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Research Article

Farmers' Awareness of Land Degradation and Adoption of Soil and Water Conservation Practices in Hidebu Abote, Ethiopia

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Abstract

In Ethiopia, land degradation is a serious problem that affects both overall economic growth and agricultural output. Even while nutrient depletion, soil erosion, and deteriorating soil quality are serious issues, many land conservation initiatives today neglect to consider the expertise of farmers and local requirements. This study's primary goal was to evaluate farmers' knowledge of land degradation and their practice of soil and water conservation techniques in Ethiopia's Hidebu Abote. Data were gathered through focus groups, key informant interviews, household surveys, secondary data analysis, and focus groups. According to the findings, over 75% of the participants were aware of the factors that contribute to land degradation, such as poverty, rocky terrain, bad farming techniques, overgrazing, overcultivation, and soil erosion. Farmers used techniques such as contour farming, fallowing, fanyajuu, cut-off drains, soil bunds, and manure application in addition to more modern methods of conserving water and soil. The adoption of soil and water conservation methods by farmers was impacted by several factors such as age, gender, size of family, educational background, NGOs' incentives, farm size, land tenure, and distance from homestead. The study indicates that encouraging farmers to manage and conserve their land should be the priority for any policy or program aiming at land resource management and soil conservation. Policymakers and development professionals can use the findings as guidance to create efficient interventions to alleviate land degradation in the research area and other comparable contexts.

Keywords

Farmer’s Awareness, Land Degradation, Land Management, Soil Conservation, Soil Erosion

1. Introduction

Land degradation is a major global concern, with significant impacts on agricultural productivity, food security, and environmental sustainability [1]. Farmers' awareness and participation in soil and water conservation practices are crucial for addressing this challenge. Soil erosion, nutrient depletion, and deforestation are common issues that challenge agricultural productivity and economic growth [2, 3]. To address these problems, various soil and water conservation (SWC) measures have been implemented since the 1970s [4]. However, many of these programs have failed to

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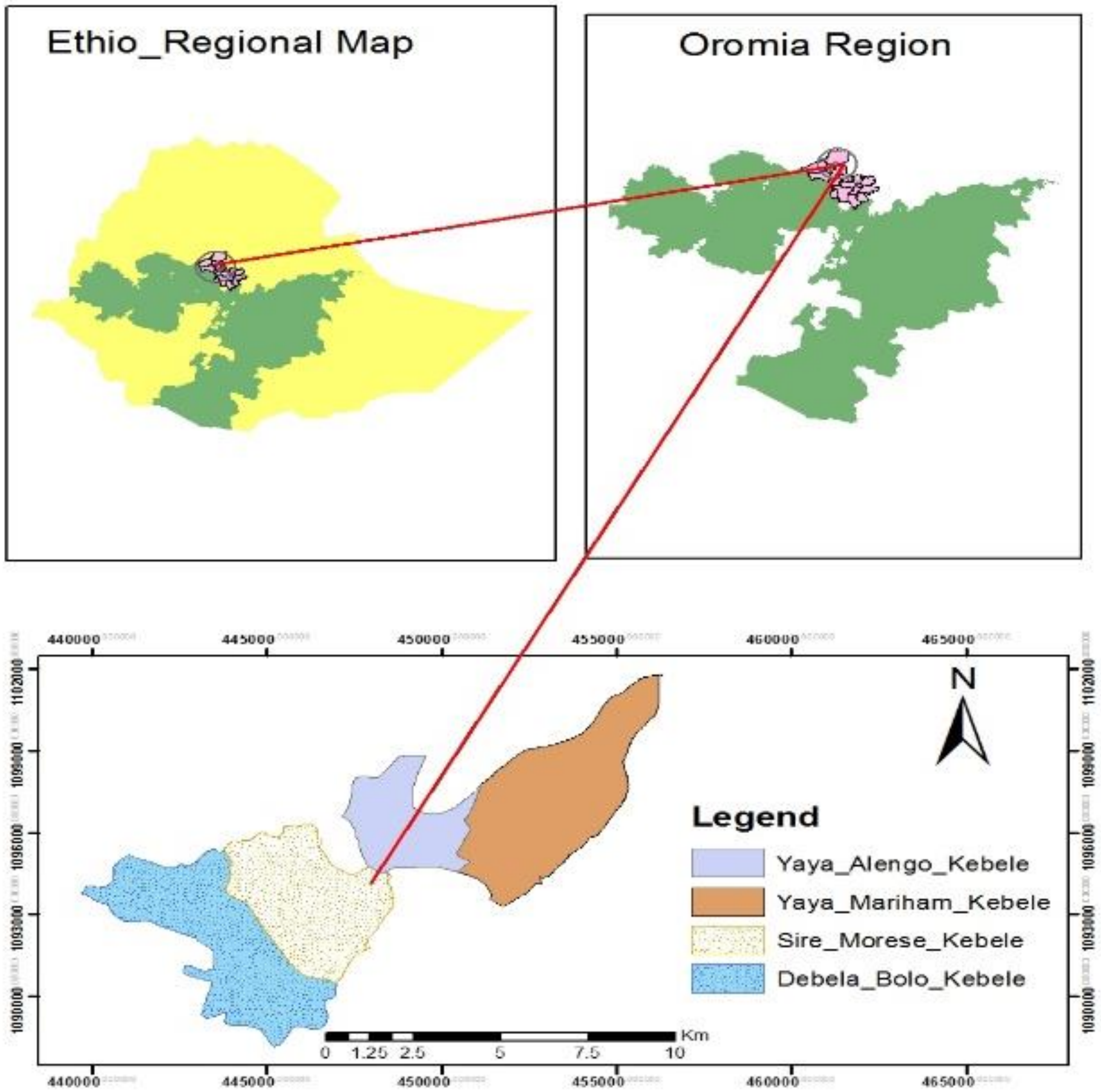
achieve the desired impact, particularly in the areas where they are most needed [5, 1]. Numerous studies have highlighted the importance of understanding farmers' perceptions and attitudes toward land degradation and conservation practices [6, 7]. Farmers' awareness and willingness to adopt soil and water conservation measures can be influenced by various socioeconomic, biophysical, and institutional factors [5]. Examining these factors can provide insights into the barriers and enablers that affect farmers' participation in sustainable land management practices. The purpose of this study is to evaluate farmers' knowledge of land degradation and their participation in soil and water conservation methods in Ethiopia's Hidebu Abote district. This research will contribute to the existing literature by investigating the level of farmers' awareness of land degradation and their involvement in soil and water conservation practices in the study area. The findings can inform the development of targeted interventions and policies that promote sustainable land use and improve the resilience of agricultural systems [8]. Objectives of the study are i) To investigate awareness of farmers about land degradation and conservation practices, ii) To identify conservation measures practiced by the local community to address land degradation and iii) To determine the variables influencing farmers' adoption of water and soil conservation techniques.

