Scientific Research Publishing

Journal of Geoscience and Environment Protection, 2024, 12, 71-94
https://www.scirp.org/journal/gep
ISSN Online: 2327-4344
ISSN Print: 2327-4336

Participatory Land Rehabilitation Strategies in Angacha District, Kembata Zone, Central Ethiopia Region

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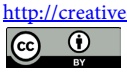
How to cite this paper: Weldeamanuel, E., & Cheng, S. P. (2024). Participatory Land Rehabilitation Strategies in Angacha District, Kembata Zone, Central Ethiopia Region. *Journal of Geoscience and Environment Protection, 12,* 71-94.
https://doi.org/10.4236/gep.2024.122005

Received: January 3, 2024
Accepted: February 19, 2024
Published: February 22, 2024



Abstract

Community participation has become widely incorporated into policies of many soil and water conservation organizations. The purpose of this study was to assess the community participation in the rehabilitation of degraded land. In order to achieve the objective of the study, both primary and secondary data were generated by employing qualitative and quantitative data. Purposive sampling was employed to select three study *kebeles* (the smallest administrative structure of the country) from 16 rural *kebeles* in Angecha District. Simple random sampling technique was used to select 183 household heads from the lists of farmers in the selected *kebeles* for detailed household survey. In addition to household survey, field observation and key informant interview were also conducted to collect the necessary data. The data were presented using descriptive statistic such as percentage, frequency, tables and figure. The data collected through the use of household survey questionnaires were analyzed using logit regression while data collected through field observation and key informant interview were analyzed and interpreted using qualitative description. The findings of the present study revealed that population pressure, soil erosion, deforestation, overgrazing, and over cultivation were the major causes for land degradation. Moreover, the results of this study indicated that the main causes of the low productivity of farmland were farmers' involvement in off-farm activities, increase in size of human population, lack of full cooperation of family members to involve in land rehabilitation practices. Households participated in rehabilitation practices at different levels, with 43.7% respondents showing intermediate participation. However, 22.4% of the farm households clarified that there is low experience sharing and motivation to participate in the process of implementation of rehabilitation programs. It is recommended that, continuous training and experience sharing

program, immediate action to increase the number of literate persons, to practicing compatible practices for the agro climatic zone such as soil bund, *Fanyaaju*, stone bunds, and tree planting, extending effective practices, create opportunities for alternative means of livelihood and promoting NGOs effort to involve in land rehabilitation practices in the highly degraded area.

Keywords

Community Participation, Rehabilitation and Degradation

1. Introduction

Land degradation is a critical environmental problem that affects millions of people globally (Temesgen, Amare, & Abraham, 2014). Soil degradation induced by water erosion in sub-Saharan Africa (SSA) is of alarmingly mainly because of its consequences for subsistence agriculture, from which about 75% of the population derives their livelihoods (Erkossa, Wudneh, Desalegn, & Taye, 2015; Tully, Sullivan, Weil, & Sanchez, 2015). In Ethiopia, land degradation is a major issue, generally in the Southern region of Ethiopia, and particularly in current study District is located (Temesgen et al., 2014). Land degradation negatively impacts the productivity of the land, leading to food insecurity, poverty, and environmental degradation. Soil is one of fundamental natural resources to support life on earth (Taffa, 2002). And however, land degradation is a global problem affecting 29% of land area in all agro-ecological zones around the world (Le, Nkonya, & Mirzabaev, 2014). Farmers' livelihoods are negatively affected, as land degradation manifests in terms of soil erosion, nutrient depletion, gully formation, water scarcity, crop yield reduction, and desertification. It results in loss of fertility of land that in turn leads to food insecurity and loss of farmers' welfare. Among the SSA countries, Ethiopia is not an exceptional to this realty, a high level of soil erosion (Gashaw, Bantider, & Mahari, 2014; World Bank, 2007). Environmental and natural resource degradation is a major concern in Ethiopia, because of its devastating consequences on economic growth and food security status of the people which are both highly dependent on natural resources (Girma, 2001). Ethiopia is the greatest environmentally troubled country which has a high level of continued soil erosion problem that extremely threatens peoples' livelihoods (Gessesse, Bewket, & Bräuning, 2016; Moges & Holden, 2007; Pulido & Bocco, 2014).

Even though degradation status is different from place to place, it is touching each corner of the globe (Ouyang et al., 2018; Vanwalleghem et al., 2017). Also land degradation is a serious problem in the highlands of Ethiopia, with the loss of soil, fertility, moisture storage capacity, and structures all reducing agricultural productivity. Soil and water conservation (SWC) practices on privately owned and community land through community mobilization in drought prone and extremely degraded parts of Ethiopia (Gebreselassie et al., 2015; Kebede & Me-

sele, 2014; Teshome, de Graaff, & Kassie, 2016) have been practiced for the last 50 years. The structural SWC and management practices such as stone bunds, soil bunds, percolation ditches, etc., are constructed (Amare et al., 2014; Teshome et al., 2016) by the coordinated efforts of government and community members. However, as farmers were forced to implement a conservation structure designed by experts, the program was not effective (Haregeweyn et al., 2015; Gebreselassie et al., 2015; Kebede & Mesele, 2014). The problem is that land degradation is a critical issue in the Angacha District, *Kembata* Zone, Southern Ethiopia, and efforts to rehabilitate degraded land have been inadequate. The lack of community participation in land rehabilitation efforts is one of the key factors contributing to the problem. This study aims to investigate the participation of the community in rehabilitating degraded land in Angacha District, Kembata Zone, and Southern Ethiopia. The study is relevant, because it addresses a critical environmental problem that affects the livelihoods of millions of people in Ethiopia. Engaging the local community in land rehabilitation efforts can help improve the productivity of the land, reduce poverty, and promote sustainable development. The current study district faces a multitude of complex food production and supply problems, mainly due to inappropriate land management practices, which are caused by both natural and human intervention problems. The community's limited involvement in land rehabilitation has led to poor sustainability, as rehabilitation efforts are often abandoned soon after project completion. Therefore, Community Participation in land rehabilitation strategies efforts is crucial to ensure the sustainability of such projects.

2. Materials and Methods

2.1. Study Area

Angacha District is one of the districts in the Southern Ethiopia Region (CER) of Ethiopia. It is located approximately 290 km from Addis Ababa and 50 km from Hossanna, the capital of the Region. The area of the District is mainly of 35% dega, 65% woina-dega and its altitude ranging from 1900 - 3018 meter above sea level. The area was characterized with Minimum and maximum temperature of 12˚C and 16˚C. The District receives an average annual rain fall of 1250 ml. Angecha has 77 km of all-weather roads and 45 of dry weather roads. The area practice mixed crop livestock farming system. Wheat is the first major cereal crop followed by teff, faba bean, field pea, barley and sorghum It is part of the Kembata Zone.

