government regulations, and other elements that influence and save water and soil was also examined in the study. Noted as before, the descriptive. Quantitative research aimed to quantify the relationships between the variables and factors that affect farmers' adoption of SWC practices, including age, sex, educational attainment, family size, farm size, distance from the land, slope of the land, extension services, credit availability, and the adoption of soil conservation technologies.

After being collected using structured questionnaires, the quantitative data was evaluated using the appropriate statistical techniques. On the other hand, qualitative information was gathered using focus groups and open-ended interviews (FGDs) to fill in the gaps left by the quantitative data. The qualitative data provided insights into the social, cultural, and economic settings influencing farmers' actions, in addition to improving our knowledge of the forces propelling the adoption of SWC practices. The collected data were subjected to statistical techniques for both inferential and descriptive analysis. Descriptive statistics were used to summarise and characterise the field data, while inferential statistics were used to test hypotheses and make inferences about the population based on sample data. In conclusion, a mixed-methods approach was used in the

study to collect and analyse both quantitative and qualitative data in order to provide a thorough knowledge of the variables impacting the adoption of SWC practices in the research region. The study's conclusions provide significant new insights into strategies that may be applied to promote the adoption of SWC practices and enhance sustainable land management in the region.

#### 4. Source of Data

Along with primary and secondary data sources, a range of data collection instruments were employed to meet the study's objectives. The fundamental data for the study came from focus groups (FGD), in-depth interviews with key informants, and sample household heads. Because they play a major role in putting soil and water conservation plans into practice, house

hold heads are essential primary data sources. They were specifically picked for the study from among the four kebeles. Experience and expertise in soil and water conservation were required for the district agricultural experts, DAs, kebeles administrators, and zonal supervisors of soil and water conservation. To get quantitative data on the socioeconomic characteristics of the farmers, farm management practices, and other factors, a survey approach (questionnaires) was used

In order to guarantee accurate and thorough replies, the surveys were created with both closed-ended and open-ended questions. To learn more about the farmers' attitudes, beliefs, and adoption level of soil and water conservation methods, focus groups were held with them. The purpose of holding these group conversations was to foster the development of varied viewpoints and the exchange of ideas. In-depth interviews with key informants, such as district agricultural experts, DAs, zonal supervisors of soil and water conservation, and kebeles administrators, were carried out to gain a deeper understanding of the institutional and policy factors influencing the adoption of soil and water conservation practices. Together with primary data, the research also collected secondary data from various sources. The secondary data sources included books, articles, journals, documents, and reports, both published and unpublished. These citations were examined and assessed in order to validate and bolster the findings from the initial study. The secondary data sources provided valuable insights into the historical and contemporary trends of soil and water conservation in the study region. As a result, the primary data for the research were acquired through a combination of focus groups, in-depth interviews with important informants, observation, and survey administration (questionnaires). With its multi-method approach, the information acquired was ensured to be comprehensive, accurate, and reliable. It also provided insightful information on the factors influencing the adoption of soil and water conservation strategies. ehold heads are essential primary data sources. They were specifically picked for the study from among the four kebeles. Experience and expertise in soil and water conservation were required for the district

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##### 5. Instruments of Data Collection

To accomplish the aims of the study, a mixed-methods approach was employed, employing both primary and secondary data sources. Primary data were collected from key informants, focus group discussions (FGDs), and sample household heads in the Gode District research region. Regarding the primary data gathering, the study employed several tools, such as surveys, key informant interviews, and focus group discussions (FGDs). To collect information on topography, erosion status, and significant terrain features, as well as soil and water conservation practices such as "soil bund," "contour ploughing," "half-moon trench," "terraces faced stone bund farming," "plantations," and so forth, extensive fieldwork known as "field observation" was conducted. Through this field observation, significant information that would not have been simple to collect through a questionnaire was gathered.

