CHALLENGES OF THE SOIL AND WATER CONSERVATION PRACTICES IN GUBALAFTO DISTRICT, AMHARA REGION, ETHIOPIA

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Abstract: *The Amhara regional state is highly affected by land degradation due to soil erosion, as such to alleviate the severity of the problem, SWC practices were introduced in different parts of the region including the study area. Even though these were implemented through wide coverage to conserve soil and water resources for improving the livelihood of rural people, the sustainability of these practices remained below expectation. The present study was conducted in Gubalafto district of Amhara region, Ethiopia; with focus to investigate the constraints in attaining intended objectives. Questionnaire survey, interview, field observation, focus group discussion were applied to collect the necessary data. The primary data was gathered from 154Nos of participants in total and the secondary data obtained from the concerned offices was also utilized. The results showed that 77.8% of respondents were in an opinion that there was the SWC practices in the study area did not yield the expected outcomes. Single factor ANOVA indicated that there were no statistical significant differences among the three agro ecological zones of the study district on the level sustainability of SWC practices. However substantial changes were noticed based on land ownership. The investigation facts indicated that, low level of awareness and misperception of farmers, low level of stakeholder participation, top down approach of government and extensive farming systems were contributing much and are responsible for the existing conditions. Hence there is a need to address these challenges for attaining successful results from the implemented SWC practices.*

Key Words: Challenges, Sustainability, Soil and Water Conservation Practices

1.0 Introduction

Agriculture plays an essential role for the societal well-being and occupies about 40% of the land surface while utilizing about 70% of global water resources. Natural resource degradation is the main challenge that is being faced across the globe (Melkie, 2016). According to the International Soil Reference and Information Center (1995) nine million hectares of the land has been extensively degraded throughout the world and the biotic functions of the land are under threat. Developing countries such as Ethiopia are more dependent on agricultural sector, and the contribution of this sector depends on how well the natural resources are managed. Ethiopia is one of the developing countries; land degradation is also one of the most challenging environmental problems in the country (Fikru, 2009).

In Ethiopia the utilization of the natural resources is under high pressure due to ever increasing population growth, inappropriate farming and mismanagement of resources (Bililign, 2010). The rate of soil and water resource degradation is found to be at a faster and increasing rate. Mostly the land degradation is due to the removal of soil particles, nutrient exhaustion, forest degradation (deforestation), and surface runoff. The majority of Ethiopian farmers are dependent on subsistence-oriented agricultural economy, i.e., cultivating on sloppy and marginal lands where soil removal is highly susceptible (Million and Belay, 2004). During 1970 and 1980s Ethiopia had implemented significant SWC measures through the food for work programs. The current government of Ethiopia had also started to implement physical and biological SWC measures through Integrated Watershed Management Approach in order to overcome the problem of soil erosion, land degradation, and deforestation. The same is true in the case of Amhara region.

The study area is found in the eastern part of Amhara Region; which is moisture stressed with hilly topography, is currently under threat due to degradation of soil and water resources. SWC measures that are being implemented in the study area include physical and biological conservation measures (Belay & Eyasu, 2017).

Though these conservation measures were introduced for the last 32 years; however, significant results could not be obtained, therefore, this study was intended to investigate the sustainability challenges of SWC practices in in Gubalafto district of Amhara region.

1.1 Objective of the Study: The objective of this study was to study the challenges towards sustainable SWC practices in Gubalafto district of Amhara region, Ethiopia, so as to propose suitable and appropriate solution to effectively tackle the issue.

1.2 Description of the Study Area: Gubalafto district is found in the north eastern part of Amhara Region, Ethiopia. Geographically, Gubalafto District, with an area of 900.49 square kilometers is located between 39^0 6'9" and 39^0 45'58'' Longitude East and 11^0 34'54''and $11^0$58'59'' Latitude North. Based on the 2014/2015 national census conducted by the Central Statistical Agency of Ethiopia (CSA), it had a population of 139,825 with an increase of 0.48% over the 1994 census.