Figure 1 shows that, Map of the study area. It bordered by Hadiya Zone to the south, Kache Bira Woreda to the west, Doyogena to the north by the Hadiya, and the east Damboya, and south by Kedida Gamela.

2.2. Climate Characteristics

The Angecha district experiences a mean annual rainfall of approximately 918.8 mm, which is seasonal and varies in space, and time. The rainfall pattern is

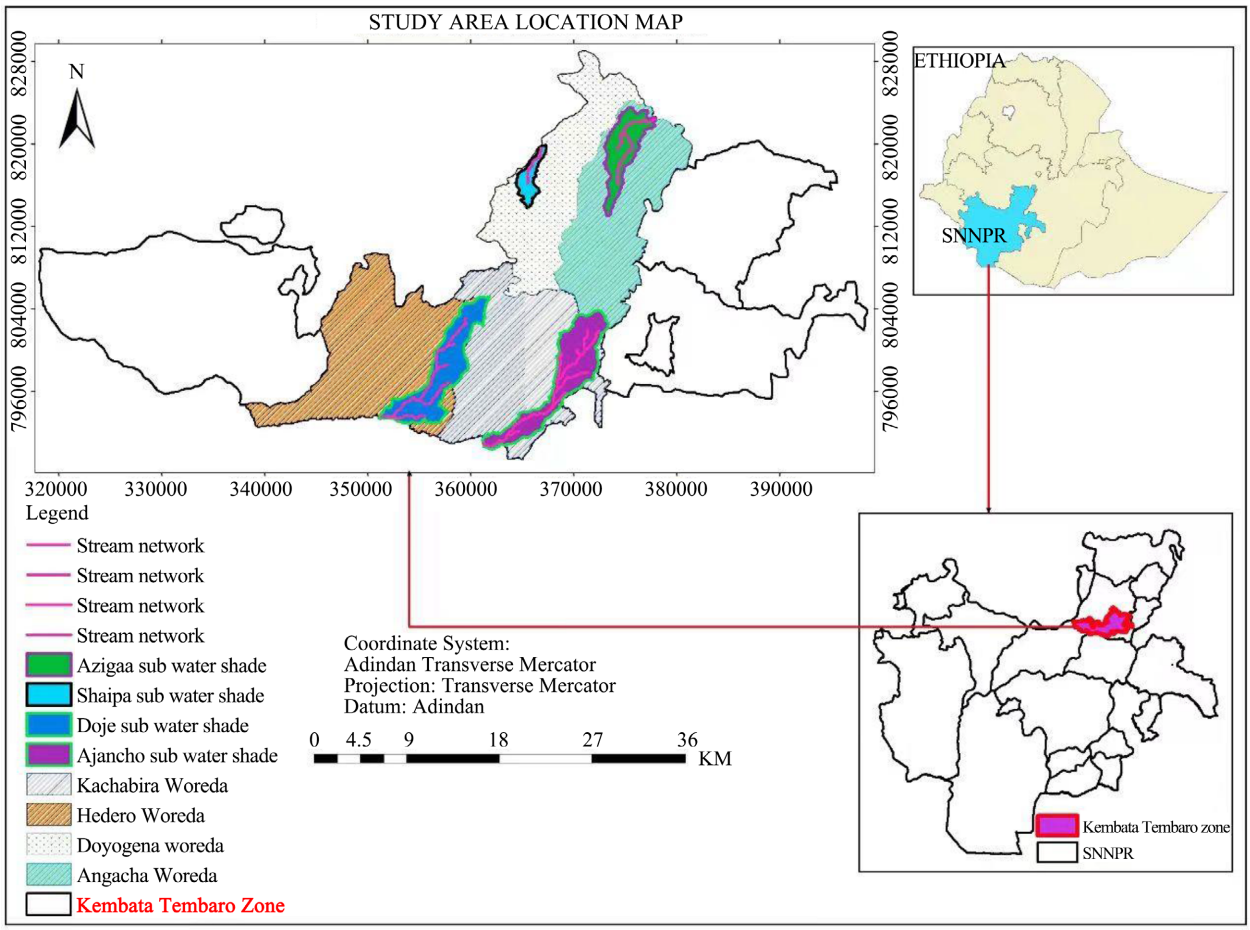


Figure 1. Map of the study area.

bi-modal, with short rains occurring from March to May and long rains from June to September. The district has an average mean annual temperature of 19.40˚C, based on long-term climatic data (Melesse, Sileshi, & Tamirat, 2018). The elevation of the Angecha District ranges from 1500 m.a.s.l to 3200 m.a.s.l. The natural vegetation in the area includes Zigba (*Afro-carpus flacatu*), Bisana (*Croton macrostachyus),* Wanza (*cordia africana*), and Kawot (*Celtis africana*) (Fugaro & Maryo, 2018). The moist vegetation is found above 1500 m elevations, while the woodland vegetation is characterized by drought-resistant trees and shrubs, either deciduous or with small, evergreen leaves, and several varieties of acacia occurring 1600 - 1900 m above sea level (AWAO, 2020).

2.3. Soils Characteristics

Soil is defined as a mixture of mineral and organic particles of varying size and composition in regard to plant growth. Soil is also unconsolidated material on the surface of the earth that has been subjected to and influenced by the genetic and environmental factors of parent material, climate, organisms, and topography, all acting over a period of time. For a farmer, soil refers to the cultivated top layer (surface soil) only, that is, up to 15 - 18 cm of the plough depth. It is the

medium from which most plants derive mineral nutrients and water. Soil also provides physical support for both plants and animals including humans and the structures they build. The Agriculture and Rural Development Office in Angecha District has indicated that the distribution of the major soil type in the study area is largely influenced by the topography.

2.4. Population Characteristics

The 2007 data of the central statistical authority of Ethiopia (CSA) shows that Angecha District has a total population of 120,491, of which 60,512 are male and 59,979 are female (AWAO, 2020). The largest ethnic group in the district is the kembata, which comprises more than 99% of the total population. The remaining ethnic groups are Amhara, Oromo and Hadiya. The majority of the inhabitants were Christian, accounting for 98.07% of the population, while 1.64% practiced Ethiopian Muslim, and the rest were Protestants. Kembatissa is spoken as a first language by 97.41% of the population, and 2.14% spoke Amharic, while the remaining 0.45% spoke all other primary languages. In terms of education, 22.74% of the population was considered literate, 24% of children aged 7 - 12 were in primary school, 42% of the children aged 13 - 14 were in junior secondary school, and 11.26% of the inhabitants aged 15 - 18 were in senior secondary school. The major crops cultivated in Angecha are maize, wheat, sorghum, barley, Teff, and pepper. Some beans and peas, including haricot beans, are also cultivated. In rank order, maize, wheat, sorghum, Teff, and barley cover the largest area in Angecha (AWAO, 2020). The farming system in the Angecha District characterized by mixed farming (crop production and livestock rearing). The major farm animals reared in the district are cattle, goats, sheep and poultry. The farming technology is still traditional plowing with a pair of oxen (AWAO, 2020).

