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Assessment, Resources Characterization and Mapping of Ilasa Watershed in the Case of Goba Distinct in Highland of Bale Zone, Southeastern Ethiopia

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Abstract: Lack of baseline information on land degradation as well as major constraint for agricultural development one of the major obstacles to delivers appropriate technology given area based on agro ecological and farming system. The relevance of identifying Ilasa watershed problems is vital for better understanding, planning, and implementing of sustainable land management through integrated watershed management approach. Survey as well as delineation and mapping of the selected Ilasa watershed was conducted during 2016 fiscal year in Goba district of Bale highland southeastern Oromia, Ethiopia With the objectives of generate baseline information and document on biophysical, socio - economic characteristics in addition to mapping and delineation of a given watershed based agro ecological and farming system. The watershed was selected purposively based on the severity of land degradation. Moreover, during the study simple random sampling technique was used with multiple methods of data collection such as household surveys, field observations, Focus Group Discussion and key informant/experts interviews to gather information and sampling of households considering both upper stream and downstream. The results indicated that land degradation is one of the major challenging for production and productivity improvement and the capability of the livelihood of smallholder farmers. The study identified five major preliminary categories of land degradation from very low to very high to overcome these problems It can be concluded that Watershed assessment play a vital role in identifying major problems, its causes , intervention as well as come up with possible recommendations for the success of any development works on these watershed. Overall the results concluded that land degraded and biodiversity los was a serious concern, and watershed management programs needed to be continued and strengthened, an immediate short-term actions could be taken particularly participatory integrated watershed management were recommended.

Key words: Watershed · Characterization · Prioritization · Baseline

INTRODUCTION

The importance of watersheds as ecological units in the context of natural resource management and conservation cannot be overstated. A watershed is the landscape that contributes surface water to a single location, such as a point on a stream or river, or a single wetland, lake or other water body [1, 3].Watersheds provide a range of ecosystem services that are valued by the society [4, 5]. These include supporting services (e.g. soil formation, nutrients and primary production), provisioning goods and services (e.g. food, water, wood, fibre and fuel), regulating services (e.g. climate regulation, flood regulation and water purification) and cultural services, such as recreation and spiritual activities [6, 7]. Watershed projects in developing countries generally however focus on typically three objectives, namely, to conserve the natural resource base optimize agriculture with other natural resources and support rural livelihood to alleviate poverty [8]. For sustainable management of natural resources, various policies have been drafted, the most promising of which is the management of natural resources through participation of the local people [9]. Before conducting the implementation of soil

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conservation and watershed management problem identification with people participation make farmers more willing to accept these technologies. To develop a successful soil conservation programme, the review of socio-economic challenges in a watershed is essential [10]. This had led to an increase in the success rate of watershed management projects [11,12].

Non conservation strategies for cultivating on steep slopes were the initial cause of the problem of land degradation, soil erosion, deterioration of soil physical properties and a steady decline of soil fertility in watershed regions in tropical areas [13]. Similarly land use practice in the selected Ilasa watershed mostly subjected to without applying soil and water conservation measure which leads to the rapid degradation of soil productivity, while soil fertility declines rapidly. Understanding historical and present biophysical characteristics of the watershed is very important to develop action plans and intervention measures. The country has experienced watershed degradation due to rapid population growth and land use changes impacting negatively on biophysical, socio- economic and institutional arrangement on the environment in the country [14-16]. The declining soil fertility, poverty, deforestation, diminishing land holding and erratic rainfall patterns contributed toward watershed degradation [17].