2. Material and Methods

2.1. Descriptions of the Study Area



Source Ethiopia ARC GIS, 2013

Figure 1. *Map of the study area.*

The study was conducted at Hidebu Abote district, North Shewa Zone of the Oromia Regional State, Ethiopia. Geographically, it is located between 9°47' and 10°11 latitude and 38°27' and 38°43' longitudes. The woreda is in the north of Addis Ababa, at 147 km and 42 km from the zonal capital Fitche, respectively. The town of the woreda is Ejere and the woreda has 19 rural and 1 urban kebeles. Namely, the study kebeles include Sire morose, Dabala Bokolo Yaya Marami and Yaya Alengo. The total area of the woreda it covers is 486 km^2 and inhabited by 104442 people with crude density of 215 persons per sq. km. The district lies within the altitudinal range of 1160-3000 m (about 1.86 mi) a. s. l and classified in to three climatic zones, dega (6%), woina Dega (50%) and kolla (44%) agro climatic conditions. The average annual temperature of the study area is ranging between 13°C and 23°C. Rainfall is dispersed throughout the year into two rainy seasons' belg rains falling in February-April and meher or main season rains fall from June-September with small showers in dry months. Annual rainfall averages range from below 900 mm for the lower kolla to nearly 1,200 mm for the higher elevations of woina-dega and dega areas. The rainfall is variable from year to year both in terms of intensity and distribution during the growing seasons causing a wide range of climatic hazards [9].

Farming Practices: The Woreda Land Administration and Use Office (2018) report states that the percentage of land covered by various LULC varies, ranging from 0.7% (covering 355 ha) in cases of assorted LULC types to 58.4% (covering 29,428 ha) in cases of farmlands. Settlements, which make up 8,446.5 ha, or roughly 16.8% of all LULCs, are the second LULC adjacent to farmlands. They are followed by shrublands (4,236 ha), forest lands (4,032 ha), grazing/grasslands (2,868 ha), and bare lands (1,016.4 ha). On the other hand, since the agroecological area of the woreda is suitable for agricultural productivity, farmers basically rely on mixed agricultural systems by engaging both on crop and livestock production. Therefore, the mixed agricultural system is the major economic means that is employed by majority of the smallholder farmers, but the farmers depend on traditional ways. The major crop types produced in the woreda include: teff, sorghums, wheat, barley, maize, pea, beans and other vegetables produced using small-scale irrigation like potato, tomato, green pepper, cabbage, lettuce, beetroot, and onion. Moreover, livestock production also practiced, which includes cattle, goat, sheep, horse, donkey, poultry and beekeeping. The woreda is mainly covered by clay (51%), silty (35%), and sand (14%) soil types whose pH ranges from 4.5 to 6.8.