2.5. Research Design

Based on the objectives of the study, this research employed mixed approaches (quantitative and qualitative). Since all the approaches have their own limitations, researchers felt that biases inherent in any single approach could neutralize or cancel the biases of other approaches. On the other hand, triangulating data sources is a means for seeking convergence a cross qualitative and quantitative methods (Creswell, 2009). Qualitative research approach, on the other hand, involves collecting non-numerical data and using qualitative form of analysis to explain phenomena.

2.5.1. Sources of Data

Data for this study were captured from two sources: primary and secondary sources. The main primary sources of data were farmers. Hence, field observation, focus group discussion, with selected farmers and other informants were primary data sources. District agricultural experts, *Kebele* administrators, soil and water conservation professionals and development agents (Das) were inter-

viewed to collect primary information. Secondary data sources were the published and unpublished document. In addition, Secondary data were taking from different District office especially from (AWAO, 2020; AWFEDO, 2022) like population number, the data show the socio economic condition of people and evidence related to community participation.

2.5.2. Data Collection

The primary data were collected using household survey, key informant interviews and focus group discussion were undertaken to assess the level of local community participation in the rehabilitation of degraded land, to identify the types of rehabilitation programs frequently implemented in the study area and to identify determinant factors that influences community participation in the rehabilitation of degraded land in the study area. The questionnaire was first developed in English and the questionnaire had to be translated in to local language Kembatissa. Different secondary sources of data were used to derive the required information. Data like; published and unpublished document.

A cross sectional survey was employed to gather both qualitative and quantitative information. This was the main tool used to obtain the detailed information from the sampled household heads by administering structured questionnaire that includes both close ended and open-ended response types. The household questionnaires were design in line with objectives and research question, and it includes a diverse issue that was provided for the understanding of the socio economic activities of households. A key informant interview was used to generate data for understanding the rehabilitation of degraded land. To identify the types of rehabilitation programs frequently implemented in the study area and to identify determinant factors that influence community participation in the rehabilitation of degraded land in the study area, Key informants are knowledgeable people and living in the area for long period of time. From each of the three Kebeles were three key informants one district expert one development agent and Kebele administration were selected. Focus Group Discussion (FGD) were conducted to complement the survey. For the FGD, there were two representative groups per Keble, which had four (4) members per groups, who were invited group discussion session (AWAO, 2020; AWFEDO, 2022).

2.6. Sampling Techniques and Sample Size Determination

In this study, a multi-stage sampling procedure was employed. In the First stage, Angacha district was purposively selected the district was one of the severely affected areas by land degradation, particularly. Soil erosion, deforestation and low SWC practice. Land degradation was the most serious in the highlands and midlands and resulted with gullies and bare surfaces. These features were good indicators of severe Land degradation in the district (AWAO, 2020). Secondly, three *kebele* (Funamura, Bucha, Fandide) were purposively selected from the existing 16 *kebele*. In the third stage, then sample household heads was selected for detailed household survey by using simple random sampling method. To deter-

mine sample size, lists of household names were obtained from the Angecha district finance and economic development office. Using the formula of sample size determination which is adopted the formula of (Kothari, 2004) the formula is given as:

$$n = \frac{z2 * p * q * N}{e2(N-1) + z2 * p * q}$$

where N = size of population;

p = sample proportion of successes;

n = size of sample $q = 1 - p$;

z = the value of the standard deviate at a given confidence level;

e = acceptable error (the precision).

Thus, $N = 2519$ $p = 0.02$ $z = 2.005$ $e = 0.02$

$$n = \frac{2.005^2 \times 0.02 \times 1 - 0.02 \times 2519}{0.02^2 \times 2519 - 1 + 2.005^{2 \times 0.02 \times 1 - 0.02}}$$

Therefore, $n \approx 183$.

Table 1. Sampling technique and sampling determination.

Name of district	Sampled Keeble's	Total household	How to compute (proportionally)	Total sample
Angecha	Funamura	921	$\frac{921*183}{2519}$	67
	Bucha	820	$\frac{820*183}{2519}$	60
	Fandide	778	$\frac{778*183}{2519}$	56
	Total	2519		183

Table 1 shows that, Sampling Technique and Sampling Determination it mentioned above.

2.7. Data Analysis

In addition, all biophysical and socioeconomic data from the study sites were organized and (SPSS-version 25) was used for analyzing the data. Qualitative data obtained from interview and discussion were analyzed and described through concepts and opinions, by sorting out, grouping and organizing in order to supplement the quantitative data of the survey result. Descriptive statistics such as percentage graphs, Pearson Correlation analysis and table were employed in order to have a clear picture about the socio-economic, biophysical, institutional and demographic characteristics of sample households. For this study the logit model was selected because it is simpler to work with and interpretation of the parameter estimates (Feder, Just, & Zilberman, 1985). Logit model has advantage over other in the analysis of dichotomous outcome variable in that it is extremely flexible and easily used function from mathematical point of view and sub-

jected itself to meaningful interpretation. Logit Model was used to measure community participation on rehabilitation of degraded land practice. This model is appropriate when the responses are only dichotomous at which (in this study) either community member participated on rehabilitation of degraded land (Feder et al., 1985).

3. Result and Discussions

3.1. Marital Status

The respondents in the study area are categorized by a researcher as, married, single, divorced, and widowed (er).

Table 2. The marital status of the surveyed 183 household head.

No	Variables	Categories	Frequency	Percent (%)
01	Marital status	Married	129	70.5
		Single	14	7.7
		Divorced	18	9.8
		Windowed (err)	22	12.0
		Total	183	100.0

Table 2 shows that, (70.5%) of the respondents were married. Whereas, the remaining (7.7%), (9.8%) and (12.0%) of the respondents were single, divorced and widowed (err), respectively. The results show that majority of respondents were married.

3.2. Educational Status

As educational status of a household heads increases, the transfer of relevant information is also assumed to increase which in turn results in an increase of community's knowledge about how to engage in the rehabilitation practices of a certain environment. It is enables community to tackle land degradation problems through the use of various modern soil fertility management practices as well as traditional soil conservation methodologies. The following table presents respondents distribution by educational level.

