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Research Article

Assessment of the Effectiveness of Biophysical Soil and Water Conservation Structures: A Case Study of Offa Woreda, Wolaita Zone, Ethiopia

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Soil erosion is a serious environmental and natural resource issue in Ethiopia, posing a significant threat to agricultural productivity and being one of the principal drivers of land degradation and soil fertility reduction. Evaluating the biophysical soil and water conservation structures' effectiveness in Offa Woreda, Wolaita Zone, was the focus of the study. Purposive sampling was used to select the three kebeles that make up this watershed. W/Dekeya, Wareza, and Yakima are the three watersheds chosen for the selected study area. To meet the objective of this study, 504, 325, and 442 family heads were sampled. They comprised the overall 17% (227) of the study participants that were selected. Those who knew how to conserve soil and water, causes of degradation, and sensitive areas of their own plots of land in the study area received preference. The lack of capital, a short stretch of land, and various socioeconomic and physical conditions impeded the use of soil and water conservation systems. As a result, farmers have a reasonable position of the current biophysical soil and water conservation systems. Farmers in the study communities are aware of some traditional soil and water conservation practices as a measure to protect and restore the fertility and productivity of their farmlands. Community participation in encouraging farmers to participate in soil and water conservation practices is critical to resolving the issue of cutting-edge poverty, food insecurity, and environmental deterioration. From the study, we recommend that the government implements specific coverage and techniques as well as corrective intervention from nongovernmental organizations.

1. Introduction

Soil erosion is one of the most serious global environmental issues, with both on-site and off-site consequences [1, 2]. Due to various socioeconomic and demographic factors, as well as limited resources, soil erosion has accelerated in most parts of the world, particularly in developing countries [3]. For example, Reusing et al. [4] state that increasing population, deforestation intensity, cultivation, uncontrolled grazing, and higher demand for firewood often cause soil erosion. About 16% of the world's agricultural land is affected by soil degradation [5]. Of all the processes that result in land degradation, water erosion is the most threatening. It accounts for 56% of the total degraded land surface in the world. In Africa alone, 5-6 million hectares of productive land are estimated to be affected by land degradation each year [6, 7].

Soil erosion is a more serious problem for developing countries, including Ethiopia, because their dependence on the soil is more direct. Erosion reduces the routable depth, removes organic matter and nutrients from the soil, and decreases the capacity to hold water. The leading causes of erosion and environmental degradation are population pressure, agricultural land mismanagement, deforestation, and overgrazing. In Ethiopia, the average annual rate of soil loss is estimated to be 12 tons/hectare/year [8]. It can be even higher on steep slopes with soil loss rates greater than 300 tons per hectare per year or about 250 mm per year when vegetation cover is sparse [9].

Although several studies [10–16] were conducted in Ethiopia on soil and water conservation, a considerable part of the country's soil and water conservation issues are not investigated. Investigators have focused mainly on the nature of soil and water conservation, the perception of soil and water conservation by farmers, and the perception of soil fertility and the cause of soil erosion. They found a high degree of soil erosion in Ethiopia in general and in the highlands in particular. However, there is a gap on the issue of social, economic, and institutional factors that determine the adoption of physical soil and water conservation structures.

This study was initiated to address a knowledge gap for responsible bodies. The following questions were addressed in this study: what is the current state of soil and water conservation biophysical structures in the selected kebeles in Offa Woreda, Wolaita Zone? What are the primary factors influencing rural farmers' adoption of biophysical soil and water conservation structures in the study area, and what recommendations are required to address the issue? The overall purpose of this study was to assess farmers' reactions to the effectiveness of biophysical soil and water conservation structures and make recommendations to aid in the development and implementation of intervention policies and programs in the Offa Woreda, Wolaita Zone.

2. Materials and Methods

2.1. Description of the Study Area. This study was carried out in Offa Woreda, one of the 16 Woreda zones in southern Ethiopia. Offa Woreda is far from the capital city of the Wolaita Zone, called Sodo, about 29 kilometers south-west and 183 kilometers from the regional capital, Hawassa. Geographically, it is located at 37°.30'E latitude and 6°.45'N longitude. The Woreda is bordered by Kindo Koysha Woreda in the north, Kucha Woreda of Gamo-Gofa Zone in the south, Sodo Zuria Woreda in the northeast, Humbo Woreda in the east, and Kindo Didaye Woreda in the west. The total area of the Woreda is 38,537 hectares [17].