2.2. Method of the Study

2.2.1. Source of Data

The data for this study was obtained from primary and secondary sources. Primary quantitative data were obtained through household surveys that emphasized smallholder farmers' conservation of water and soil practices as well as related expertise. Focused group discussions (FGD), key informant interviews (KII), and field observation were utilized to track additional data. However, secondary data were also acquired from several reports [10]. It is useful in addressing the study's goal and exploring activities that have been put into effect, identifying obstacles, and identifying factors that influence farmers' adoption of soil and water conservation techniques.

2.2.2. Sampling Techniques and Procedure

In the study, a multi-stage sampling technique was applied. Therefore, firstly the district was purposively selected and then from 19 rural kebeles of the district four kebeles were purposely selected. By using a multi-stage stratified random sampling technique 182 households were selected from 4 kebeles of the study district. Since the households were large in number to manage, the researcher used Yamane's formula cited by Robert to determine the size of the sample (see the formula below) [11]

$$n= \frac{N}{1+N(e)2} \tag{1}$$

Where n = sample size, N = total number of households, e = margin of error set at 5, confidence level 95%.

Based on simple random sampling techniques the researcher selects (182) farmer participants from the total population (N= 1823). These 182 farmers were selected from four villages of the district i. e. Sire Morose, Dabela Bokolo, Yaya Marami & Yaya Alengo, by using the proportionality formula [12].

$$nh = (Nh/N)n \tag{2}$$

Where, nh= sample size of the kebeles, Nh= Total household head in the kebele and N= Total Population (Total household head in the study area)

2.2.3. Data Analysis

Descriptive statistics were used to analyze demographic, socioeconomic, farm, and institutional characteristics, as well as awareness and implementation of soil and water conservation practices. Arc GIS was used to get a clear picture of the study area and its features. A logistic regression model was then applied to identify factors affecting the implementation of soil and water conservation practices by farmers. The logistic regression model used a dichotomous dependent variable (implemented or not implemented soil and water conservation structures) to analyze how the independent variables influence the probability of adoption. Overall, the research employed a combination of descriptive and econometric analysis to understand the determinants of soil and water conservation implementation by farmers in the study area.

3. Results and Discussion

3.1. Demographic and Socioeconomic Characteristics of Respondents

The age distribution of the household heads showed that the majority (69.7%) were between 21-45 years old, with 34% in the 21-35 age group and 35.7% in the 36-45 age group. Older household heads (over 56 years) were more likely to use less labor-intensive conservation practices. In terms of gender, 17.6% of the sample households were female-headed. The study revealed that female-headed households often face greater challenges and workloads compared to their male counterparts, due to cultural barriers and their involvement in domestic, reproductive, and community roles. The average household size was 6.45 members, which is higher than the national average of 5.2. The average adult equivalent household size was 5.2. Educational attainment was generally low, with 45.6% of respondents being illiterate and only 2.2% having completed high school. The document notes that education level can influence farmers' awareness and perception of land degradation and conservation issues. The average land holding size was 0.488 hectares per household, with variations from less than 0.5 hectares to more than 2.1 hectares. Larger farm sizes are expected to enable farmers to implement a wider range of conservation practices.

3.2. Farmers' Awareness on Degree of Land Degradation

According to the farmers' responses, the major indicators of land degradation were decline in yield, the need for high fertilizer input for crop production, and changes in soil color, texture, and vegetation cover. These findings are similar to those obtained by Admasu, Z., Kessler, A. et al., which showed that Ethiopian farmers perceived water erosion and soil fertility depletion as the main indicators of land degradation [13]. Other studies have also shown that land degradation is perceived by farmers through soil erosion and soil fertility depletion [14, 15]. Most of the farmers confirmed that land is degrading from year to year due to improper land use and continuous cultivation on sloping lands without conservation practices. The results indicated that land is experiencing severe to moderate degradation. According to the farmers' responses, 35.7% reported severe degradation, 32.4% reported less severe degradation, 27.4% reported moderate degradation, and 2.74% reported no risk of degradation. This result is in line with the reports of Agere Belachew et al, who stated that vast areas of the Ethiopian highlands could be classified as suffering from severe to moderate land degradation [16]. The finding is also consistent with Bezuayehu, T., & Sterk, G., who found that farmers were aware of the problem of soil erosion and soil fertility decline and believed that the severity of the problem had increased over time [17].