The topography of the district is mostly characterized by a chain of mountains, hills and valleys ranging from 1379- 3809 meter above sea level (m.a.s.l). Gubalafto District has three agro-ecological zones, viz., Lowlands (Kolla) 1379-1500 m a.s.l, Mid-altitude (Woinadega) 1500-2300 m a.s.l, and Highlands (Dega) 2300-3200 m a.s.l. Most of the rural population is settled on the highlands and plateaus. A bi-modal nature of rainfall characterizes most parts of Gubalafto District. The short rainy season (Belg), occurs during the months February and April, while the long rainy season (Meher), and occurs between June and September. The dominant soil types in the area found in the district are Eutric Leptosols, while Eutric Cambisols, Lithic Leptosols, and Vertic Cambisols (Dereje and Desale, 2016). The dominant economic activities are agriculture, trade, different services, micro and small enterprises etc.

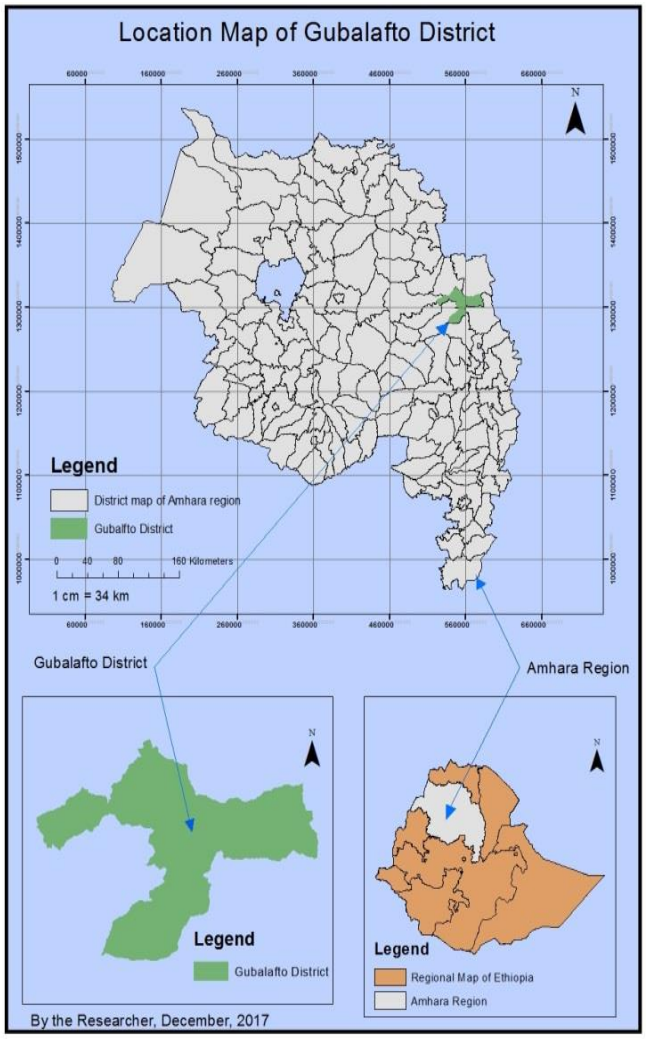

Figure 1.1: Location Map of the Study Area, Source: Prepared by the Researcher, December, 2017

2.0 Literature Review

Soil and water are the key natural resources for the survival of life on earth, proper utilization and conservation of these resources is important for long-term agricultural productivity. SWC measures can prevent loss of soil and water, and also build the soil organic matter; hence these should be properly planed and implemented (Addisu, 2011). These conservation measures can be applied based on technology available, land characteristics and degradation extent. SWC measure broadly classified in to biological and physical SWC measures (Addisu, 2011).

Biele (2014) carried out a study to assess the existing SWC practices and evaluate their sustainability in Dejiel watershed, East Gojjam, Ethiopia. The result of the study showed that the quality of SWC structures in closure area was in good position compared to SWC structures implemented on agricultural lands. Fanya-juu structures (stone masonry structure) that were practiced on cultivated lands showed very significant differences at the vertical back of the structure and collection ditches (width and depth). The soil analysis results showed that

organic matter (OM), available phosphorus, total nitrogen (TN), pH, and electrical conductivity are significantly ($p \leq 0.05$) affected by soil conservation practices. Habtamu (2014) conducted a study on the challenges of SWC practices and measures to be undertaken: the case of Wuchale district, Oromia region, Ethiopia. The study result showed that factors such as; slope of the area, tenure status, age, and gender, educational status of households, land size and lack of information had influence on the adoption and sustainability of SWC practices.