According to [18] watershed degradation is influenced by land use methods and modification, high population, increase demand for food and rapid economic growth with negative impact on bio physical and, socio- economic and institutional arrangements. Therefore this project was initiated for the following objectives: to establish common understanding in integrated watershed management among the stakeholders though training; to delineate and map the selected Ilasa watershed based on agro-ecologies, farming system, and level of land degradation; to characterize, identify, prioritize and analyze biophysical and socioeconomic issues; to prepare action plans and intervention measures for the priority issues in the selected watershed with full community participation and to describe and evaluate the present resource use, management practices and socio-economic conditions in the watershed

MATERIALS AND METHODS

Characterization of the Study Area: The study was conducted at Goba districts in Ilasa watershed which is situated 25km away from Goba town of Bale zone of south eastern Ethiopia Where soil erosion, gully formation and loss of agricultural land are a serious problem for production and productivities in this area. It is geographically located at between UTM 40° 4’81’’E 6°59’29’’ N which is the Northern or the lower part of watershed bounded by walti Magida kebele to 40° 5’61’’ E and 6°57’21’’ N which is the upper or southern part of watershed bounded by barbare district , on the western part of watershed 40°41’13’’E to 60°58’24’’N wich is bounded by walti Qubsa kebele and 40°5’26’’E to 6°58’46’’N which is the eastern part of watershed bounded by wacho Misirge and Genearly having 500 to 600 msl in altitude (Fig. 1) and covering the total area of 506 ha.

Project Phase Analysis: The project was implemented in two Phases. The first phase was survey and planning phase which were implemented in three activity categories within the first period while the second phase was an intervention phase

Activity Category -1 Selection and Mapping of the Watershed: The map of the Ilasa watershed was developed and delineated Based on the preliminary outlet identified, the watershed boundary was delineated using primary data (GPS reading), Secondary data (Topographic map 1:50,000) and in consultation with the local communities. The delineated watershed was geo-referenced and digitized for its contour, roads, rivers, and other features. The preliminary delineated boundary was verified in the field and finally, map of the watershed were produced; other information such as elevation ranges, area, slopes and aspect was extracted.

Activity Category -2 Biophysical Resource Surveys: Based on the interpretation of land use land cover map and observation, Composite soil samples and one profile pit was sampled from different land use and land cover taking into consideration the topography, soil types and vegetation cover.

Activity Category -3 Socio Economic and Farming System Analyses: Surveying was conducted using structured questioner to identify the existing farming system and the associated opportunities and constraints of production. Important parameter for Socio economic and farming system database establishment was also collected. Survey conducted including group discussion, trend analysis, problem ranking to generate information and questionnaires were used to quantify important variables. SPSS computer software was used for socioeconomic data analysis. Based on the data obtained,

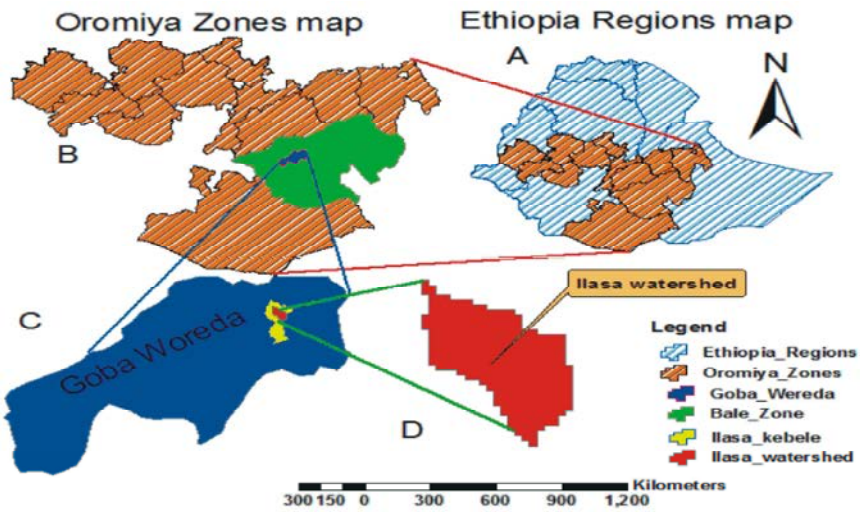

Fig. 1: Topographic map of Ilasa watershed of Goba district

statistical tools like cross tabulation, percentages, graphs, was used to analyze quantitative data. Generally After all the above data and information (Biophysical and socioeconomic survey) were analyzed, the problem which should be prioritized in the watershed was identified.