3.3. Farmers' Awareness on Causes of Land Degradation

All the respondents were aware that deforestation is one of the causes of land degradation. Additionally, 69.23%, 61.5%, 57%, and 53.8% of the respondents indicated that soil erosion, population pressure, over-cultivation, and overgrazing, respectively, are causes of land degradation. This shows that most farmers were found to have a better awareness of the causes of land degradation. The result is in line with the work of Tsegaye, D., & Bekele, W. which stated that the perceptions of farmers on the causes of land degradation were inappropriate land use, inadequate vegetative cover, deforestation, and lack of proper conservation methods [18]. Furthermore, the respondents were aware that poor farming systems (41.75%), rugged topography (30.7%), and lack of fertilizers (23.8%) were also causes of land degradation. Overall, over half of the farmers were found to have better awareness about the causes of land degradation. The chi-square test results showed a positive relationship between different age categories and awareness of the causes of land degradation. Younger farmers (21-49 years) were better aware of the causes, such as population pressure, over-cultivation, overgrazing, lack of fertilizers, poor farming practices, rugged topography, and soil erosion, compared to their older counterparts (≥50 years).

Table 1. *Chi-Square Results Between Different Age Categories Awareness On The Causes Of Ld.*

Cause of LD	Age categories					
	21-49 years		> 49		Chi-square	P-Value
	Freq	%	Freq	%		
population pressure	85	46.7	27	14.83		
Over cultivation	65	35.7	39	21.42	1.95637	0025*

Cause of LD	Age categories					
	21-49 years		> 49		Chi-square	P-Value
	Freq	%	Freq	%		
Over grazing	78	42.85	20	10.98	1.8265	.0146*
lack of fertilizer	20	10.98	23	12.64	3.6824	.0397*
poor farming practices	59	32.4	17	9.34	11.9	3.035**
rugged topography	37	20.33	19	10.4	5.67	.0029*
soil erosion	102	56	24	13.18	4.27	.0078*

P ≤ 0.05 statistically significant* statistically not significant**

3.4. Farmers' Awareness on Major Consequences of LD and SWC Practices

All respondents were aware that land degradation leads to a loss of agricultural productivity due to declining crop yields, income reduction, and the progressive price increment of fertilizers, which farmers are unable to afford. This finding is in line with the literature, which indicates that land degradation through soil erosion is a major cause of poverty in rural areas of developing countries. Additionally, the farmers recognized that land degradation can have other adverse consequences, such as increased vulnerability to drought and famine, reduced availability of fuelwood and construction materials, and the loss of biodiversity and ecosystem services.