3.0 Research Methodology and Data Sources

In order to achieve the intended objective of this study; selection of an appropriate research design is very important, as such descriptive research design was adopted. The descriptive type of research design was applied to describe systematically the sustainability challenges of SWC practices. This was adopted as it is economical in approach to obtain information from wider areas and large population, time efficient and can easily draw inferences. The data collection instruments such as questionnaires, interview, focus group discussion and field observations were used.

In this approach, purposive sampling method was used for selecting sample respondents (151Nos farmer household heads, 2Nos Environmental Protection Office experts, 4Nos Agricultural Office experts, 3Nos Kebele chairmen and 1No Agricultural Office Head) of the district. The three Kebeles (Ezet, Geshober and Dorogbir) were selected out of the 34Nos of Kebeles of Gubalafto District using stratified sampling technique based on agro-ecological zones. According to Gubalafto District Agricultural Office plan (2016/17), from the total household heads of the district, the household heads of Ezet, Geshober and Dorogbir Kebeles were 731Nos, 934Nos and 797Nos respectively, as such the samples were chosen proportionally.

The Sample size is actually the total number of units which were selected for the analysis in the research study. To determine the size of the sample for the study there are various methods; however Kothari (2004) method was selected by the researcher and the sample size was calculated as 151 Nos of household heads from a total of 2462 Nos of household heads of three selected Kebeles (Ezet, Geshober and Dorogbir) of Gubalafto district. Sample size of each Kebele was determined by Kothari (2004) proportionality formula and sample size of each Kebele was calculated as Ezet Kebele 45Nos, Geshober Kebele 57Nos, and Dorogbir Kebele 49Nos from the total calculated 151 sampled household heads.

In this study, both primary and secondary data sources were utilized to gather reliable and valid information, to minimize biasness and reduce the subjectivity of the research findings. Primary data was obtained from sampled respondents through questionnaires, while the information from interviews, observations and focus group discussions also contributed to the primary data. The secondary data comprised of the office reports, books, researches, government policy and strategy manuals, government plans and electronic media (internet). These were utilized in obtaining the past data and sufficient materials to improve the scope of the present work.

4.0 Data Analysis

According to Tavakol and Dennick (2011) internal consistency should be determined before a test can be employed for research purpose to insure validity. As stated by them, there are different reports about the acceptable value of alpha, ranging from 0.70 to 0.95. In the present study a pilot test was conducted on ten individuals before conducting the main survey to evaluate the internal consistency between variables in the questionnaire. After conducting the pilot test, necessary suggestions were incorporated and appropriate modifications were applied. The questions in the questionnaire were tested for their alpha value and it was found to be that questions regarding to sustainability of SWC practices based on land ownership 0.84 and factors for lower sustainability of SWC practices 0.70. Based on the test result it is interesting to note that, the test results were within the recommended level of Cronbach alpha value and the questionnaire were reliable.

To collect valid and reliable data, social survey, interview and focus group discussion guidance questions were translated in to Amharic language, because it is the working language of the study area. The facts from respondents', interview and focus group discussion were strengthened using field observation checklist.

This study was targeted for 151Nos of farmer household heads around Gubalafto District. After coding and checking for accuracy in the data, 144 Nos questionnaires were found useful for the study. This gave a response rate of 95.36%. In the interview study, 1No of District Agricultural Office Head and 3Nos of Kebeles Chairmen

were interviewed. In the focus group discussion study, 2 Nos of Environmental Protection Office and 4 Nos of Agricultural Office Experts were participated (154 in total). The response rate of interview and focus group discussion were 100%. Data analysis was done by using SPSS version 21 and MS. Excel packages, and the results obtained were presented in the form of Graphs, Tables, Charts and qualitative and quantitative presentations.

5.0 Results of the Study

5.1 General Information about Respondents: To obtain relevant and reliable data, it would be necessary that the researcher addresses and gathers the demographic details of the sample respondents. The information regarding the household characteristics determined the representativeness and the details are furnished in Table 5.1 below.

Table 5.1: Age and Educational Status Respondents

Variable	Items (cases)	Frequency (Nos)	Percent (%)
Gender category of respondents	Male	105	73
	Female	39	27
Age of respondents in years	18-29	27	18.8
	30-44	65	45.0
	45-49	23	16.0
	50-60	25	17.4
	Above 60	4	2.8
Educational status of respondents	Illiterate	7	4.9
	Adult education	91	63.1
	Elementary School	43	29.9
	Secondary school	3	2.1

Source: Field Survey, 2018

It is to be noted that the farmers who were the respondents were mostly males and the majority of them were in the age groups of 18-44 years. They contributed to the major working force, educational background was very poor and about 63.1% of them are currently obtaining education through adult education program.