2.2. Research Methodology. In the study, a descriptive design was used with the application of content analysis in the interpretation of qualitative thematic responses [18]. Primary quantitative data was collected from the sample of 227 sample households using an interview schedule in the selected kebeles. To determine the reliability of the research sampling, qualitative data were triangulated with quantitative data.

2.3. Sampling Technique. Most importantly, the kebeles (smallest administrative unit) were selected to represent the main area for the effectiveness of biophysical soil and water conservation structures in economic, social, political, and cultural aspects. In the second phase, the numbers of households in each target kebele were identified. The sample size was determined using the systematic random sampling (SRS) method because there are different agroecologies in the study that are Woreda in the population of three kebeles. Consequently, W/Dekeya, Wareza, and Yakima consist of 504, 325, and 442 household heads, respectively. Therefore, the total number of household heads living in these three kebeles was 1,271. Of the total, 227 were selected for this research study to achieve the objective of the study. The standard formula for Yamane's [19] sample size was determined because of its suitability for determining the sample. The formula of the sample size is as follows:

$$\begin{aligned} n &= \frac{N}{1 + Ne^2} \\ &= \frac{1271}{1 + 1271\,(0.06)^2}, \\ n &= 227, \end{aligned} \tag{1}$$

where n is the sample size, N is the total population, and $e = 0.06$.

Samples of the household heads of each kebele (Table 1) were taken applying Yamane's formula. In addition to these, seven key informants and six participants in the focus group discussion were purportedly selected because they are considered to provide adequate data on the issue under the study.

2.4. Methods of Data Analysis. In this study, qualitative and quantitative methods of data analysis were employed. Qualitative data was collected using semistructured interviews using quantitative techniques. During this study, descriptive statistics, mainly percentages, were familiar with the analysis of the data. Furthermore, the linker scale method was used to express the attitudes of the respondents towards erosion indicators and the knowledge of farmers about trends in soil and conservation over time. Furthermore, using information collected through field observation and focus discussion, the investigator used the qualitative method to elucidate farmers' attitudes towards soil and water conservation structures and techniques in relation to physical, socioeconomic, and environmental conditions in the study area. Finally, the analysis was supported with tables.

3. Results and Discussion

3.1. Farmers' Family Profiles and Landholding. The heads of households that lived in the selected kebeles in Offa Woreda, Wolaita Zone, from which the sample was taken, were 87.2% of males and 12.8% of females out of 227 (100%). 48.5% of all household heads were between the ages of 15 and 64, and 3.9% were over the age of 64. As shown in Table 2, the study

Table 1: Sample size of household heads.

Type of kebele	Total household heads	Sample size	Sample (%)
W/Dekeya	504	81	6.3
Wareza	325	70	5.5
Yakima	442	76	5.9
Total	1271	227	17

Table 2: Total household, average family size, and age structure.

Categories of kebeles	Total number of HH heads			Average family size of sampled HH	Age structure of the family			
	Male (%)	Female (%)	Total (%)		0–14 (%)	15–64 (%)	>65 (%)	Total (%)
W/Dekeya	86.4	13.6	100	6.2	17.1	16.8	1.6	35.7
Wareza	87.1	12.9	100	5.8	15.1	14.7	1	30.8
Yakima	88.1	11.9	100	5.9	16.3	16	1.1	33.5
Total	87.2	12.8	100	6	48.5	47.5	3.9	100

HH: household and W/Dekeya: Woshi Wocha Dekeya.

area has a high dependency ratio, with young age dependence accounting for 96.1%.

According to Shibru [20], the large number of children, compared to adults, indicates that there will be growing demand for land, of which, in the longer term, the pressure on resources may become relatively more severe, given the limited arable land and lack of employment opportunity in other sectors [21]. As reported by farmers during the interview, the dramatic increase in the population caused multiple problems within the watershed. However, the increase in the population could also be a positive. As an example, Amsalu and de Graaff [22] cited in their study that better environmental conditions were observed in Kenya with a growth in the population [8]. By increasing the value of land relative to labor, the increase can induce farmers to make labor-intensive investments in land improvement and soil management, such as planting trees, constructing terraces, composting, and mulching. The standard family size was six persons; more than half of the respondents (82.4%) had no formal education, while 11.3% had completed school/grade school, only 5.8% had completed secondary school, and there was no level of teaching among the respondents (Table 3).

Table 3: Farmer's educational level of the household.