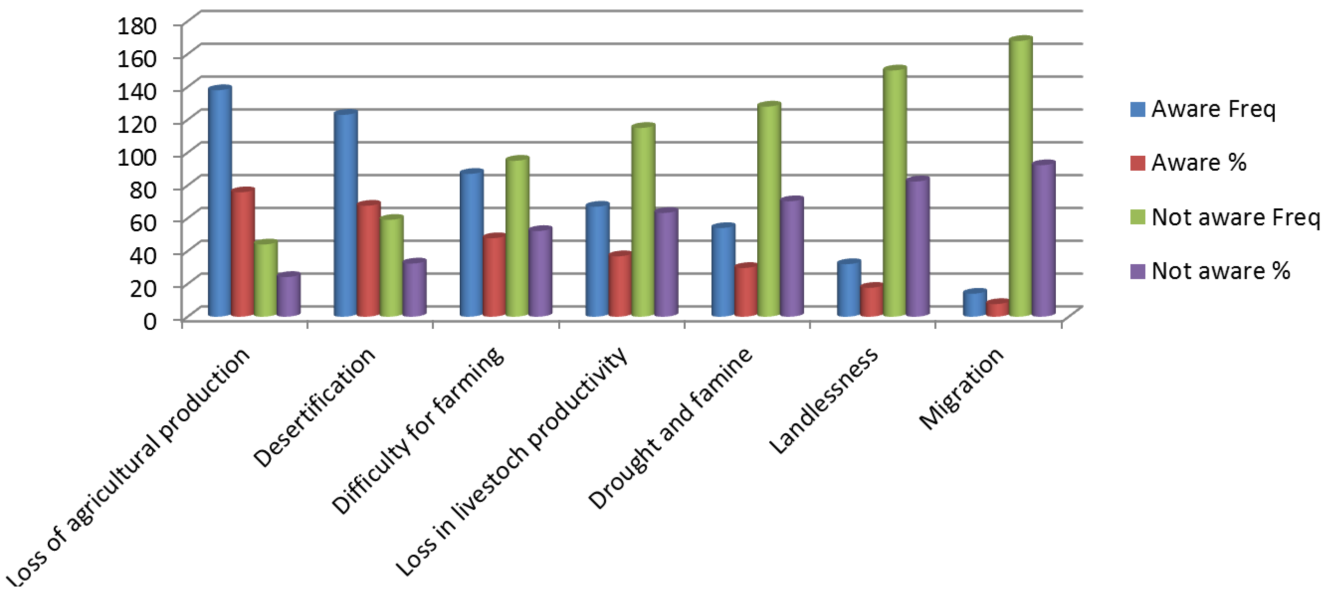


Figure 2. *Consequence of Land degradation in study area.*

These findings suggest that farmers have a comprehensive understanding of the multifaceted impacts of land degradation on their livelihoods and the environment. The farmers demonstrated a good understanding of various soil and water conservation practices. The most known practices included terracing, contour plowing, crop rotation, intercropping, and the use of organic and inorganic fertilizers. Farmers also mentioned practices such as agroforestry, mulching, and the construction of check dams and gully rehabilitation structures. However, the adoption rates of these practices were relatively low, with only 31.9% of farmers implementing at least one conservation measure on their farmlands. The main barriers to adoption include lack of access to technical support and financial resources, labor constraints, and the perceived short-term benefits of conservation practices compared to their long-term investments.

3.5. Soil and Water Conservation Measures

The survey result shows that 92% of sampled farmers participate in soil and water conservation practices. To prevent land degradation, especially soil erosion, farmers of the study area participated in soil and water conservation methods in communal lands and individual farming land. This result is in line with Brenner, S. W.,, et al. through the application of various soil conservation measures, farmers and authorities try to prevent further land degradation [19]. They implement different traditional and newly introduced SWC practices i. e application of manure, cutoff drain, soil/stone bund, fanyajuu, leaving crop residue, and fallowing of farmland. This result is in line with a report by Yitaferu and Amare which stated that several known Indigenous soil and water technologies and management systems have been documented and particularly applied [20, 21].

Figure 3. Soil bund constructed at the study area (Sire Morose kebele).

These farmers suggested things that were expected from the government such as financial, and material support, continuous training, experience sharing, and incentives should be given for the community to understand and implement the SWC measures. Therefore, persuasion rather than coercion seems a better way. Indeed, cooperation and participation are essential if progress on limiting soil erosion is to be made.

3.5.1. Traditional SWC Practices

According to the data depicted in Table 2 respondents implemented different traditional soil and water conservation practices. Accordingly, 34, 47, 68, 24, 45 and 7% were practiced application of manure, traditional cut of drain, soil bunds, leaving crop residue, contour farming and fallowing, respectively.

Until recently, traditional soil and water conservation practices have often been ignored or underestimated by development agents, researchers, soil and water conservationists, and government staff [22]. However, surveying both traditional and improved soil and water conservation practices provides an understanding of farmers' way of thinking about the interventions [23].

Table 2. Traditional And Newly Introduced Swc Practices Implemented By Hhs At Study Area.

Types of SWC practices	Traditional SWC	Introduced SWC
	Percent	Percent
Application of manure	34	_
Traditional cutoff drain	47	_
Improved cutoff drain	_	18
Ridge plantation	_	43

Types of SWC practices	Traditional SWC Percent	Introduced SWC Percent
Stone bunds	_	35
Soil bunds	68	72
Leaving crop residue	24	_
Contour farming	45	_
Fallowing	7	_
Fanyajuu	_	4
Area closure	_	3

Cut-off drains: Nearly two-thirds of the 182 studied plots had either traditional or enhanced cut-off drains, or both, according to survey results (Table 2). These drains are built by the farmers to stop water running onto the plot from an incline, which would otherwise result in the loss of soil, fertilizer, manure, and seeds. Water that is in excess is disposed of off-field. However, certain traditional drain arrangements, in the perspective of farmers, over time worsen soil erosion. This was verified by transect walks with the key informants, who pointed out multiple gullies that were created by the cutoff drains between farm boundaries. As a result, farmers in the research region are hesitant to implement this kind of SWC technique. SWC technicians feel that with better surveying, the performance of the cutoff drains can be improved. On their fields, the majority of farmers implemented various soil and water conservation techniques through community or group involvement, such as improved cutoff drains and soil/stone bunds. Research conducted in Ethiopia's East Wollega Zone revealed that farmers built "Boraatii" (cut-off drains) using oxen-drawn plows and strengthened them with stones, wood blocks, and grassed soil. These measures prevented significant erosion [24].

Leaving crop residues: After harvest, leaving crop wastes on the field is another custom that is widespread in the region. Process residues and field residues are the two categories of agricultural crop residues. Crop wastes are typically not used by area farmers to increase the fertility of the soil. According to Table 2 of the survey data, the majority of users are using this method to prevent soil erosion. Very little crop residue was seen in agricultural plots during the transect walks with the farmers according to key informants, the farmers eventually exploited the agricultural leftovers for off-plot uses since they were severely short on animal feed and firewood. Most of the farming households in the region, particularly those headed by women, gather crop wastes from the field for use as fuel wood, and animal feed. Similarly, farmers in Areka removed all crop residues from their fields and used them in their household gardens or livestock pens, according to research done by Mengstie, F. A. [25]. Some of the residues from cereals (wheat, barley and teff) and legumes (haricot beans and pea beans) are preserved in the home compound and sold as fodder or used to feed livestock during the dry season.