To ensure that the survey questions were clear and appropriate for the local way of life, the questionnaire was translated into Somali. The survey was administered through in-person interviews between the enumerators and the respondents, with heads of households being the appropriate respondents for the questions. The primary data collection strategy of the questionnaire allowed the researchers to obtain reliable and relevant information from the Gode District sample houses. Based on their familiarity with and proficiency in the research

field, key informants were carefully selected for the interviews. Three development agents (DAs), two SWC supervisors, four kebele leaders from each of the four kebeles, and three elderly people who had lived and worked in the research region for a long time comprised the eleven participants. The participants in the focus group discussions (FGDs) were two SWC supervisors, one development agent (DA), two agriculture extension workers, and a few selected model farmers from the sample kebeles. The FGD members were carefully selected based on their expertise, background, and familiarity with the erosion issue. Eight knowledgeable people were picked, especially for the focus group discussion. The plot layout, techniques for saving soil and water, choices and levels of adaptability to soil erosion, and continued farm use were taken into consideration when selecting the model farmers.

#### 6. Sample Size and Sampling Technique

A multi-stage stratified sampling procedure was used as the sample technique in this study. The sample and selection procedure used both non-probability and probability sampling techniques. Although the intentional sampling method was the primary non-probability sampling tool used in the selection of research units and elements, simple random sampling is still a frequent type of probability sampling methodology. Phases one, two, and three of the sample method involved choosing the district; phases four and five involved choosing the kebeles and household respondents in the study location. As a result, a four-step sampling process was employed to choose the participants. Gode District was specifically chosen for the study's initial phase by the researcher because of the district's potential utility, source availability, problem with soil erosion, and inadequate adoption of water and soil conservation methods. In the second phase, four kebeles—Kayane, Barre, Ubaley, and Godirey—were chosen at random from a total of twenty-three recognised kebeles in Gode District. Following that, a list of every residence in each kebele was supplied by the kebele government. In addition to the lists, a systematic random sampling process was used to choose all of the household heads in the sample. After selecting the sample kebeles, the researcher tried to compute the sample size using Kothari's (2004) formula. You can attain some of the necessary precisions by specifying the number of errors in the sample estimates that you are willing to accept. The population under study usually uses a 5% error margin; however, larger sample sizes and greater expenses are required to achieve such high levels of precision. Because of this, the researcher's acceptable threshold of risk for this study when using the data to make decisions was 7% sampling error in order to simplify the larger population. Thus, the sample respondents were chosen.)

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2(N - 1) + z^2 \cdot p \cdot q}$$

Tolerance (e) is given. In this study, a normal distribution and percentage were obtained using  $P = 0.5$ , where  $q = (1-p, 1-0.5 = 0.5)$  and  $n = 187$ , with a confidence level of 0.95 and an error tolerance of 0.07. The target population (N) divided by the total number of households in the four picked kabeles provides a total sample size of 187 ( $n = 187$ ) for the four nominated kebeles. The HH numbers of Kayane, Barre, Ubaley, and Godirey were, respectively, 960, 1230, 740, and 1090. The previous technique produced an actual sample size of 187 for this study, totaling 4020 households. To determine how many respondents there were among the four Kabeles, the third stage's proportionate to population size (PPS) based on HHs is fundamental. Finally, the systematic random sampling technique (SRS) was used to hand-pick 187 sampled respondents.