Types of kebele	Educational levels of HH heads				
	I (in %)	II (in %)	III (in %)	IV (in %)	Total
W/Dekeya	80.2%	13.6%	6.2%	—	100%
Wareza	81.4%	12.8%	5.8%	—	100%
Yakima	80.3%	13.1%	6.6%	—	100%
Total	80.7%	13.2%	6.1%	—	100%

HH: household, I: no education, II: primary school, III: high school, and IV: higher education.

Almost all the farmers interviewed owned land (97.2%). The rest 2.8% of respondents rely solely on settlement land and nonagricultural activities (neighborhood businesses), while the rest rely on the roofs of their homes. The implied landholding length becomes approximately 1.1 hectares. Using the sample households' average household size and average land holdings, the per capita holding was 0.2 hectare, which agrees with Benjamin et al. (2007), who discovered that average land holdings in Ethiopia decreased from 0.5 hectare per person in 1960 to 0.11 hectare per person in 1999. There is a large version within the length of landholdings of householders. Of the households sampled, the majority, 50.2%, had one hectare of land. Only 11% have beautiful hectares, while the remaining 38.8% have 1-2 hectares (Table 4).

Table 4: Landholding sizes of the households.

Kebeles	Land holding size (in %)		
	<1 hectare (%)	1-2 hectares (%)	>2 hectare (%)
W/Dekeya	50.6	40.7	8.7
Wareza	50	38.6	11.4
Yakima	50	38.1	11.9
Total	50.2	39.2	10.6

3.2. Assessment of Soil and Water Conservation Structures Situation of Soil and Water Conservation Practices of the Study Area. Within the observed area, the investigator determined time-honored soil and water conservation measures. There are unique conservation systems built on the land of man or woman farmers and outside the farmlands. Commonly determined conservation systems are conventional methods. Modern conservation systems are specially built on fragile lands outside the doors of cultivated and grazing lands [24, 25]. According to farmer reviews, the development of a cutting-edge degree in soil conservation recognized domestically as "Dega" (a cutting-edge soil conservation shape) occurred with the help of the authorities through the campaign.

Furthermore, according to Woreda's Agriculture and Rural Development file, farmers are proof against adopting SWC (soil and water conservation) systems when considering that they assume that the shape consumes their lands. Farmers on steep slopes are resisting the expert layout of "Dega" constructions. Due to the steepness of the slope growth, the distance among the systems is predicted to be close to each other, which results in them occupying their land with the aid of the systems.

3.3. Evaluation of Farmer Participation in Soil and Water Conservation Practices. Throughout the evaluation of soil and water conservation structures, farmers from the observed location volunteered. Most farmers (87%) within the observed location accept that erosion may be managed, while only 23% of farmers mentioned it as impossible. The same number of respondents were also asked to protect their land from soil erosion devastation, and the rest 56% stated that they are working on conservation techniques, indicating that a significant percentage of farmers (44%) do not own their land. The motivations for the farmer's inability to preserve their land are defined in Table 5. However, 56% of the people interviewed who hold onto their land are more or less using the techniques defined in Table 5.

According to Table 5, the maximum critical technique for soil and water conservation within the examined site is to cultivate along the contour (37.4%), observed with the aid of stone tufting (22.9%), leaving crop residues in the field (11.8%), tree planting (9.6%), and strip cultivation (7.4%). However, the grassed waterway is not always considered with the help of the farmers of the examination place. This demonstrates that the anticipated soil and water conservation techniques within the Ethiopian highlands are being practiced within the research area with various levels of attractiveness among a number of farmers; that is, contour plowing is the most popular technique, while fallowing is followed with the aid of using a tiny percentage of the population. To some extent, they have expertise in controlling soil erosion on their farmlands. However, as studies conducted on farmers in the Amhara region with the aid of the United Nations Economic Commission for Africa (UNECA), 1996, and Derebe [26] reveal, approximately 30% of the families did not know anything about the problem of erosion, while 40% went to the terrace, 24% planted trees, and 10% constructed lookout dams to combat soil erosion.

Strip cropping (Strip intercropping) which allows developing multiple crops on a piece of land [27, 28], is not always perceived as a soil conservation technique. Instead, farmers use this technique to obtain more extraordinary plants from a small area because of the lack of land for cultivation. This shows that the strip cultivation approaches at this examination site are now more probable and are no longer adjusted for conservation practices.