Contour farming: To lessen runoff on fields with a slope greater than 6%, contour farming involves cultivating the soil along contours of equal elevation. It can be applied either by itself or in conjunction with other conservation techniques like planting a variety of trees and cutting off drains. Table 2 shows that 45% of the examined plots had contour farming, even if the farmer was aware of the practice's ability to conserve water and soil. Additionally, because they plow the field to create a suitable seedbed for production, it was implemented during land preparation before the planting season.

Fallowing: One of the most effective ways to lessen the loss of soil fertility is to allow [23]. Fallowing is limited to severely damaged areas in the research region that will take a long time to repair. In most cases, only stones are discovered on these grounds. Table 2 shows that just 7% of farmers polled engaged in fallowing. Speaking with the farmers, it was discovered that as agricultural output declines and population pressure mounts, the customary fallowing seasons are being observed less and less.

Application of Manure: According to Table 2 application of manure was used on more farms than other conservation practices, next to terraces where 56% of farmers practiced. Farmers applied manure near the homestead, rather than to land at a distance. Based on focus group discussions with key informants, farmers have increased the amount of manure applied because of the high price of inorganic fertilizers (such as DAP and UREA) which the farmers cannot afford. As the respondent said one person prepares 2 tons of animal manure on average throughout the year.

3.5.2. Improved Physical Soil and Water Conservation Practices

Since the study area is located in the country's central highlands, it is susceptible to the degradation of natural resources, especially vegetation and soil. The Ministry of Agriculture and GTZ have worked to address this issue by promoting and implementing "improved" practices such as physical soil and water conservation [26].

Soil bund: a water collection channel built by hurling material down the plot's slope to reduce erosion by shortening the slope's length and runoff velocity. In comparison to other methods, the majority of respondent households employed soil bunds on at least one of their farmlands, per the survey results. According to the results, 72% of the respondents had added soil bunds to their farms. In comparison to the other structures in the research region, the proportion of soil bunds is higher. The likely cause is that adding a large amount of soil bund to other SWC techniques has been shown to effectively lower runoff velocity in farmlands with steep slopes. This outcome is consistent with the findings of the Anley, J., et al. report, which claimed that the soil bund is the most extensively and widely used soil conservation structure compared to the other because it requires less labor input. After all, the excavated material from the ditch is thrown district [27].

Stone terraces: The data implies that just 35% of the respondents used stone bunds. However, farmers are typically discouraged from using stone terraces rather than soil bunds in the study region due to the lack of accessibility to stone, its labor- and time-intensive character, and the fact that it serves as a good breeding ground for rodents. This outcome is consistent with the findings of Aklilu, A, who discovered that framers in the Berassa watershed in Ethiopia's Central Highlands reported problems with rodents and high labor demand [28].

Fanya juu bund: a particular kind of small-scale SWC technique used in the research domain. Merely 11.8% of the participants in the research have engaged in fanyajuu terrace practices. It was revealed through focus group discussions and interviews with key informants that the majority of farmers are ignorant about fanynjuu terraces. Even if some have awareness about the practice, they show little enthusiasm in using it. According to the farmers, this structure's drawback is that, despite slowing runoff more than a soil bund, it causes waterlogging and washes the embankment during periods of high rainfall.

Waterway: To prevent croplands from being destroyed by erosion, waterways must be prepared by restoring runoff from hill slopes or blocking drains. However, it is challenging to put into effect the methods that the sampled household farmers identified as important restrictions because of the relatively high labor need and the necessity to increase grass stripes. Furthermore, to drain the runoff across many farmers' farms spread far apart, the method requires the cooperation of two or more farmers.

The farmer cites a lack of cooperation among farmers as the main obstacle to widely practicing waterways during group discussions.

Figure 4. *Stone paved waterway in the study area.*

Figure 5. *Checkdam constructed by the community at the study area for gully rehabilitation.*

3.6. Relationship Between the Fertilizer Type and Soil Degradation

The result showed that farmers in the study area were using both organic and inorganic fertilizers for crop production. Where animal manure and Compost were among organic fertilizer and Nitrogen and Phospharous fertilizers were inorganic fertilizers, type used by farmers of the study area. The study revealed that synthetic fertilizers, particularly those high in phosphorus, can disrupt the delicate balance of these beneficial microbes, leading to reduced soil fertility and increased susceptibility to disease. A study by Smith et al. found that excessive nitrogen application, a common practice with synthetic fertilizers, can lead to soil acidification, reducing the availability of other essential nutrients like phosphorus and potassium [29]. This imbalance can hinder crop growth and contribute to soil degradation.