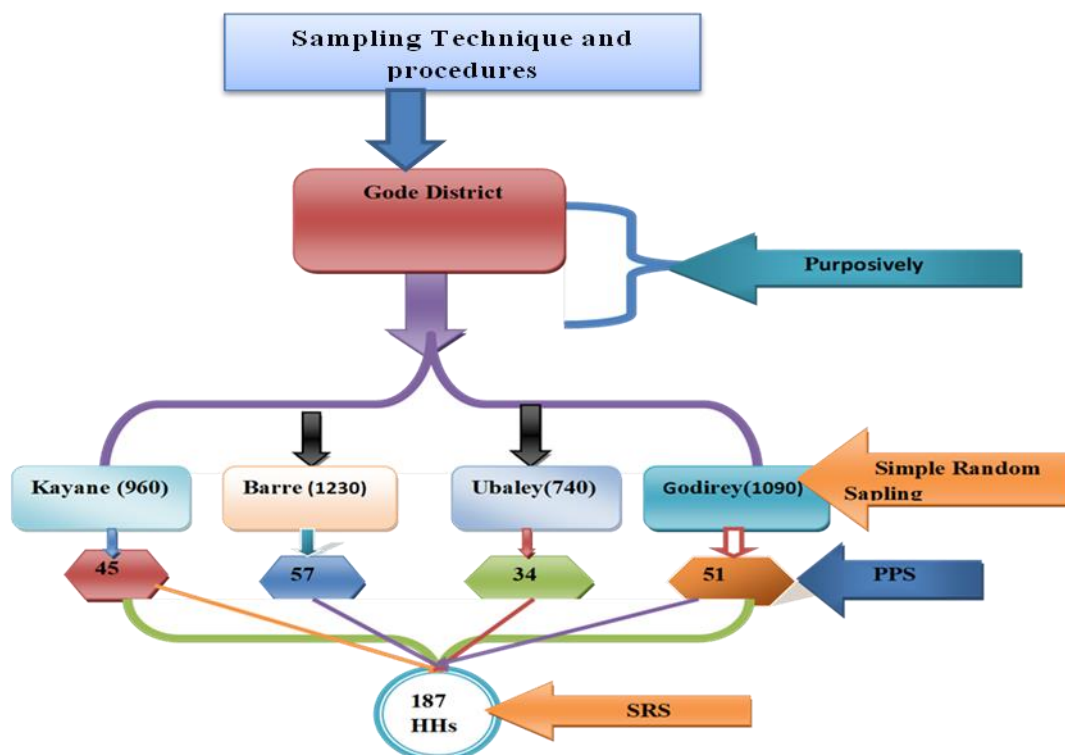


Figure-2-Sampling Technique and Procedures

## 7. Methods of Data Analysis

The data were congregated by survey questionnaires, coded, edited, and imported into the quantitative data analysis programmer, Statistical Package for Social Sciences (spss). Then, binary logistic regressions, means, standard deviations, chi-square tests, percentages, frequencies, and T-tests were calculated. Both qualitative and quantitative data analysis approaches were used in the study. The differences in family size, animal ownership, farm size, and farm distance between the groups that adopted and the non-adopters of soil and water conservation techniques were compared using the T-test. The relationship between farmers' adoption choices and the categorical explanatory variables, It suggests that depending on a family's decision to implement soil and water

conservation measures, its value might be either one or zero. binary logistic regression model was used to assess the relative importance of the factors impacting a family's likelihood of adopting soil and water conservation techniques. The adoption of soil and water conservation techniques was thoroughly assessed based on the survey findings, taking into account factors that affect o and soil maintenance aspects of the households being studied. Probability ratios with 95% confidence intervals were used to evaluate and quantify the degree of correlation between the descriptive and outcome variables. To improve the survey questions, the data from focus groups, interviews, and field observations was qualitatively (textually) assessed.

#### 8. Definition of Variables in the Study

This study looked at the variables that affect farmers' adoption of water and soil conservation techniques. The adoption theories offer a comprehensive list of variables influencing farmers' choices. These studies demonstrated that institutionalised physical, socioeconomic, and social variables all have an impact on the adoption of SWC methods.

The dependent variable's adoption of water and soil conservation techniques by the farmers was the study's main finding. Farmers' use of conservation practices for soil and water was noted, and this was reflected in model 1's dichotomous dependent variable (the logit analysis). 1. In this case, 1 stood for those who independently adopted soil and water conservation techniques, and 0 for those who did not.