Data Collection

Data Types and Collection Methods: The data used for this study were collected from both primary and secondary sources. Primary data pertaining to demographic and socio-economic characteristics, participation in agricultural extension activities of farmers, whether practices or not soil and water conservation, major agricultural productivities and production constrains were collected from sampled farm households using structured questioner. Participatory problems identification through Close field observations both upper stream and downstream of Ilasa watershed were the process of the data collection and correction of major mistakes in data- recordings have been made by the investigator together with the respondents while data were being collected. Primary data collection took place between May and June 2016. To supplement the primary data secondary data were also gathered from concerned district Bureaus of Agriculture and Rural Development and from published and unpublished sources.

Sampling Technique: Farmer household survey was conducted to collect quantities data about biophysical and resource characteristic of Ilasa watershed. The study used multiple methods of data collection such as household surveys, field observations, Focus Group Discussant interviews (FGDs) and key informant/experts interviews to gather information and sampling of households along a vertical transect lines. Twelve (12) respondents for focus groups discussion were interviewed. The five (5) key informant respondents were drawn among the people with technical expertise and active role community issue. During the study simple random sampling technique was used to select sample respondent with some stratification based on watershed position considering both upper stream and downstream of the watershed and a total of 67 sample sizes were considered.

Data Analysis: The quantitative data collected through questionnaire based survey were entered into Statistical Package for Social Sciences (SPSS) computer program and analyzed using descriptive statistics as well as using various analytical tools based on the objectives of the baseline survey.

RESULTS AND DISCUSSION

General Socio-Economic Characteristics of the Selected Ilasa Watershed: The results (Table 1) indicated that regarding the general socioeconomic characteristics of households, such as age, educational attainments of the household head, family size, farm size, etc. Such characteristics help in knowing the community for planning an intended intervention for the implantation phase II of watershed management. These characteristics also determine the extent to which the community will adopt the intervention and can be helpful in devising a strategy for entering into the community development work.

Table 1: Total population characteristics of the selected Ilasa watershed community

Sex Category	Agro ecological zone Ilasa watershed
Total population	3,822
Male	1522
Female	1319
HH heads (land owners)	
Male	428
Female	51

Source: District Agricultural Development Offices

Table 2: Selected house hold characteristic in Ilasa watershed (N= 67)

	Descriptive Statistics			Frequencies	
Characteristic	Minimum	Maximum	Average	Frequency	In percent (%)
Number of house hold	1	13	7		
Gender respondent					
1. Male	65	-	-	65	97
2. Female	2	-	-	2	3
Mean average age of Household head	17	75	44	-	-
House hold family age categories					
1. 1-15 Male	-	4	2	-	-
2. 1-15 Female	1	4	2	-	-
3. 16-60 Male	1	6	2	-	-
4. 16-60 Female	1	6	2	-	-
5. Greater than 60 Male	-	1	1	-	-
6. Greater than 60 Female	-	-	-	-	-
House hold family size	1	13	7	-	-
Level of education house hold					
1. 1-6	-	-	-	32	47.8
2. 7-8	-	-	-	15	22.4
3. 9-10	-	-	-	9	13.4
4. 11-12	-	-	-	1	1.5
5. Greater than 12	-	-	-	1	1.5
6. Illiterate	-	-	-	9	13.9

Source: own computational result

Population, Age, Educational and Family Structure of the Community in Ilasa Watershed

Household Family Size Composition: The total population of Ilasa was 3,822 and out of which 39.82 % was male and the rest was female as presented (Table 1). Household size and characteristics are direct related to the supply and demand as well as also impact on watershed which in turn direct or indirect influence adopting integrated watershed management and also important in understanding the farming system of given watershed. The results (Table 2) indicated that among the sampled of 67 household the respondent stated (97%) of the heads of the household were male and 3% were female household head. The life of rural farm households mainly depend on agriculture which requires more labor for various activities like land preparation, planting, weeding, cultivation, harvesting, threshing, animal keeping, fetching water and fire wood and practices of any land management measure. The family size with age composition is important to carry out different agricultural activities. Larger family size with the productive age category is important in rural households to share the variety of agricultural duties. According to the survey result, the minimum and maximum family size of the sample farm households was 1 and 13 respectively.