5.2 Constraints for the Sustainability of SWC Practices

5.2.1 Nature of SWC Practices in the Study Area: From the social survey it was learnt that, SWC practices were started after the 1985 famine that had caused by drought. The reasons behind the introduction of SWC practices were to rehabilitate the area. It was observed that physical and biological methods of SWC measures are being practiced. The most common practiced physical measures included hill side terraces, eye brow basin, micro basins, bench terraces, farm land terraces, check dams, trenches, water diversion canal and others. The biological measures were agronomic practices such as contour farming; strip cropping, agroforestry and crop rotation; the other approach were plantation of different plant species in accordance with the space available.

5.2.2 Level of Sustainability of SWC Practices: The awareness levels of the sustainability and benefits of the SWC measures were necessary to interpret the extent of applicability of these activities. These levels about sustainability varied from place to place with in study district depending on the misperceptions existed. Based on the data presented in Table 5.2, it is interesting to state that major respondents stated that they do not think that these measures are sustainable. But in the communities which had a better perception on the uses of these activities, the success of these measures was high.

Table 5.2: Level of Sustainability of SWC Practices

Variable	**Items(cases)**	**Frequency (Nos)**	**Percent (%)**
Level of sustainability of SWC practices	Medium	9	6.2
	Low	23	16.0
	No sustainability	112	77.8
	Total	144	100.0

Source: Field Survey, 2018

Comparison Based on Agro ecology: In order to check the level of significance for the level of sustainability of SWC practices regarding to agro ecological settings, a single factor ANOVA was calculated and tabulated in Table 5.3. It was found that there was no statistically significant difference between three agro ecological zones of the district, and the observed p-value (0.92706) is greater than 0.05.

Table 5.3: Comparison on the Level of Sustainability of SWC Practices among Agro Ecological Zones

Source of Variation	SS	df	MS	F	P-value
Between Groups	56.54762	2	28.27381	0.077189	0.92706
Within Groups	1465.167	4	366.2917		
Total	1521.714	6			

Source: Developed for this Research from Field Survey, 2018

Comparison based on Land Ownership: In this survey three types of land ownership (government owned land, individual owned land and community owned land) were evaluated for the level of sustainability of SWC practices by using ANOVA. The result of a single factor ANOVA indicated that there was a statistically significant difference among the three types of land ownership on the level sustainability of SWC practices, as the observed p-value (0.490949) and the results on ground also proved the same. The information is presented in Table 5.4.

Table 5.4: Comparison on the Level of Sustainability of SWC Practices among Three Types of Land Ownership

Source of Variation	SS	df	MS	F	P-value
Between Groups	2592	2	1296	0.822962	0.490949
Within Groups	7874	5	1574.8		
Total	10466	7			

Source: Developed for this Research from Field Survey, 2018

5.2.3 Contribution of Selected Factors for Lower Sustainability of SWC Practices; A numbers of selected factors which might contribute for a decrease in the sustainability of SWC practices, such as social, institutional, physical, technical and economic factors were evaluated. The survey result as summarized in Table 5.5 indicated that, even though the degree varies all evaluated factors as indicated in in the table had been contributed for lower sustainability of SWC practices. More than 50% of respondents were agreed with in all factors except slope for their contribution towards lower sustainability. Based on the data the contribution of low level of awareness of farmers, misperception of farmers, low level of stakeholder participation, extensive farming system and top down approach of government were higher.

Table 5.5: Contribution of Selected Factors for Lower of Sustainability of SWC Practices

Variable	Items (cases)		Frequency (Nos)				Percent (%)			
			High	Medium	Low	No effect	High	Medium	Low	No effect
Contribution of selected factors for lower sustainability of SWC practices	Social factors	Low skill, knowledge and attitude of Das and SWC experts	37	41	61	5	25.7	28.5	42.3	3.5
		Low level of education of farmers	53	48	19	24	36.8	33.3	13.2	16.7
		Low level of awareness	126	11	5	2	87.5	7.6	3.5	1.4
		Misperception of farmers	121	16	6	1	84	11.1	4.2	0.7
	Institutional factors	Poor implementation of land use and management policy	23	19	39	63	16	13.2	27.1	43.7
		Low level of stakeholder participation	108	14	22		75	9.7	15.3	
		Top down approach of	119	21	4		82.6	14.6	2.8	

		government								
	Physical factors	High amount and long duration of rain fall	5	24	74	41	3.5	16.6	51.4	28.5
		Higher slope	7	17	33	87	4.9	11.8	22.9	60.4
	Technical factors	Poor quality of SWCMs	11	40	47	46	7.7	27.8	32.6	31.9
		Extensive farming system	113	21	10		78.5	14.6	6.9	
	Economic factors	unsecured property right/ land ownership	24	27	54	39	16.7	18.7	37.5	27.1
		Smaller farm size	8	67	69		5.6	46.5	47.9	