The independent variables were the elements that affected the farmer's choice to implement a particular soil and water conservation technique (X). The following were the model's independent variables: A variety of demographic and socioeconomic factors, including the household's financial situation and institutional support systems, influenced the farmer's decision to adopt a certain soil and water conservation approach. . The lists of independent factors, which included continuous and categorical variables, were thought to have an impact on families' adoption of SWC practices. The logistic regression model had the following independent variables: age, sex, education level, access to extension services, and off-farm activities: family size, ownership of animals, and livestock (TLU). Farm size and farm distance between

## RESULTS AND DISCUSSION

### 1. Factors Affecting Farmer's Adoption of Soil and Water Conservation

The dichotomous dependent variable and the independent components were compared using a binary logistic regression model. The primary determinants impacting household heads' adoption of SWC were determined by analysing the measurements of the dependent variable using 13 explanatory variables. The binary logistic model was found to be statistically significant (Chi-square = 58.090, P-value<0.001, df = 13) by the omnibus test of model coefficients, suggesting that it suited the data well. The predictive validity of the model is shown by the fact that 75.3% of the 187 respondents that were part of the analysis were accurately predicted. Furthermore, with a total percentage accuracy of

75.3% for each group, it accurately categorised 85.6% of adopters and 52.2% of non-adopters. The values of the Cox, Snell, and Nagelkerke R-squares were 0.365, 0.2677, and 0.2677, respectively. The model's suitability was further verified using the Hosmer-Lemeshow test, which had a P-value of 0.033 and a Chi-square value of 16.725. The findings of the binary logistic regression showed that the decision of household heads to adopt SWC practices was significantly predicted by age, sex, family size, farm size, number of animals, slope of agricultural land, access to extension services, availability of financing, and training (P-value<0.05). With the exception of farm size, off-farm activities, and financing availability, all of these factors had negative effects. but education was not shown to be an accurate sign.

Table 1. Summary and Result of Binary Logistic Regression Model

<b>Variables in the equation</b>	<b>B</b>	<b>s.e.</b>	<b>Wald</b>	<b>Df</b>	<b>Sing.</b>	<b>Exp-b</b>
Age	1.844	.267	9.956	1	.002	2.430
Sex	1.043	.575	3.287	1	.000	0.839
Educ-status	.211	.383	.304	1	.581	1.235
Family-size	1.449	.304	2.182	1	.040	1.568
Farm-dist.	1.154	.266	7.334	1	.034	1.166
Slope	1.166	.488	6.116	1	.033	.847
Off-farm	-1.390	.818	8.567	1	.004	1.477
Plan	1.629	.445	1.996	1	.158	1.875
Acc-credit	-4.132	.383	2.118	1	.031	.877
Live stock	1.725	.532	10.516	1	.001	5.614
Farm-size	-1.371	1.644	8.088	1	.007	.511
Exten-Serv	.481	.586	5.674	1	.002	.618
Acc-training	1.622	.384	2.619	1	.006	1.862

Source: spss -v-23 outcome \*statistically significant at <0.05

## 2. Demographic Characteristics and Adoption of SWC Practices

Age: The age of the household head was shown to be a significant predictor of farmers' adoption decisions at the 0.05% level of significance [B = 1.844, P-value = 0.002] in the binary logistic regression analysis. A significant correlation was found between adoption and age, indicating that older farmers with more agricultural experience appeared more likely to adopt SWC practices. Young farmers, on the other hand, were more likely to give up on conservation methods. This outcome is in line with the findings of Chombo (2004), who found a substantial correlation between respondents' ages and their adoption of water and soil conservation measures. In a similar vein, Sisey (2009) discovered that growing older was linked to more agricultural expertise and experience, which

boosted the uptake of SWC policies. Additionally, Fikru (2009) observed that more experienced

**Sex--** The adoption of SWC practices was significantly impacted by the sex of household heads, according to the findings of the binary logistic regression ( $B = 1.043$ ;  $P < 0.001$ ). The Wald statistic (3.287) and the Exp (B) = 0.839 support the idea that there was a negative correlation between sex and adoption, meaning that female household heads were less likely than male household heads to adopt SWC practices. This result is consistent with reports by Eleni (2008) and Krishna (2008) indicating male home heads were more likely than female household heads to engage in SWC activities. In relation to Birhanu (2016), this may be explained by the fact that the majority of the women in the area under study spent their time on household duties and activities.