As depicted in Table 6, the highest percent of farmers (34.36%) agreed that the reason for the inability to preserve their land is capital loss accompanied by policy-associated problems of 20.98%. Similarly, 16.29% of the respondents indicated the bodily function of the plot of land. Most straightforwardly, 14.53% connected the problem with climatic conditions, and 14.09% were associated with the effectiveness of off-farm activities (the ones who prefer nonagricultural activities). However, all farmers perceive elements differently, which may be concluded from a fair share distribution during the elements. These findings indicate that farmers are aware of their low level of soil conservation and the factors that prevent them from practicing. The respondents indicated that having network participation in soil and water conservation measures was seeking to continue to exist daily. "Thinking about the next day is beyond their reach." This shows that the food insecurity problem reduces farmers' willingness to protect the land as they prioritize activities related to their immediate food needs. In some cases, farmers are aware that their moves are genuinely destructive to the land. However, the instantaneous advantages of those moves appear to be more critical than the long-time period degradation. Wolde Mekuria et al. [29] also suggested the farmers' belief in Tigray. They have fantastic information about the reasons for their lack of ability to protect their land from soil erosion devastation. The use of traditional land aid in many regions has accompanied an exploitative series that includes clearing, cultivation, erosion, and, in the end, abandonment. This unsustainable farming exercise is connected to a loss of desire due to poverty connected to neglect. The question raised about the severity of land degradation in the study area by more farmers in the study suggests that land degradation is a major issue at the country level, particularly for rural farmers who rely on the agricultural and livestock sectors. Interviews with Tigray farmers confirm that, in reality, they may be involved approximately in the degradation of their land [30]. However, there seems to be great apathy because of the reality that they may be living slightly below the subsistence level. They lack the financial and hard workability to put in place critical conservation structures.

The structures and systems of cultivation and the practices of farmers also decide the level of soil erosion and its severity. Farmers in the watershed regularly practice crop rotation. Extrude to different crops (crop rotation), plant the same crop every year, fallow and crop rotation, then 93 % fallow and crop rotation, and 7% plant the same crop every year without fallowing. This suggests that crop rotation is the best opportunity to practice with the aid of using maximum farmers. Farmers mentioned that they are practicing crop rotation for numerous reasons: loss of affordability of synthetic fertilizers because the rate is growing from time to time, scarcity of land to exercise fallowing, and inefficiency of crop manufacturing if they plant the identical crop every year. According to them, the cultivation of an identical crop usually results in a reduction in crop yield. Therefore, they enforced the extrusion of forms of the crop every year. For example, although they cannot purchase synthetic fertilizers to domesticate teff, they can extrude the crop into wheat or barley, which is not a ton of aid for the security of family meals. This suggests that they are using crop rotation without a hobby. However, it is best to maintain the quantity of manufacturing.

Farmers in this study perceived soil and water conservation as a mechanism for preserving farmland. On the other hand, almost all the farmers polled (97.5%) saw soil erosion as a barrier to crop production on their farmland. Causes of soil erosion are provided for them in the form of bodily and sociofinancial elements to discover how they understand every factor (Tables 6 and 7, resp.). They understand all the elements anticipated due to soil erosion, although the degree of notion varies due to a number of variables and the number of farmers in various kebeles. The variation in notions among farmers can be due to the variation within the approach to soil cultivation,

Table 5: Farmer's response to the practice of physical soil and water conservation structures.

Types of SWC structures	Kebele			Overall percent (%)
	W/Dekeya (%)	Wareza	Yakima (%)	
Cultivation along the contour	41.9	41.9%	41.9	37.44
Stone bunding	24.69	21.4%	22.3	22.9
Leaving crop residues on the field	9.8	14.2%	11.8	11.89
Tree planting	8.67	10%	10.5	9.69
Grassed waterways	0	0%	0	0
Strip cropping	6.1	7.1%	9.2	7.48
Fallowing	0	1.4	1.3	0.8
Total	100	100%	100	100

Table 6: Response to the view of the respondents on the physical and socioeconomic factors that hinder farmers from conserving their agricultural land.

Perceived factors hindering conservation practices	Kebele			Percentage of farmers (%)
	W/Dekeya (%)	Wareza (%)	Yakima (%)	
Lack of capital	34.56	34.28	34.21	34.36
Policy-related problem	20.98	20	21.05	20.98
Physical features of the plot of land	16.04	17.14	15.78	16.29
Heavy rainfall	14.81	14.28	14.47	14.53
Effectiveness of off-farm activities	13.58	14.28	14.47	14.09
Total	38	30	32	100

Table 7: Perception of farmers about the biophysical causes of soil erosion.