Source: Field Survey, 2018

6. Facts from Focus Group Discussion, Interview and Field Observation

6.1 Facts from Focus Group Discussion: According to the the information obtained from the focus group disscussion held with the Agricultural and Environmental Protection Office Experts of the study district, the types of SWC measures identified in the discussion were similar with that of identified in the respondents' response. The focus group discussion also indicated that trends of sustainability of SWC practices were not increased significantly; however, the sustainability varies depending on land ownership. Sustainability were better in government owned land, lower individual owned land and it is possible to say there was no sustainability in community owned land. Because of this insignificant level of sustainability community was not benefited to the required level.

6.2 Facts from Interview: According to the information gathered from the interviews held with Gubalafto District agricultural office head and the kebele chairmen (Ezet, Geshober and Dorogibr Kebeles), it was said that the SWC practices were introduced following the 1985 famine to rehabilitate the area by the food for work program through payments. In the past 10 years (2009-2018) 40976.9 and 150010.4 hectares of land were covered under the physical and biological SWC measures respectively, but the sustainability of these measures was below expectation.

6.3 Facts from Field Observation: In this study field observations was attended in the three selected Kebeles (Ezet, Geshober and Dorogibr) through prepared checklist related to the stated objective of the study in order to strengthen the reliability and validity of the data gathered through questionnaires**.** From filed observations similar and strengthening facts were observed with that of the facts identified in respondents' response, interview and focus group discussion.

7. Interpretation and Discussion

The objective of the study was well addressed in the questionnaire; the relevant information was also gathered from the focus group discussions and interviews. In the present interpretation part, the key findings from the results which were interpreted as important are stated below.

- The SWC practices were started after the 1985 famine to rehabilitate the area through food for work program by providing payments in the form of grains and oil.
- Both physical and biological measures were implemented for the last 32 years, but it lacks sustainability.
- Level of sustainability was found lower, based on ANOVA evaluation there were no significant variation among agro ecology, however there were remarkable variations among land ownership on the level of sustainability of SWC practices.

Standing from this fact it is possible to interpret that, the demographic characteristics and perception level towards SWC practices did not created variation on the sustainability of SWC practices whereas the property right played a crucial role on the level of sustainability of these practices. The contribution of low level of awareness, misperception of farmers, low level of stakeholder participation, top down approach of government and extensive farming system were higher for lower sustainability of SWC practices.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The study was conducted to assess the sustainability challenges of SWC practices in Gubalafto district of Amhara region. In the study area both physical and biological SWC methods were applied for the past 32 years in a scientific approach. In the study area there was low sustainability of SWC practices and there was no significant variation among agro ecological zones in the level of sustainability of these practices. However land ownership yielded remarkable variations. Low level of awareness of farmers, misperception of farmers, low level of stakeholder participation, top down approach of government and extensive farming system contributed much for lower sustainability of SWC practices.

8.2 Recommendations

Based on the conclusions made, the following suggestions or recommendations are forwarded to improve the sustainability of SWC practices in Gubalafto district for effectively addressing the challenges and constraints.

- Necessary measures must be ensured to increase awareness level of the community towards SWC practices and involving most of the stakeholders during all the working phases of these practices, this is very crucial, as this contributed for difference of opinions among the participants.
- Government institutions which hold a stake on SWC practices should follow the participatory approach and should secure property right on land resource.
- The attitude of ownership must be inculcated, whereby the farmers will be the custodian for protecting these measures and enjoying the benefits yielded.
- The District and Kebeles agricultural office should address the misperception and eliminate them by effective awareness creation.
- The farmers must be educated to adopt appropriate cultivation practices and to leave free grazing methods and adopt limited (rotational grazing) and cut and carry methods to prevent the degradation SWC measures.

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