**Family size:** A significant correlation was also found in the binary logistic regression findings between the adoption of SWC practices and the size of the household's family ( $B = 1.449$ ,  $P = 0.040$ , Wald = 2.182, and Exp (B) = 1.56). Farmers with bigger families were more likely to adopt SWC techniques than those with smaller families, suggesting that family size had a favourable impact on adoption. The findings of Asfaw (2017) and Eleni (2008), who discovered that family size positively impacted the adoption of SWC practices, are in line with this outcome. Smaller families, they claimed, were less likely than bigger families to keep up their efforts to save water and soil. Larger families might provide the labour needed to set up and keep up conservation measures. Likewise, Abera (2003) and Chombo (2004) discovered that a high

**3.2 Physical characteristics and adoption of SWC measures**

**Farm size:** Farm growth was predicted to suffer as a result of household heads using SWC techniques. The binary logistic regression analysis showed that, at the 0.05 level of significance, farm size had a negative and significant connection [ $B = -1.371$ ,  $P = 0.007$ , Wald = 8.08]. The odd ratio finding also showed that adoption of SWC decreased by 0.007 factors on bigger farms, whereas full removal of conservation buildings was more common among smaller farmers. This was actually caused by young, inexperienced farmers who didn't possess a large amount of land and lacked the know-how to maintain structures. This result fits in with Asfew's (2017) study, which found Farm size: It was projected that the use of SWC techniques by household heads would negatively impact farm growth. that farmers' adoption of SWC methods was negatively and negligibly impacted by farm size. He went on to say that the negative sign suggests that the chance of adopting new SWC methods declines with farm size; older farmers with larger holdings were not participating in the establishment and upkeep of SWC practices because of a labour force shortage. In a similar vein, Habtamu (2006) discovered a strong and direct correlation between farm size and the choice to keep using water and soil conservation measures. He maintained that the majority of large-scale farmers were elderly, without the workforce to carry out ongoing conservation initiatives, and with short-term goals. Birhanu (2016) endorsed this viewpoint as well, saying

Distance of farmland: The adoption of SWC methods and the separation of farmland from farmers' homes had a statistically significant beneficial connection [B = 1.154, P = 0.034]. There was a high link between farm distance and the adoption of SWC methods, as evidenced by the Wald statistic (7.334). This suggests that farmers who lived near their farms were 1.166 times more likely to adopt SWC than farmers who lived farther away from their farms. Kessler (2006), who recommended that farmers participate in more appropriate SWC activities near their homes, supports this outcome. Conversely, Fikru (2009) contended that individuals adopted fewer SWC techniques depending on how far their residence was from their farm. Alemante (2010) discovered no correlation between the distance between farms and the adoption of SWC methods.

Slope: A significant and positive correlation was found at the 0.05 level of significance between the adoption of SWC methods and the slope of farmlands (B = 1.17, P = 0.033). The high connection between slope and SWC practice adoption was validated by the Wald statistic (6.116). More conservation was practiced by farmers cultivating steeper slopes than by those cultivating gentler slopes. This implies that farmers who farmed sensitive soil had a higher propensity to use conservation techniques. The likelihood of using conservation buildings was higher in areas with steeper slopes than in areas with gentler slopes, at almost 0.847 times higher chances. According to Wagayehu and Lars (2003) and Habtamu (2006), there was a strong correlation between slope and the adoption of SWC methods, and these factors affected farmers' decisions.