Types of causes	Percentage			
	W/Dekeya (%)	Wareza (%)	Yakima (%)	Overall total (%)
Gradient (slope)	33.33	32.85	14.47	26.87
Heavy rainfall	0.86	30	22.36	27.75
Lack of vegetation covers	16.04	18.57	38.15	24.22
Flood	11.11	14.28	17.10	14.09
Overgrazing land	8.64	4.28	7.89	7.04
Total	100	100	100	100

the gradient of the plot of land, the landholding device, the size of the land, and different sociofinancial variants of the family of equal kebele and special kebeles.

As indicated in Table 7, the farmer's mindset regarding the physical elements of soil erosion is distinct among the households surveyed. In W/Dekeya, most farmers understand the steep slope on their land as the determinant physical reason for soil erosion (33.4%), despite the fact that overgrazing land growth is the least important cause of soil erosion (7.4%), runoff (11.1%), and loss of flora cover (16.2%), and excessive rain (25.9%) is the most important causes after steep slope. according to respondents on this kebele. This may also be due to the comfortable shape of the location, which is noticeably steeper than the slopes of Wareza and Yakima. According to the notion of farmers, look at the location; the steeper the slope, the more the erosion due to the high velocity (swiftness) of the water flow. The gullies start and grow on the steep slopes under the escarpments. They go all the way down to the fields that you can see.

Generally, steep slopes are more prone to sheet and splash erosion than gentler slopes [31–33]. This situation is found at this place throughout the sphere survey. However, farmers' perception of the cause of soil erosion in Yakima has narrowed to the loss of flora cover (38.15%) observed by additional rain (22.36%), runoff (17.10%), steep slopes (14.47%), and growth of grazing land (7.04%). This is consistent with what may be found in the field. The erosion functions, including rills and gullies, are denser in W/Dekeya than in Wareza and Yakima. In some ways, the exams are a compromise with Sierra Leone farmers who blamed erosion on their land on deforestation, excessive rainfall, steep slopes, overculturing, and overgrazing [20]. In general, according to the findings, the knowledge of farmers and the notion of the reasons for soil erosion are mixed. This is found through the findings of many types of studies on unique components of Ethiopia [26, 34].

According to farmer comments, the impact of rainfall is greater on the land prepared for seedlings with the aid of repeated plowing. For example, teff plots must be more conserved than barley and wheat plots. As a result, soil erosion is critical at the start of rain, and plowed fields lack flower cover. Cropping cereals, particularly teff, aggravates the situation because the farmland requires repeated plowing (heavy pulverization) before sowing and remains naked when rain arrives [35, 36]. This is much like the location of Sterk [37] inside the Chemoga watershed.

3.4. Assessment of Indicators and Severity of Soil Erosion on Farmland. Although all farmers perceive the problem of soil erosion on their land, their attitude towards its severity varies widely in the study area of the catchment, possibly due to the variety of factors and their intensity that influence soil erosion. On the other hand, the household profiles of farmers, land ownership, and occupations reflect the socioeconomic status of farmers in all the areas studied. However, there are specific differences in physical characteristics, so the researcher decided to analyze farmers' perceptions of the severity of soil erosion on their farmland according to their respective kebele.

As indicated in Table 8, W/Dekeya was the hardest hit area in the basin. Most farmers reported that the severity of soil erosion on their land was severe (86.42%), and only 13.58% said it was moderate. In comparison, no respondent said low, and in Wareza, 55.71% said severe, 20% said moderate, 14.28% said indecisive, and 10% said low. Only 38.15% of the respondents in Yakima, where the slope of the terrain is relatively gentler, stated that the degree of severity was rated moderate and 11.84% low. These data can be used to determine how the slope of the land influences farmers' perceptions of the severity of soil erosion. Yakima farmers have a good perception of the severity of soil erosion due to the location of the country's hills, as none of the respondents said that the severity is undecided. The variation in the perception of farmers observed in the study area is closely related to the results of other researchers [23, 38]. According to this, the slope influences the decisions of farmers such that farmers on steep slopes always practice nature conservation due to the severity of soil erosion.