Table 3. Educational status of the surveyed 183 household heads.

Household heads	Education status										*P*-value	r
	Illiterate		Read and write (1 - 4)		5 - 8		above 9		Total			
	No.	%	No.	%	No.	%	No.	%	No.	%		
Male	30	16.39	74	40.43	9	4.91	12	7.1	125	68.3	0.002	0.225
Female	13	7.1	32	17.48	5	2.73	8	3.82	58	31.7		
Total	43	23.49	106	57.91	14	7.64	20	10.92	183	100		

Note: correlation is significant at 0.05.

Table 3 shows that, 43 (23.49%) of male and female household heads were illiterate, while 106 (57.91%) male and female respondents could read and write (1 - 4). On the other hand, 14 (7.64%) male and female respondents were within grade 5-8, and the remaining 20 (10.92%) male and female respondents were above grade 9. The proportion of respondents who have attended education decreases as the grade level increases. In the study area, many of the sampled household heads can read and write. The Pearson Correlation analysis (P = 0.002) showed a positive correlation (r = 0.225) for the educational status of sample households and participation in rehabilitation practices between the two groups, which was found to be significant at a 5% level of significance. This indicates that farmers who attended a higher grade level were found to have a good participation level in land rehabilitation practices than those who attended a lower grade level or were illiterate farmers. This means that the participation level of farmers increased with increasing grade level.

As a result, there was an association between the educational statuses of household heads and participation in rehabilitation practices. This is in agreement with the findings of other studies that education is one of the factors that determine participation in rehabilitation practices related to land degradation. Similarly, Desalegn (2010), states that education enables farmers to tackle SWC using various ways of soil fertility improving practices. The impacts of education on land management practices are mixed, but education generally favors land investments and improved land management practices.

In the study area, the number of household heads with a low level of education background can reduce the effectiveness of the efforts of the entire population. This, in turn, could have its implications on the dissemination of new technologies about rehabilitation practices that could be integrated with local practices.

3.3. Land Degradation

In Ethiopian, land degradation has become a serious problem affecting all spheres of social, economic and political life of the population. It is one of the major challenges to agricultural development and food security of the country. The rate of the country's land degradation is very high. A large portion of the agricultural land, which is mainly located in the highland part of the country, is affected by severe to moderate land degradation. However, is impairing the capacity of forests and the land to contribute to food security and to provide other benefits such as fuel wood and fodder. Soil degradation increases worldwide, especially in the tropical countries. Management of arable areas by farmers and grazing areas by livestock owners is one of the major causes of soil degradation. Natural hazards including land topography and climate factors such as: steep slope, frequent floods and torn does blowing of high velocity wind, rain of high intensity strong leaching in humid regions and drought conditions on dry regions. Deforestation of fragile and land over cutting of vegetation, shifting cultivation, over grazing, Land is the most important resource in traditional and sub-

sistent agrarian society. It is very scarce and getting scarcer since the population size is increasing. Expansion of farm lands and irrigation possibilities to increase production are difficult because of the rugged topography (Desalegn, 2010).

Table 4. Percentage distribution of respondents in land degradation issues (n = 183).

No	Variables	Categories	Frequency	Percent (%)
1	The existence of land degradation problems.	very high	23	12.6
		high	128	69.9
		low	32	17.5
		total	183	100.0
2	The level of land degradation in respondent's farm land.	very high	21	11.5
		high	120	65.6
		low	42	23.0
		total	183	100.0
3	Population pressure is a cause of land degradation.	yes	164	89.6
		no	19	10.4
		total	183	100.0

Table 4 shows that, Population growth is one of the important factors, which determine the effort made to rehabilitate degraded areas. As can be seen from table (8), farmers were asked about the existence of land degradation problems in their farm land and off farm. Indeed, majority (69.9%) of the respondents ensured the existence of land degradation problem in their surroundings is high. The remaining (12.6%) and (17.5%) of them replied that the existences of land degradation in their localities are very high and low, respectively. From the respondents confirmation it is possible to substantiate that the land with less vegetation cover and the decrease of the land fertility to grow crops are implications of the existence of land degradation in the study area, and this in turn indicates the intensification of land degradation in the area.

Households were also requested about the level of land degradation problem on individual farmland. Accordingly, (66%) of the farm household heads agreed that the level of the land degradation on their farmland is high, while (11.5%) of them replied as if there is very high land degradation problem in their farm land. Furthermore, the rest (23.0%) of the respondents replied that the level of land degradation was low.

With regard to the responses of the respondents, through field observation, the researcher realized the prevalence of land degradation in the localities of respondents in general and in individual farmers' farm lands in particular. Whenever the researcher compare and contrast what had been practically observed on the ground and the responses of the respondents, it is possible to conclude that there is absence of awareness among the household heads with pertinent to the similarity of land degradation in their farm land and common land localities.

Pertaining to the information from the respondents about the relationship between population pressure and land degradation, majority (89.6%) of the respondents revealed that population pressure is the main underlying cause of land degradation in the area. On other hand, (10.4%) of the respondents did not agree on population pressure as cause of land degradation in the study area. On top of this, focus group discussion was held with selected house hold heads. During the discussion it is learnt that the high population growth in the study area has resulted in land degradation. As they reported, due to an increase of the population size, the need for the exploitation of natural resources had increased to meet their basic necessities and thereby land productivity had been decreased and this in turn exposed the area to land degradation. Similarly, they also listed specific causes like soil erosion, deforestation, overgrazing, and over cultivation as causes which emanated from population pressure for land degradation in the study area. According to the findings of focus group discussions and key informant interview, population is a triggering factor which initiates other causes of land degradation. Population pressure resulted in deforestation, expansion of farming to marginal areas and grazing lands. In addition, they further mentioned that the attention of concerned government officials to take immediate action is less when people encroached in to enclosed area in searching cultivation land and grazing area which contributes to the problem of land degradation. Therefore, the household heads confirmed that population pressure was the major reason (underlying cause) for land degradation.

Figure 2. Partial view of land degradation in the Bucha Kebele.

Figure 2 shows that, the status of land degradation varies from place to place due to variation in management practices and topography. Different factors are responsible for land degradation in the study area.

Table 5. Causes of the land degradation in the study area.