### 3. Socio-Economic Characteristics and Adoption of SWC Practices

Education-status: Farmers with higher education levels are better able to oversee their businesses and comprehend the recently enacted SWC requirements. Based on the education-status data and the results of the binary logistic regression analysis (B = 0.211, P = 0.51, Wald = 0.304, Exp = 1.235), it was determined that there was no significant correlation between the degree of education and SWC practices. The adoption of SWC methods was more common among educated farmers than illiterate farmers, according to positive logit coefficient values. It was demonstrated by Fikru (2009) and Alemeta (2010) that there was no causal relationship between adoption of SWC practices and education level. Eleni (2008) came to the same judgement. Sisey (2009) discovered that the adoption of SWC methods had a positive effect on education level.

Livestock: The size of the livestock was considered to have a positive and substantial effect on household heads' decision to use SWC structures. Livestock size was significant at the 5% level of significance [B = 1.725, P<0.001], according to the binary logistic regression model's results. Larger livestock numbers were associated with a higher likelihood of using SWC techniques compared to smaller livestock sizes, according to positive logit coefficient values. Genene and Wogayehu (2010) corroborated this conclusion, reporting a positive relationship between the quantity of livestock and the adoption of SWC methods. Similarly, Birhanu (2016) discovered that the size of the livestock positively influenced farmers' decisions to implement SWC methods.

Off-farm activities: The majority of the sample households' income came from farming. On the other hand, several farmers enhanced their income and supported themselves by working off the farm. A non-significant and negative correlation was found between off-farm activities and binary logistic regression analysis ( $B = -1.390$ ,  $P = 0.004$ ). A further finding of the odd ratio result was a reduced adoption rate of SWC practices when off-farm activities were undertaken. Farmers' engagement in non-farm activities has been demonstrated to have a negative impact on the consistent application of soil and water conservation practices, as Asfew (2017) observed. The farmer's decisions to embrace SWC methods were significantly influenced by their family members' participation in non-farm activities, as confirmed by Birhanu (2016). According to 2009 research by Sisey, farmers that participated in off-farm

#### 4. Institutional characteristics and adoption of SWC measures

Access to support services includes Extension agents significantly improve the adoption of SWC measures by giving farmers reliable and highly accurate information. The strong relationship between extension agents and farm production is negative. As a result, when the significance threshold was chosen at 0.05 [ $B = 0.481$ ,  $P = 0.002$ , Wald = 5.674], the results confirmed the hypothesis. According to the odd ratio study, farmers who have access to extension services have a 0.618-times higher chance of adopting SWC structures than farmers who do not. This result agrees with Asfew (2017). Fikru (2009), Eleni (2008), and Habtamu (2006) also showed that farmers who receive better information from extension agents are more willing to adopt new soil and water conservation techniques and maintain existing ones. He stated that the likelihood of using and sustaining the introduced soil and water conservation practices would increase as a result of extension workers' support and their awareness of the benefits of conservation practices. who reported a positive relationship between access to extension services and the adoption of newly implemented soil and water conservation practices.

Access to training: At a significance threshold of 0.05%, the regression findings showed that access to training was positively associated with the adoption of SWC practices [ $B = 1.622$ ,  $P = 0.006$ ]. The Wald statistic (2.619) indicates that training had a substantial impact on the adoption rate of SWC practices. Put another way, compared to farmers without access to training, farmers with training had a higher likelihood of implementing soil and water conservation measures. According to Neka and Asfew (2017), access to training was favourably and substantially correlated with the adoption of soil and water conservation strategies. The adoption rate of established soil and water conservation methods was found to have improved due to farmers receiving training on how to apply and execute these practices. The adoption of recently introduced soil and water conservation techniques has shown a good and substantial association with training accessibility, according to Eleni (2008) and Habtamu (2006).