Table 9 shows the evaluation of soil erosion indicators in agricultural areas, with 65% of respondents fully agreeing that a decrease in crop yields indicates the presence of soil erosion in their agricultural areas. In comparison, 7.5% were undecided; no one denied that soil erosion has an impact on crop production. Farmers realized that the rate of soil loss and the level of soil fertility were related, according to Shibru [20], defining the potential yield of crops in each specific place of the landscape. 36.3% of the respondents strongly agree with the change in soil color as an indicator of soil erosion. In comparison, 54.6% agreed, 2.6% said undecided, and 6.2% did not agree with the change in soil color as an indicator of soil erosion from black to red. Farmers strongly agreed with the formation of small depressions (streams) as an indicator of soil erosion (63.8%), and 22.5% agreed with the indicator, while only 13.7% disagreed. Among the indicators provided to the respondents to assess the degree of their indication, it is surprising that most farmers regard ditch formation as an indicator, while 71.2% agree that ditch development is an indicator of the existence of soil erosion in their area. Farmers perceive soil erosion indicators as an issue that limits soil productivity, according to their answers. Farmers, for example, stated that soil erosion occurs as a result of overflowing ditches damaging their crops; if there are sediments inside and outside your field, they are mostly at the bottom of the field when small streams appear in your fields, when the soil color in the upper part of the field turns red, and the soil color in the lower part turns black. Regions can explain the differences in respondents' perceptions of soil erosion in the fields. Investigate differences in exposure, farmland location, knowledge of the surrounding environment, or knowledge of the impact of current soil and water conservation measures on your immediate surroundings. This has also been confirmed by research done in different parts of Ethiopia [39–41].

3.5. Farmer Acceptance and Adoption of Soil and Water Conservation Structures. As recently demonstrated, all farmers are familiar with the SWC structure, and they recognize it as a government strategy for restoring degraded areas, not just a soil and water conservation method. Farmers say that these buildings are very important (94%). However, only 2% of the respondents have participated in SWC design demonstrations, field trips, and seminars.

Table 10 shows that more than half of the respondents (52.5%) confirmed that these structures effectively reduce soil erosion. More than half of the respondents (57.5%) also believe that the new SWC design has potential. However, it is unreasonable to think that design is an effective measure to prevent soil erosion and its potential to increase soil productivity upon its adoption on the farm. Although the implementation is more dependent on the design of structural features related to efficiency, the implementation of measures at the farm level also depends on several socioeconomic and institutional factors. Therefore, farmers who have implemented some structures were asked how their position measures would improve SWC. The effectiveness of closed structures with fertile mineral deposits accompanies the development of cultivated plants mainly [42, 43]. The amount of sediment carried by this structure is estimated to be very high. If this defensive structure is not built, it will be moved out of the field. Farmers were also asked about their intentions for the future structure of SWC (Table 10).

The respondent responded to the interview question about their knowledge of SWC structure implantation on their farmland, "have you been aware and experienced using SWC structure on your farmland?" Almost all interviewees expressed interest in maintaining the established structure of the surveyed farmers if they wanted to apply the SWC structure to another cultivated land (land that had not yet been cultivated at the time). Only 42.5% of those polled said they intended to use the SWC structure. They were asked if they should pay to establish and maintain an SWC structure on their farm to assess their attitude towards the need for government assistance. 72.5% answered "No," and only 27.5% answered "Yes." This shows that if there is technical support from competent authorities, farmers can build natural protection structures. Thus, they are responsible for protecting their land from destructive soil erosion through SWC design.

Table 8: Farmer's perception of the severity of soil erosion on farmland.

Level of severity of soil erosion severity	Severity of soil erosion on farmland (in percent)			Overall total
	W/Dekeya	Wareza	Yakima	
Severe erosion	86.42%	55.71%	38.15%	60.79%
Moderate erosion	13.58%	20%	50%	27.75%
Low erosion	0	10%	11.84%	7.04%
Undecided	0	10 (14.28%)	0	4.40%
Total	100%	100%	100%	100%

Table 9: Farmers' perception of soil erosion indicators.

Indicators of soil erosion	Degree of agreements in percent (%)				
	Strongly agree (%)	Agree (%)	Undecided (%)	Disagree (%)	Strongly disagree (%)
Crop yield reduced	65	27.58	7.52	0	0
Soil color change	36.36	54.62	2.61	6.21	0
Formation of a small depression in which water flows (rill)	63.81	22.54	0	13.73	0
Dissection of fields (gullies)	71.25	25	3.84	0	0

Table 10: Farmers' acceptance and adoption of SWC structures.