No	Variables	Categories	Frequency	Percent (%)
1	Causes of the Land Degradation	soil erosion	105	57.4
		Overgrazing	30	16.4
		Deforestation	48	26.2
		Total	183	100.0

Table 5 shows that, about (57.14%) identified soil erosion as the main cause of land degradation in the study area. Whereas (26.2%) and (16.4%) of the household heads pointed out that deforestation and overgrazing were the causes for land degradation, respectively. As far as the identification of the causes for land degradation is concerned, farmers used their land for grazing and frequently practiced deforestation. According to the findings of focus group discussions and key informant interview, soil erosion is a triggering factor which initiates other causes of land degradation. Soil erosion resulted in deforestation, expansion of farming to marginal areas and grazing lands. In addition, they further mentioned that the attention of concerned government officials to take immediate action is less when people encroached in to enclosed area in searching cultivation land and grazing area which contributes to the problem of land degradation. Therefore, the household heads confirmed that soil erosion was the reason (underlying cause) for land degradation.

3.4. Rehabilitation Practices in the Study Area

By considering the problem of land degradation, different land management and rehabilitation practices have been undertaken in the study area with the involvement of stockholders. Therefore, in the following section, an attempt was made to discuss the implementation of different land rehabilitation practices in the study area. With the efforts of government and concerned body, Land Rehabilitation is a broad term and it refers to any effort exerted for repairing or restoring a damaged ecosystem, without necessarily attempting a complete restoration to any specific prior conditions or status. However, rehabilitation contains little or no implication of recreating the original ecosystem (Harrington, 1999). Land rehabilitation programs have been launched and implemented in different parts of Ethiopia. However, the required awareness about land rehabilitation programs by the household heads was not the same among the individual households. Accordingly, the sample house hold heads were asked whether or not there is rehabilitation practice in the area. They were also asked if they involved in the practices, and the effectiveness of the rehabilitation measures on the degraded lands.

Table 6 shows that, the data from Angecha District Agricultural Office, the rehabilitation practices were introduced in the study area since 1980s. The response from the majority of the farm house hold heads and the data from Agricultural Office of the district confirmed the existence of the rehabilitation practices in the study area. Furthermore, the farmers were asked how often they have

been implementing the rehabilitation practices. In this case, about (15.8%) of the respondents replied that they sometimes practicing rehabilitation program in common land and their farm land. Whereas, (18.6%) of the respondents justified as they rarely practicing the rehabilitation program. The others (60.1%) of the respondents expressed that they practicing the rehabilitation program frequently. Based on the result of the survey, it is learnt that farmers in the study area were already started to implement and participate in the rehabilitation practice in their farmland and common lands. To check the existing change on the environment after the land rehabilitation program in the area understudy, the farm household heads were asked to identify the issues. Thus, about (41.5%) of them come to be agree that they have observed an intermediate environmental change after the implementation of the practices. Among the respondents, (42.1%) and (16.4%) have justified that the change on the environment after the implementation of land rehabilitation programs are high and fair respectively. The facts from farm households implied the sufficient awareness they have on the change of the environment because from the prevailing situation, it is suitable to summarize that the changes in the environment which followed the rehabilitation practices are high. Hence, this awareness is an implication of the farmers to accept the high change on environment and the assignment still waiting for the community regarding the same practice.

Table 6. Status of rehabilitation practices in the study area.

No	Variables	Categories	Frequency	Percent (%)
1	The change on the environment after the implementation of land rehabilitation programs	High	77	42.1
		intermediate	76	41.5
		Fair	30	16.4
		Total	183	100.0
2	The practicing of the land rehabilitation program by respondents	frequently	110	60.1
		sometimes	29	15.8
		rarely	34	18.6
		Total	183	100.0

Figure 3. Comparisons of Degraded and Rehabilitated lands (Source: field survey, 2023).

Figure 3 shows that, the comparisons of Degraded and Rehabilitated lands and Partial view of land degradation in Bucha Kebele, in Angacha District.

3.4.1. Trend of Rehabilitation Practices

Rehabilitation program have been introduced and implemented in various areas by different stakeholders, but the practices are not equally implemented in all areas. To collect the relevant data on rehabilitation programs and participation level over time, the author has forwarded questions to sample farmers and the result is discussed in the forthcoming section.

Table 7. Trend of rehabilitation practices.

No	Variables	Categories	Frequency	Percent (%)
1	Trend of Rehabilitation Practices	Increasing	150	82.0
		Decreasing	21	11.5
		no change	12	6.6
		Total	183	100.0

Table 7 shows that, According to the result presented in above, (82%) of the respondents reported that rehabilitation program is increasing overtime whereas (11.5%) of the respondents explained as it is decreasing, and (6.6%) of the respondents has reported no change in practice of rehabilitation program through time. Respondents were also asked to give reasons for the response of rehabilitation practices overtime. In this regard, majority of the respondents in study area replied that the expansion of land degradation due to soil erosion is the major reason for increasing the rehabilitation practices of land. According to the respondents' reasons, in areas where there is a decrease of land rehabilitation practice, there is a continuation of land use for further grazing and agricultural activities. The reason for those respondents who have said no change was their failure to participate in the practice. Based on the responses of the majority of the households, the researcher concluded that rehabilitation practices are increasing overtime.

3.4.2. Advices of Development Agents

Any rehabilitation practice in particular area need adequate mechanism for transmitting information. Lack of relevant and current information can prevent a widespread practice of natural resource conservation activities. Advice of the Developmental agents helps farmers to gain better understanding of the rehabilitation practices as well as enhancing knowledge on the application of soil and water conservation technologies on common land and farm land. So, sample house hold heads were asked to justify about the status of advice from Development agents.

Table 8 shows that, soil and water conservation as a practice has to be thought and demonstrated on the catchment level as well as field level. The demonstration is ultimately done when local people are directly informed, consulted and

Table 8. Advices from development agents (das) in the practices.

No	Variables	Categories	Frequency	Percent (%)
1	Do you get advice from DA's?	yes	146	79.8
		no	37	20.2
		total	183	100.0
2	How often do you contact with DA's?	once a week	32	17.5
		two times a month	50	27.3
		every month	101	55.2
		total	183	100.0

involved (Chizana, Mapfumo, Albrechi, Vanwuk, & Giller, 2006). It was indicated that advices have been given about rehabilitation issue for farm households by DA's, which was ascertained by (79.8%) of the respondents. And, the remaining (20.2%) of the respondents reported that they have not advised by DA's. Anyway, in the study area, the result indicates majority of the farmers get advices this is important for community participation on rehabilitation of degrade land and technical support from Development Agents but some farm household heads have little contact with DA's. In addition, the respondents were provided with supplementary questions to reason out why they did not have contact with the DA's; they responded that in some kebeles, the DA's are not frequently present to provide advice concerning the wise use of resources and implementation of management practices; some the farm households have no closer relations with DA's. Regarding the frequency of contact of development agents with farmers, about (27.3%) of the respondents indicated that they have contact with development agents twice a month, whereas about (17.5%) reported to have contact with these bodies once in a week. Again, about (55.2%) of the household heads proved to have contact with development agents once every months. From this result, it is possible to conclude the frequency of contact of farmers with DA"s is differing from farmer to farmer regarding to community participation in rehabilitation practice that brought irregularities. During the focused group discussion as depicted in **Figure 4**, the farmers also assure the existence of three development agents who are assigned to work in each kebele. But, some Development Agents do not have time to offer enough technical support for farmers on community participation rehabilitation practice since they believe that they are assigned primarily to facilitate only agricultural activities.