In contrast, organic fertilizers, such as compost and manure, have emerged as potential allies in the fight against soil degradation. A study by Brown found that organic fertilizers can improve soil structure, enhance water retention, and increase the abundance of beneficial microbes. These positive effects contribute to increased soil fertility and resilience, making the soil less susceptible to degradation [30].

3.7. Factors Affecting Farmers' Motivation to Practice Soil and Water Conservation

Table 2 presents the results, which indicate that 72% of the farmers in the sample have built and maintained soil bunds. Small farmers (less than 1 ha) who own cultivated land have not constructed and maintained physical SWC structures because, (1) they do not see a clear benefit to using them; rather, they believe that SWC structures narrow already-limited cultivable lands, which lowers crop yields; and (2) they do not see any immediate financial gain. Although the structure does not produce crops on the ground where it is put, it does prevent and lessen soil erosion [31]. It showed that farmers' opinions of soil erosion and its effects had a significant impact on whether they adopt (or reject) SWC structures. However, instead of concentrating on the long-term advantages of SWC structures, farmers are searching for short-term gains.

The main characteristics of the respondents including sex of household head, age, level of education, labor, land holding, Training on SWC, Distance farmland, and number of livestock were investigated to understand their influence on the practice of SWC measures.

To find the determinant elements influencing families' decision-making regarding the implementation of soil and water conservation measures, a binary regression model was employed. The following explanatory variables were chosen for this purpose: land security (LANDSECU), farm age (FARMAGE), educational level (EDULEVEL), and soil and water conservation training (SWCTRING) (Table 3). Variables were discovered to have a substantial impact on the decision to conduct soil and water conservation as well as motivation.

Other variables like labor availability (LABOAVA), family size (FAMILYSIZE), extension contact (EXTCONTA), distance of the plot from the residence to home (DESTHOME), of the plot owned by the farmers, and land holding, or farm size were not significant relation to the adoption of improved SWC practice. The result of model shows in (Table 3) and only the significant variables were discussed.

Farm age (FARMAGE): This variable was expected to take a positive sign than a negative sign, aged farmers have long year experience and have enough land to implement SWC practices. This result is agreed with the study of Aklilu and Brkalem found that age has a positive impact on practicing SWC measures older farmers are better to constructing and maintaining SWC structures while early age farmers were more motivated to participate for the economic reward obtained from participation [32, 33]. Similarly, different studies have been conducted by various researchers about farmers' attitudes on SWC in Ethiopia, and they agreed that age has a profound effect on farmers' participation in SWC activities [34-36].

Educational level (EDULEVEL: It was anticipated that this variable would assume a positive rather than a negative value because it was believed that the adoption of SWC technologies would increase with one's level of formal education over time. Adoption and usage of SWC technology were favorably correlated with the head of the household's level of education. Farmers with higher levels of education are said to have had greater exposure to contemporary breakthroughs and technologies, making them more open to receiving and implementing new ideas [37].

Land security (LANDSECU): This variable was predicted to show a positive trend, but instead, a significant negative trend was seen at ($P<0.01$). and farmers for implementing and carrying out land-improvement projects in their plots of water and soil conservation techniques. The odds ratio in favor of the decision on soil and water conservation practices increases by a factor of .484 or 51.6% for a unit increase of farmers' land security in Oromia and Tigray of Ethiopia revealing that the security of tenure positively and significantly associated with farmer's probability of participating in soil conserving activities [38]. That is, a farmer feeling less comfortable about their plot possession has a lesser probability of investing in land-improving activities.

Table 3. *Binary Logit Model Output Of Factor Affect Swc Practices.*

Variables	Estimated coefficient (B)	Standard error	Wald statistics	Degree of freedom	Significant level	EXP (B)
FAGE	0.02	0.174	0.014	1	0.0053 *	1.521
FAM SI	0.203	0.186	1.191	1	0.275	1.225
EDU	0.362	0.37	0.961	1	0. 033**	0.437
FAR SI	0.435	0.511	0.724	1	0.395	1.544
LAB A	0.129	0.547	0.056	1	0.813	1.138
LA SE	0.395	0.603	0.429	1	0.00512*	0.484
EX CO	0.021	0.026	0.64	1	0.424	0.98
SWCT	-1.191	0.595	4.009	1	0.045**	1.304

Variables	Estimated coefficient (B)	Standard error	Wald statistics	Degree of freedom	Significant level	EXP (B)
DESHO	-0.37	0.279	1.76	1	0.185	0.691
CONSTANT	2.554	2.376	1.155	1	0.282	12.861

Source SPSS output *, **, significance at .01 and .05 respectively.
Chi-square=6.788
-2log likelihood 97.592
Percentage correctly predicted 79.4

3.8. Farmers' Awareness on Soil and Water Conservation Measures

The outcome demonstrates that the claims regarding soil and water conservation techniques are true. Approximately 86.26% of those surveyed concur with statement B1. demonstrating that a major element influencing soil conservation efforts is the area of the land. According to B2, terracing slows down the rate of erosion and runoff, and over 63.18% of respondents agreed with this statement. According to Statement B3, roughly 46.7% of respondents concur that the practice of structural soil conservation is impacted by the distance between the homestead and the agricultural field.