Indicators of acceptance and adoption	Percentage (%)	
	Yes (%)	No (%)
Indicators of acceptance		
(a) Can the recently introduced SWC design effectively prevent 52.5 G and 5% soil erosion?	52.5	47.5
(b) Do you think the new SWC structure has the potential to increase land productivity?	57.5	42.5
Indicators of adoption		
(a) Do you plan to keep the structure that has been built?	68.7	31.3
(b) Do you plan to introduce a new structure in an area that you have not dealt with currently?	42.5	57.5
(c) Do you think maintaining SWC is the responsibility of farmers?	86.3	13.7
(d) Should farmers pay to build and maintain SWCs on their farms?	27.5	72.5

The focus group discussion raised the current status of local water and soil conservation practices and their effectiveness compared to the newly introduced water and soil conservation structure (SWC). The group agrees with the existence of traditional methods. You have to admit that both are valid, but their applications do not run in the same place. They believe that traditional methods, especially contour plowing combined with drainage, have influenced farmland. However, they practice the newly introduced structure (terraced fields on rugged mountains) through campaigns and state subsidies, mainly combining well-designed areas (not on their arable land) because the structure consumes arable land. In her opinion, cultivation and its benefits seem insignificant. The government's restoration of degraded land is not just Russia's soil and water conservation method for sports. This is done by those who build remote mountain areas. This shows that farmers are unaware of the significance of the recently introduced SWC structure and are unwilling to build on their farmland, preferring instead to use it as a means of restoration in highly degraded areas.

3.6. Factors Influencing Farmer Acceptance and Acceptance of Soil and Water Conservation Structures. Several factors influenced farmers' acceptance and acceptance of soil and water protection structures in the Offa Woreda basin in the study area. The main factors perceived by farmers (Table 11) were the small size of the agricultural land (47.57%) and the new structures requiring too much work to implement (14.97%), and 5.28% identified other factors not on the list. This also includes a lack of time for implementation, a focus on daily livelihood rather than land sustainability, a lack of financial and material support, and dissatisfaction with local leaders (5.28%). The most important reason is the small size of their lands, which is why they do not believe it is prudent to establish protective measures in small areas. With the discovery of Assefa [26], a household that owned up to six parcels of arable land within the small total farm size in the Debre Wami Basin near Lake Tana, the farmers' intention was realized. The implementation of soil and water protection structures is hampered by this fragmentation.

As farmers pointed out in the discussion, building terraces or dikes on these small farms was considered another problem because they thought it would consume their land. Farmers were advised against building physical structures on very small farmland. Approximately 7.5% of those polled stated that they have agricultural experience. 95% of selected farming experiences gave a negative explanation for farming experiences in their comments. They said that experienced farmers are unwilling to accept the newly introduced SWC

Table 11: The main constraints for farmers to apply SWC structures on their farmland.

Major factors	Kebele			
	W/Dekeya (%)	Wareza (%)	Yakima (%)	Percentage (%)
Small size of agricultural land	45.7	50	47.36	47.57
SWC requires too much labor	16	14.28	14.47	14.97
Farm income condition	9.87	10	10.52	10.13
Lack of knowledge	8.64	8.57	9.21	8.81
Farm experience	8.64	7.14	7.89	7.92
Insecurity of land tenure	4.93	5.71	5.26	5.28
Do not think that erosion is a serious problem	0	0	0	0
Others	6.17	4.28	5.26	5.28
Total	100	100	100	100

structure. In addition, they found that farmers in severely eroded areas are actively adopting and implementing the recently introduced SWC. Farmers in the study area who are least affected by soil erosion are not more willing to accept the newly introduced SWC structure than they were previously. The size of the farm also affects acceptance so farmers with small plots of land are not interested in maintaining the structure. Soil erosion and farm size determine the farmers' acceptance of the SWC structure. A researcher interviewed W/Dekeya on this topic: I think erosion is not a serious problem. Of course, they confirmed that very few people pay attention to this topic. However, they also affirmed that the office had formulated a technology application strategy based on the regional government strategy. Farmers are aware of these structures, but a few people, including kebele, are unwilling to encourage them to participate in compulsory measures. They even refuse to formulate nature protection measures because they also consider this. Most of the land is occupied by buildings.

However, some studies explore this in more depth. For example, according to Okoba and Graff [44], farmers have particular criteria to distinguish between different land management farm types. The standards are based on personal attitudes and land management practices. These standards are very different from the methods used by scientists and agricultural consultants in participatory assessments of rural communities. In addition, this situation reflects the problem of adapting the structure to the needs of farmers, and the current state of the agricultural system partially reflects this problem. When planning and implementing these structures, some people think participatory procedures will be followed, but local facts do not seem to support this; for example, the knowledge and preferences of farmers in dealing with soil erosion were respected at the time and ignored; they are not convinced that coercion is an unacceptable erosion method. Ethiopia's nature protection plan has been put into place, but not very well, according to Wassie [45], Gessesse et al. [46], and Eze (2007). Small farmers who work on slopes have a growing problem of not being able to coordinate land management with the current level of land degradation. They want to make short-term money but also to keep the environment in mind.