3.5. Community Participation in the Rehabilitation Practices

The practice of rehabilitation practice must not be the responsibilities of a single organization and individuals alone. It requires the working together of all the community, the government and related institutions as well as non-governmental organizations. In this regard, data were collected from the respondents about who were the major participants in the rehabilitation programs in the study area and their responses are illustrated in the following table.

Figure 4. Focus group discussion with respondents.

Table 9. Participants in the rehabilitation practices.

No	Variables	Categories	Frequency	Percent (%)
1	Participants in the Rehabilitation Practices.	Farmers	96	52.5
		governmental experts	54	29.5
		NGOS	21	11.5
		religion institutions	12	6.6
		Total	183	100.0

Table 9 shows that, out of the total sample house hold heads, (29.5%) of the respondents replied that governmental experts have been frequently participating in the rehabilitation practices; whereas, about (52.5%) reported as if the major participants were farmers. Again, (11.5%) and (6.6%) of the respondents replied that NGO's and religious institutions were frequently participating in the practices, respectively. This issue was further discussed with District Administration Head and DA's, and they explained that farmers are frequently participating in the program by participating in the implementation of the rehabilitation practices on their farm land, and common lands on land rehabilitation practices; but, NGO"s and religious institutions have relatively less level of participation in rehabilitation programs. In general, the end users/farmers are expected to use their efforts in decreasing land degradation on one hand, and increasing the rehabilitation practices on the other hand.

3.5.1 Rehabilitation Practices

Figure 5 displayed that local community practice in land rehabilitation activities in current research area. The concept of rehabilitation practice accommodate a wide range of involvements and demanding continuous planning as well as the carrying out of proper planning through setting up of relevant strategies ,which directly associated with the plans that have already intended. In detail, the rehabilitation practice that aimed to support the sustainability of various environments might depend on the put in to effective and appropriate land management practices in accordance with the nature of different topographies. For that matter, respondents were asked to identify varieties of land conservation practices, which are presented below.

Figure 5. Community participation on SWC in study area.

Table 10. Respondent's distribution by types of practices in the area.

No	Kind of conservation practice	Number of respondents	Percent (%)
1	Soil bunds	167	91.3
2	Fanyaaju	143	78.1
3	Water ways	33	18.0
4	Tree planting	66	36.1
5	Stone bunds	100	54.6
6	Trench	55	30.1
7	micro basin	51	27.9
8	Check dams	53	29.0

As it can be seen from Table 10 below, it shows the respondents participation on different rehabilitation practices in the study area. The result indicates that most of the farm households practice soil bund (91.3%), Fanyaaju (78.1%), Stone bunds (54.6%), Tree planting (36.1%), Trench (30.1%), Check dams (29.0%), micro basin (27.9%), and Water ways (18.0%) as presented in Table 10. Indeed, from the presented data, it is possible to deduce that soil bund, Fanyaaju, Stone bunds and Tree planting was the activities, which are widely implemented in the study area. This clearly implies that farmers have relatively encouraging awareness about the different rehabilitation practices. On steep eroded bare lands stone terraces are most used structures in the study area. As it is stated by the key informants the stone terraces are considered effective in erosion control. In the study area the respondents have constructed soil bund and stone bund in the common eroded lands especially around the mountainous area.

3.5.2. Extent of Rehabilitation Practices Applied by Farmers

During the data collection farmers were asked about which practices are more effectively and frequently applied in the study area. Accordingly, the respondents have forwarded their responses as it is presented in the following table.

Table 11. Extent of the application of the rehabilitation practices.

No	Practices	Extent of the application of rehabilitation							
		Frequently		Sometimes		Rarely		Never	
		Freq	%	Freq	%	Freq	%	Freq	%
1	Soil bunds	127	69.4	23	12.6	21	11.5	12	6.6
2	Fanyaaju	96	52.5	54	29.5	21	11.6	12	6.7
3	Check dams	57	31.1	56	30.6	51	27.9	18	9.8
4	Water ways	55	30.1	47	25.7	34	18.6	12	6.9
5	Tree planting	58	31.7	76	41.5	38	20.8	12	6.8
6	Stone bunds	90	49.2	82	44.8	21	11.7	25	13.7
7	Trench	18	9.8	41	22.4	31	16.9	93	50.8
8	micro basin	15	8.2	31	16.9	41	22.4	96	52.5

Table 11 shows that, the extents of the farmers apply different land rehabilitation practices. Accordingly, the farm household heads reported that Soil bunds (69.4%), Fanyaaju (52.5%), Water ways (30.1%), Check dams (31.1%), Tree planting (31.7%), Stone bunds (49.2%), Trench (9.8%) and micro basin (8.2%), were frequently applied. For the same rehabilitation practices; Stone bunds (44.8%), Tree planting (41.5%), Check-dams (30.6%), Fanyaaju (29.5%), Water ways (25.7%), Trench (22.4%), micro basin (16.9%) and Soil bunds (12.6%), of the respondents explained that they applied "sometimes". Again, rehabilitation practices such as Check dams (27.9%), micro basin (22.4%), Tree planting (20.8%), Water ways (18.6.8%), Trench (16.9%), Stone bunds (11.7%), Fanyaaju (11.6%), Soil bunds (11.5%), were indicated as rarely applied. And the remaining Trench (50.8%) micro basin (52.5%), Stone bunds (13.7%), Check dams (9.8%), Water ways

(6.9%), Tree planting (6.8%) Fanyaaju (6.7%) and Soil bunds (6.6%), of the respondents reported that they never applied. The result of the study showed that the rehabilitation practices mentioned above have not been equally applied by farmers in the study area. For example, stone bund, Trench and micro basin practices were applied by a few farmers but the same practices were never applied by the largest proportion of respondents in the area understudy. On the other hand; Soil bunds, Fanyaaju, stone bund, tree planting and chekdom are those practices which implemented more effectively and frequently as suggested by majority of the respondents in the study area. The remaining practices were also another principal rehabilitation practices but, not that much used by the sampled respondents except by a few farmers who attended primary and secondary education, and by model farmers.