Access to credit: The results of the binary logistic regression analysis showed that credit availability for the head of the household was significant at the 0.05% level of significance [B = -4.132, P-value = 0.031]. It adversely affected farmers' adoption decisions to a large degree. Additionally, the Wald statistic (2.118) provided evidence for the importance of financial accessibility in the use of SWC techniques. This implies that the rate at which farmers who have access to funding use SWC methods is 0.877 times higher than that of farmers who do not. According to key informant interviews, farmers with financial access can have different objectives for their investments than these activities; yet, Fikru (2009) showed that they were more likely to employ SWC tactics than farmers without credit. Source: Spss -V-23 Outcome \*Statistically Significant At <0.05

## CONCLUSIONS AND RECOMMENDATIONS

Soil and water are the most vital resources for human survival. But in the modern world, soil decline is a significant issue for both agriculture and the environment. By limiting the potential to increase agricultural output and production, soil erosion poses a threat to global food security. The study area is characterised by impulsive and undulating terrain that is vulnerable to erosion. Governmental and non-governmental organisations have implemented several types of SWC techniques and procedures to address the problem of erosion and increase the production capacity of agricultural land. However, the initiatives taken to improve the usage of the recently adopted technologies appear to have had little effect on enhancing the long-term adoption of SWC measures. The objectives of this study were to identify demographic, institutional, socio-economic, and physical factors that influence farmer adoption of SWC practices, screen out various types of SWC measures used in the study area, and inspect the influence of socio-economic and institutional factors on the adoption rate of SWC practices in Gode District. The results of the inferential and descriptive analyses were mixed by the researcher. The Chi-square test and the t-test result were analysed before the binary logistic regression model was summarized. To identify the key obstacles impeding the adoption of soil and water conservation techniques, the researcher also focused on the mean, standard deviation, and percentage of categorical responses in addition to the findings of focus group discussions. In order to increase agricultural productivity. Finally, a binary logistic regression model was used to analyse the main factors that regulate farmers' adoption of SWC strategies.

Many factors that contribute to soil erosion and land degradation and ultimately have a negative effect on agricultural output are the subject of investigations. In light of the results of this analysis, the researcher has offered the following advice:

It should be made clear to farmers that in order to improve and manage their farmlands sustainably, they must comprehend the numerous aspects of their agricultural situations, potential, and limitations. Farmers should be guaranteed that they will use existing local knowledge and blend it with recently introduced knowledge to combat the issue of soil erosion and land degradation through community involvement in the planning, designing, and

implementation of SWC conservation activities. To increase the participation of female and young household heads in the adoption of SWC activities, the agricultural office of Gode district. NGOs and the concerned bodies could create awareness and encourage farmers collaborations in the adoption and maintenance of SWC practices. Because farmers cooperation can mitigate labour shortages Distance of farmlands from residence and household heads participation in off-farm activities are significant factors that adversely influence farmers' practice of SWC measures. Farmers who are involved in off-farm activities and farm lands located far from their homestead face the constraint of time and labour to maintain SWC activities.

Therefore, farmers have to find solutions to such problems in the adoption of SWC measures. Different types of SWC measures are employed on both individual and communal farm land to improve agricultural production. Introduced soil and water conservation methods, such as soil bund, soil-faced stone bund/terrace farming, cutoff drains, and waterways, were complained about by farmers since they occupied farm space, harboured rats, odents, and were difficult to traditional ploughing. Hence, concerned government bodies at different levels (nation, region, and/or district) should help farmers by showing appropriate conservation mechanisms by considering environmental conditions and cost-effective methods based on research findings.

So, the present researcher invites other researchers to undertake further studies on this area and recommend other possible ways to alleviate barriers to soil erosion and land degradation constraints. Besides, to gain full knowledge, it's virtuous to conduct experimental and quasi-experimental research to determine the level of soil fertility and take suitable steps.

### **FURTHER STUDY**

This research still has limitations, so it is necessary to carry out further research related to the topic of Factors Affecting Farmer's Adoption of Soil and Water Conservation Practice in Case of Gode District, Shebelle Zone, Somali Region in order to improve this research and add insight to readers.

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