In addition, in face-to-face interviews, farmers were asked to make suggestions on improving the effectiveness of the SWC structure. They provided many things that farmers and the government expected. First, you do not have the materials to create SWC tools, so you need financial support from the state; second, you need technical support from structural design experts; third, continuous training, experience exchange, and incentive measures must be provided for the community to understand and implement the new SWC structure, although farmers are aware of the problem of soil erosion; fourth, with government consent, farmers must establish basic rules and obligations for the maintenance and maintenance of the buildings they build; fifth, experts must determine how and where to build SWC structures so that self-assured local leaders do not mislead peasants.' labor. Finally, efforts should be made until the peasants say that they will accept these structures.

4. Conclusion

Farmers in the study area experience difficult socioeconomic conditions. This can be accomplished through the use of the following methods: relying on self-sufficient agriculture with little or no diversification of livelihoods, with more than 92% of the population entirely reliant on agriculture, and demographic conditions that are favorable to agriculture (large family and high dependence). Smallholder farmers in Kebel Offa Woreda also suffered severe erosion, which was primarily caused by the characteristics of different soil erosion indicators, which were mainly streams and gullies, and which was primarily determined by socioeconomic factors. The quality of the water and the amount of vegetation in the basin have both declined significantly. Farmers are unhappy with the state of their current land holdings. The farmers in the study area recognized that soil erosion is a problem that limits their ability to produce crops on their farmland. Most farmers have been able to identify the physical and socioeconomic factors that contribute to soil erosion. The kebeles interview revealed that they have different perspectives on why the most obvious reasons are steep slopes, deforestation, and runoff in W/Dekeya, Wareza, and Yakima, according to the interview. This could be due to the fact that the physical conditions in the area are different, whereas the socioeconomic conditions are more or less the same. The understanding of farmers of the causes of soil erosion is influenced by the slope of the land. Farmers' acceptance and adoption of the SWC structure are influenced by a number of factors, including limited agricultural land, the structure being too labor-intensive to implement, a lack of time, a lack of financial and material resources, and dissatisfaction with the government and local leaders.

4.1. Recommendations

(i) The method of extending the SWC structure should not be top-down or mandatory. Instead, they should cooperate and rely on the local knowledge of the farmers.

(ii) Resilient and participatory water and soil protection structures should be built to keep the land from being eroded and to make it more productive.

(iii) Rural and urban residents widely use natural vegetation and crop residues as fuel; they pose a major threat to soil and water protection. Governments and nonprofit organizations should also provide alternative fuel sources that can be used instead of coal, oil, or gas.

(iv) Farmers are aware of the trend of soil erosion over time and point out the reasons for the scarcity of land due to rapid population growth. However, they do not intend to solve the problem of land fragmentation through diversification of livelihoods and other methods, so it is recommended that supervisor departments intervene to raise farmers' awareness of reversing problems and adopt other forms of livelihood.

(v) Any policy or any plan aimed at general land management, especially water and soil conservation, should take into account the education and mobilization of farmers and give them priority to increase their awareness of land management and sustainable use, strengthening land resources.

(vi) Based on these findings, we recommend that efforts to mitigate land degradation using SWC structures focus on increasing human and institutional capacity. To do this, farmers need to receive better education and training, and people need to learn more about land degradation and how to properly use SWCs to keep soils from getting bad and increase farm output.

(vii) Furthermore, it is critical to develop credit facilities that are specifically designed to solve the issue of smallholder farmers' access to finance.

Data Availability

The data used to support the findings of this study are available upon request.

Additional Points

(i) Farmers in the study area recognized soil erosion as a problem that limits farmland production. (ii) Almost all the farmers polled (97.5%) saw soil erosion as a barrier to crop production on their farmland. (iii) Soil erosion and the size of the farm determine the farmers' acceptance of the soil and water conservation (SWC) structure.

Conflicts of Interest

The authors declare no conflicts of interest.

Authors' Contributions

Elias Bojago contributed to conceptualization, data curation, investigation, methodology, validation, visualization, writing original draft, and review and editing of the paper. Marisennayya Senapathy contributed to conceptualization, visualization, and review and editing. Innocent Ngare contributed to contextualization, revising, rewriting, proofreading, and editing. Tsegaye Bojago Dado contributed to rewriting, proofreading, and editing.

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