3.5.3. Effectiveness of Rehabilitation Program and Satisfaction of Respondents

The households were asked questions regarding the effectiveness and their satisfaction in the process of implementing the rehabilitation programs and their responses are organized as follows.

Table 12. Satisfactions of respondents.

No	Variables	Categories	Frequency	Percent (%)
1	level of your satisfied	Greatly satisfied	17	9.3
		Satisfied	150	82.0
		Unsatisfied	16	8.7
		Total	183	100.0
2	effectiveness of rehabilitation	More effective	37	20.2
		Effective	122	66.7
		Less effective	24	13.1
		Total	183	100.0

As it is indicated in the below Table 12, about (82.0%) of the respondents explained that they are satisfied with the rehabilitation program introduced in the area. Then, (9.3%) of them reported as if they are greatly satisfied with the introduction of rehabilitation programs. However, very few (8.7%) of the respondent justified that they are not satisfied with the introduction of the programs. This issue was further raised by the researcher during interview held with selected Development Agents, and they explained that the farmers need more land for agricultural and grazing purpose; and that is why some farm households are not always happy in the implementation of rehabilitation practices. The effectiveness of the rehabilitation practices in the study area was understood by farmers at different levels. In this regard, the researcher asked the sample house hold heads about its effectiveness. Thus, (66.7%) of the farmers responded that the rehabilitation practices are effective. About (20.2%) of farmers indicated that

the practices are more effective and whereas (13.1%) of sample household heads replied that the rehabilitation practices are less effective. The effectiveness of the rehabilitation program is obvious as explained by majority of the respondents. However, still there are some households, who answered the rehabilitation practices less effective and unfamiliar with its effectiveness. Thus, one can understand that the need to inculcate the effectiveness of the rehabilitation practices to the community understudy.

3.5.4. Source of Information and Factors Affecting Community Participation in Rehabilitation Practices

As indicated in many studies there are so many factors that influence the participation level of the community to rehabilitate degraded land, and the farmer's use of different sources of information. In this regard, respondents were asked questions pertaining the participation and source of information, their responses are presented as follow.

Table 13. Source of information.

No	Variables	Categories	Frequency	Percent (%)
1	Source of Information	Friends and relatives	24	13.1
		Developmental agents	114	62.3
		Training	25	13.7
		Media (TV, radio, etc.)	20	10.9
		Total	183	100.0
2	Factors affecting level of participation	Age	48	26.2
		Educational background	84	45.9
		Training	38	20.8
		Gender	13	7.1
		Total	183	100.0

Table 13 shows that, (62.3%) of the farmers responded that Development agents are their primary information source for land rehabilitation. Whereas, (13.7%) of the farmers responded that Training is their major information source about land rehabilitation practices. The rest (13.1%), and (10.9%) of the farmers responded that Friends and relatives and Media (TV, radio, etc.) are their primary source of information, respectively. This implies that, for most of the farmers, the primary sources of information are Development agents. This notifies that Agricultural Office has contributed a lot in providing information about community participation on the rehabilitation practices. During the field survey, sample farmers were also asked about the factor that influences their participation level to rehabilitate degraded land. The above Table shows the number and parent distribution of the respondents based on the responses to these issues. Thus, about (45.9%) of respondents said the major factor that affects the community participation level on the rehabilitation of degraded land in the study

area is Educational background. About (26.2%) of respondents reported age, and (20.8%) and (7.1%) of respondents stated that the major factors that affecting community participation level are training and gender, respectively.

4. Conclusion and Recommendation

Based on the above result, the community participation level in the rehabilitation of degraded land in South Ethiopia, a total of 183 rural household heads were involved in the survey, selected from three Kebeles in Angecha District, Kembata Zone. The study found that only 59% of the households participated in rehabilitation practices or technologies at least in one of their plots and common lands. The study also revealed that population pressure, soil erosion, deforestation, overgrazing, and over cultivation were the major causes for land degradation. The study found that most farm households confirmed that there is a high land degradation problem in individual farmlands, with 12.6% of respondents verifying that there is a very high land degradation problem in individual farm lands and common lands.

Based on the above result lack of fallowing, sloppy cultivation, deforestation and limited use of conservation measures, poverty, land shortage and heavy rain fall are the major immediate and underlying causes of land degradation in the study area respectively. As it was clearly indicated in the result and discussion part, different land scopes (Geographical features) such as valleys, slope, mountain as well as level land have various effects on land rehabilitation practices. However, only limited farmers were found to not face land degradation problems in their farm lands and common lands. Various land management and rehabilitation practices are launched and undertaken in the study with the participation of stockholders. However, the level of implementation depends on the level of farmer's know-how to use these practices. Nearly 82.0% of the farmers revealed that the practices are increasing overtime. Households participated in rehabilitation practices at different levels, with 43.7 % respondents showing intermediate participation. Motivations of household heads and sharing one's experience among themselves are important for implementing rehabilitation practices in any area. Nearly half of the farm households explained that there is good experience sharing and cooperation among inhabitants of the rehabilitate degraded land. However, 22.4% of the farm households clarified that there is low experience sharing and motivation to participate in the process of implementation of rehabilitation programs. Governmental bodies like Development Agents and Woreda Agricultural Office experts play pivotal roles in the process of implementing rehabilitation programs. Nearly 78.7% of the farmers explained that they get much advice from DAs but their degree of contact with DAs is not frequent. The major participants in the rehabilitation practices were farmers, governmental experts, NGOs, and religion institutions. Farmers played a greater role in participating in rehabilitation practices, as they are expected to use their efforts in decreasing land degradation and increasing rehabilitation practices.

However, the responses from respondents realized that currently, governmental experts are playing greater positions in practicing rehabilitation programs on behalf of farmers. In conclusion, the study found that most farmers have intermediate levels of participation and a positive attitude towards land rehabilitation, but this does not necessarily lead to sustainable land management.

Acknowledgements

We acknowledge Tongji University for financial support. We would like to express our sincere gratitude to Kebeles and district authorities of Angecha, Ethiopia for their valuable cooperation in providing us with secondary data for our research.

Conflicts of Interest

The authors declare no conflicts of interest.