Age Distribution of the Respondents: Age is one of the important characteristics of the community which plays a significant role in any kind of employment pattern, mobility and quality of work done, particularly in agriculture, because the use of child labor on the farms is quite high. The respondents are divided into three age groups (i.e. up to 15, 16 to 60, and above 60 years of age). The idea behind these classes is that the middle group (16-60 years) is the most productive age group in farming.

Table 3: Household land holding and Land use types Characteristic in Ilasa watershed (N= 67)

Characteristics	Frequency	In percent (%)
Own agricultural land		
1. Yes	66	98.5
2. No	1	1.5
Occupation		
1. Primary occupation		
1.1 Agriculture	67	100
1.2 Trade	-	-
1.3 Government worker	-	-
2. Secondary occupation	-	-
2.1 Agriculture	-	-
2.2 Trade	12	17.9
2.3 Government worker	-	-

	Minimum	Maximum	Average
Total land holding (ha)	0.33	7	2.9
Way of Land access			
1. Inherited	0.17	5	2
2. From government	-	5	1.98
3. Rent in	-	3	0.86
Land use type (ha)			
1. Cultivated land	0.13	5	1.93
2. Grazing land	-	2	0.46
3. Woodlot	-	17	0.75
4. Homestead	0.08	1.5	0.38
Distance of residence from farm land (km)	0.5	15	5.7

Source: own computational result

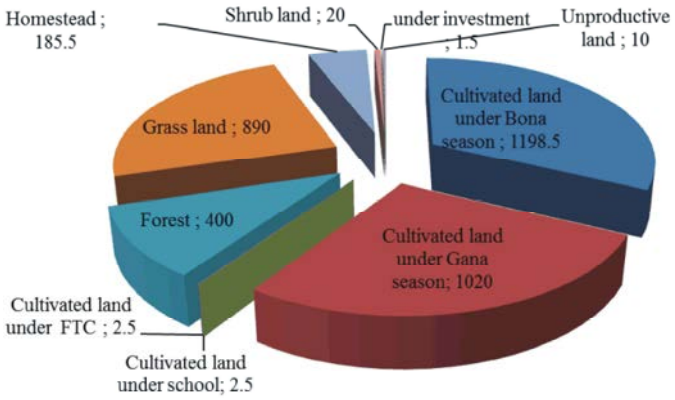

Fig. 2: Land use type characteristic of Ilasa watershed in hector

The results (Table 2) indicate that the distribution of respondents with respect to these age groups. The mean age of the sample respondent is 44 as well as the maximum and minimum ages of the sample household heads were 17 and 75 respectively.

Educational Background of the Respondent: The educational level of a person represents the development of character or mental Power which it helps the farmers in raising their understanding and the level of acceptance of, or receptivity to, new farming techniques. Education can also contribute to decision-making processes that alter the paths people take in life. The results (Table 2) indicated that, the majority of the respondents were found between the range of grade 1-6 which cover 47.8 % of the total sampled house hold followed by 7-8 which covers 22.4 % and Overall, the percentage of illiterates was about 13.9% of the sample farmers were found. Education is one of the influential socio-economic factors which play's considerable roles in the lives of the community.