This leads one to the conclusion that farmers have a high degree of awareness regarding land deterioration. It is also reasonable to anticipate that this might result in a positive attitude toward the environment and conscientious environmental activity. A greater understanding of the environment and the problems it faces influences positive attitudes, which in turn influence behaviors that improve the quality of the environment [39].

Table 4. *Percentage Distribution Of The Respondents Towards Soil Conservation Practices.*

Statements	Agree		Undecided		Disagree	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
B1	157	86.26	25	13.74	-	-
B2	115	63.18	31	17.03	36	19.78
B3	85	46.7	55	30.22	40	21.98

3.9. Respondents' Sources of Information on Land and Land Management

It is a well-known fact that one of the key factors favorably influencing the uptake and continued use of a particular technology is the dissemination of knowledge about better technological alternatives. The adoption of any new land management approach will fail in the absence of a sufficient mechanism for information transmission. Inadequate and delayed information can impede the general adoption of contemporary technologies. Public extension services are a common way to disseminate knowledge in the study region and throughout the rest of Ethiopia.

In the study area, the most important sources of information cited were communication with relatives and neighbors, community leaders, NGOs, and the government's mainstream agricultural extension program. The government's extension service was cited by farmers as being the most significant. They went on to say that among the topics covered by the extension services are information on soil conservation techniques, land management techniques, better cultural practices, and input supply and use.

The NGO involved in agricultural technology diffusion and dissemination in the area is GTZ. Over the past few years, the GTZ sustainable land management (SLM) has introduced better farming methods and watershed management initiatives. The assessment reveals that GTZ has created and applied several technological advancements consistent with the "Integrated watershed management approach" [26]. This strategy emphasizes the use of biological soil conservation techniques, as opposed to the government's emphasis on using physical methods to limit erosion.

4. Conclusion

The findings indicate that a significant proportion (around 75%) of the farmers were aware of the various causes of land degradation, including population growth, over-cultivation, overgrazing, soil erosion, poor farming practices, rugged topography, and poverty. This awareness is an important foundation for promoting sustainable land management practices.

The farmers were found to be using a variety of conventional and improved techniques for conserving soil and water, including contour farming, fallowing, fanyajuu, soil bunds, cut-off drains, and manure application. This indicates that farmers are able and ready to implement appropriate measures to tackle issues related to land degradation.

The study also identified several key factors that influence the farmers' participation in soil and water conservation practices. These include socioeconomic variables like age, sex, family size, and educational qualification, as well as institutional factors such as incentives from NGOs, land tenure arrangements, and proximity to homesteads. Understanding these determinants is crucial for designing effective interventions that can better engage and support farmers in sustainable land management.

The researchers emphasize that any policy or program aimed at land resource management and soil conservation must prioritize the mobilization of farmers and consider their existing awareness and practices. This approach can help ensure the relevance and sustainability of interventions, ultimately contributing to improved agricultural productivity, food security, and environmental sustainability in the Hidebu Abote district and similar contexts.

5. Recommendations

Based on the results, the following are recommended.

1. Leverage farmers' awareness: Policymakers and development practitioners should build upon this existing knowledge and engage farmers as active partners in designing and implementing conservation programs.
2. Encourage farmers to reverse the problems and adopt alternative livelihood to reduce pressure on land resources.
3. Training and education on soil conservation and land management practice must be provided to create more awareness of land resources conservation.
4. It is better if further study is conducted by using time series data and effects of land management practice on soil fertility are supported by experimental work.

Abbreviations

BMP	Best Management Practices
CSA	Central Statistical Agency
DA	Development Agent
EPA	Environment Protection Agency
FFW	Food for Work
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
HH	Household
LD	Land Degradation
SPSS	Statistical Package for Social Science
SWC	Soil and Water Conservation
UNDP	United Nations Development Program
WV	World Vision

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Author Contributions

Feyisa Ararsa: Formal Analysis, Writing – original draft
Chala Debele: Data curation, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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Research Fields

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Chala Debele: Sustainable Natural Resource Management, Forest Management and climate-smart agriculture