References

Amare, T., Zegeye, D. A., Yitaferu, B., Steenhuis, T. S., Hurni, H., & Zeleke, G. (2014). Combined Effect of Soil Bund with Biological Soil and Water Conservation Measures in the Northwestern Ethiopian Highlands. *Ecohydrology & Hydrobiology, 14,* 192-199. https://doi.org/10.1016/j.ecohyd.2014.07.002

AWAO (2020). *Angacha Woreda Agriculture Office (AWAO) Assessment of Socio-Economic Data on House Hold Survey.*

AWFEDO (2022). *Angacha Woreda Finance and Economic Development Office (AWFEDO) Assessment of Socio-Economic Data on House Hold Survey (Population).*

Chizana, C., Mapfumo, P., Albrechi, A., Vanwuk, M., & Giller, K. (2006). Smallholder Farmers' Perception on Land Degradation and Soil Erosion in Zimbabwe: Printed in El-Minia, Egypt. *African Crop Science Conference Proceedings, 8,* 1484-1490.

Creswell, J. W. (2009). *Research Design: Quantitative, Qualitative and Mixed Method Approach* (3rd ed.). SAGE Publications Ltd.

Desalegn, M. (2010). *Challenges and Prospects of Land Rehabilitation Practices: A Case of Angacha Woreda, Kambata Tambaro Zone, SNNPR.* Addis Ababa University.

Erkossa, T, A., Wudneh, B., Desalegn, G. T., & Tayem G. (2015). Linking Soil Erosion to On-Site Financial Cost: Lessons from Watersheds in the Blue Nile Basin. *Solid Earth, 6,* 765-774. https://doi.org/10.5194/se-6-765-2015

Feder, L., Just, R. E., & Zilberman, O. (1985). Adoption of Agricultural Innovation in Developing Countries: A Survey. *Economic Development and Cultural Change, 33,* 255-257. https://doi.org/10.1086/451461

Fugaro, F., & Maryo, M. (2018). Ethio Botanical Study of Wild Edible Plants in Kedida Gamella Woreda, Kambatta Tembaro Zone, SNNPRS, Ethiopia. *International Journal of Modern Pharmaceutical Research, 2,* 1-9.

Gashaw, T., Bantider, A., & Mahari, A. (2014). Population Dynamics and Land Use/Land Cover Changes in Dera District, Ethiopia. *Global Journal of Biology Agriculture & Health Sciences, 3,* 137-140.

Gessesse, B., Bewket, W., & Bräuning, A. (2016). Determinants of Farmers' Tree Planting Investment Decisions as a Degraded Landscape Management Strategy in the Central Highlands of Ethiopia. *Solid Earth, 7,* 639-650. https://doi.org/10.5194/se-7-639-2016

Girma, T. (2001). Land Degradation: A Challenge to Ethiopia. Group of the Rio Conventions, Germany. *Environmental Management, 27,* 3-6.

Haregeweyn, N., Tsunekawa, A., Nyssen, J., Poesen, J., Tsubo, M., Tsegaye, D. et al. (2015). Soil Erosion and Conservation in Ethiopia: A Review. *Progress in Physical Geography: Earth and Environment, 39,* 750-774. https://doi.org/10.1177/0309133315598725

Harrington, C. A. (1999). Forests Planted for Ecosystem Restoration or Conservation. *New Forests, 17,* 175-190. https://doi.org/10.1023/A:1006539910527

Gebreselassie, S., Kirui, O. K., & Mirzabaev, A. (2015). Economics of Land Degradation and Improvement in Ethiopia. *Economics of Land Degradation and Improvement—A Global Assessment for Sustainable Development* (pp. 401-430). https://doi.org/10.1007/978-3-319-19168-3_14

Kebede, W., & Mesele, N. (2014). Farmers' Adoption of Soil and Water Conservation Technology: A Case Study of the Bokoleand Toni Sub-Watersheds, Southern Ethiopia. *Journal of Science & Development, 2,* 35-48.

Kothari, C. R. (2004). *Research Methodology, Methods and Techniques* (2nd revised ed.). New Age International Publishers.

Le, Q. B., Nkonya, E., & Mirzabaev, A. (2014). *Biomass Productivity-Based Mapping of Global Land Degradation Hotspots*. ZEF-Discussion Papers on Development Policy, University of Bonn. https://doi.org/10.2139/ssrn.2465799

Melesse, M., Sileshi, N., & Tamirat, B. (2018). An Ethnobotanical Study of Medicinal Plants of the Kembatta Ethnic Group in Enset-Based Agricultural Landscape of Kembatta Tembaro (KT) Zone, Southern Ethiopia. *Asian Journal of Plant Science and Research, 5,* 42-61.

Moges, A., & Holden, N. M. (2007). Farmers' Perception of Soil Erosion and Soil Fertility Loss in Southern Ethiopia. *Land Degradation and Development, 18,* 543-554. https://doi.org/10.1002/ldr.795

Ouyang, W., Wu, Y., Hao, Z., Zhang, Q., Bu, Q., Gao, X. et al. (2018). Impact of Historical Land Use and Soil Management Change on Soil Erosion and Agricultural Sustainability during the Anthropocene. *Anthropocene*.

Pulido, J., & Bocco, G. (2014). Local Perception of Land Degradation in Developing Countries: A Simplified Analytical Framework of Driving Forces, Processes, Indicators and Coping Strategies. *Living Reviews in Landscape Research, 8,* 1-21. https://doi.org/10.12942/lrlr-2014-4

Taffa, T. (2002). *Soil and Water Conservation for Sustainable Agriculture, Addis Abeba. Cambridge University*. Taylor the Intergovernmental Panel on Climate Change.

Temesgen, G., Amare, B., & Abraham, M. (2014). Population Dynamics and Land Use/Land Cover Changes in Dera District, Ethiopia. *Global Journal of Biology, Agriculture and Health Sciences, 3,* 137-140.

Teshome, A., de Graaff, J., & Kassie, M. (2016). Household-Level Determinants of Soil and Water Conservation Adoption Phases: Evidence from North Western Ethiopian Highlands. *Environ Manage, 57,* 620-636. https://doi.org/10.1007/s00267-015-0635-5

Tully, K., Sullivan, C., Weil, R, & Sanchez, P. (2015). The State of Soil Degradation in Sub-Saharan Africa: Baselines, Trajectories, and Solutions. *Sustainability, 7,* 6523-6552. https://doi.org/10.3390/su7066523

Vanwalleghem, T., Gómez, J. A., Infante Amate, J., González de Molina, M., Vanderlinden, G. K., & Giráldez, J. V. (2017). Impact of Historical Land Use and Soil Management Change on Soil Erosion and Agricultural Sustainability during the Anthropocene.

Anthropocene, 17, 13-29. https://doi.org/10.1016/j.ancene.2017.01.002

World Bank (2007). *Enhancing Agricultural Innovation: How to Go beyond the Strengthening of Research Systems* (p. 185). The International Bank for Reconstruction and Development.