Table 4: Major crop production and Cropping pattern in the selected Ilasa watershed

	Descriptive statistic			
Major Crop type grown in the area	Minimum	Maximum	Mean	Std. Deviation
1. Wheat				
Wheat area cultivated	0.17	4.00	1.24	0.97
Wheat total obtained	0.17	150.00	33.71	28.16
Wheat home consumption and seed	2.00	55.00	17.94	11.60
Wheat amount sold	.00	140.00	22.81	31.14
2. Barley				
Barley area allocated	0.17	13.00	0.75	1.74
Barley total obtained	0.17	160.00	15.09	20.62
Barley home consumption and seed	1.00	30.00	11.69	6.52
Barley amount sold	.00	12.00	4.21	4.19
3. Emmer wheat				
Emmer wheat area allocated	.00	2.00	0.41	0.34
Emmer wheat total obtained	.00	21.00	8.03	4.32
Emmer wheat home consecution and seed	.00	16.00	2.39	2.96
Emmer wheat total sold	.00	13.00	6.75	3.68
4. Faba bean				
Faba bean area allocated	0.17	1.00	0.36	0.26
Faba bean total obtained	1.00	10.00	4.55	2.37
Faba bean home consumption and seed	.50	4.00	2.59	1.24
Faba bean total sold	2.00	7.00	3.59	1.36
5. Field pea				
Fied pea area allocated	.00	.25	0.063	0.13
Field pea total obtained	.00	5.00	1.25	2.50
Field pea home consumption and seed	.00	1.00	0.25	0.5000
Field pea area total sold	.00	4.00	1.00	2.00

Cropping pattern	Frequency	Percent (%)
1. Mono cropping	48	71.6
2. Mixed cropping	3	4.5
3. Crop rotation	16	23.9

Source: own computational result

Land Use Type and Land Size Characteristic in Ilasa Watershed: Land is a major determinant of the farm income and control over land has a strong association with the adoption of new farming techniques. Farm productivity is closely related to the size of the farm [19]. The result (Table 3) indicated that the majority of the sample farmers (98.5 %) owned land size varies from 0.33 to 7 hector and on the average 2.9 hector of land holding. The most common livelihood activity of households is crop production. Cereals, pulses and oil seeds are major crops in terms of production and area coverage in that order. The choice of livelihoods strategies and farmers' land management practices, crop verities, and land use methods has impact on health of the watershed in terms of its continued productivity and sustainable with of the livelihood strategies [20]. It has been observed that the distance between the farmland and a homestead were one of the factors in land degradation particularly in maintaining soil and water conservation measure and field monitoring.

Table 5: Problem analysis constraint for crop production in the selected Ilasa watershed

Constraint	Rank
Shortage of land	6
Insects, disease, pest's	3
Climatic change	2
Land degradation	1
Lack of agricultural inputs	7
Shortage of improved crop varieties	5
High price of input	4

Source: own computational result

Major Crops and Crop Production Constraint in the Selected Ilasa Watershed: The result (Table 4) indicated that Crop production is one of the major agricultural activities undertaken by community in the selected Ilasa watershed. The main crop cultivated are cereals and legumes with low occurrence of horticultural practices mainly potato. The major cereal crop dominated was wheat followed by barely and emmer wheat and pulse crop faba bean and field pea commonly practiced in the

area. The most crops produced in the area are used for home consuming, seed while a few are sold in local markets as they came after threshing. In addition to crop production and livestock rearing, households also engaged in off-farm activities. The common type of off-farm income generating activities is petty trade. About 17.9 % of households in the area are involved in these income generating activities in addition to agricultural practices.

The results (Table 5) show that the major constraint for crop production in the area were land degradation, high price of chemical fertilizers, shortage of improved seeds, the existence of pests, diseases and weeds are also the problems of farm households in crop production and they contributed significantly to the low yield. As the result (Table 5) indicated that farmers were allowed to rank the major constraint for crop production was prioritized. Pair wise ranking methods was employed for further assess the main constraints existed in Ilasa watershed. Different constraints have been identified during this baseline survey as the factors challenging crop production and productivity. Among these land degradation, High price of input, shortage of improved crop varieties, weed, pests and disease and climatic change are the common in the selected Ilasa watershed.

Livestock Production and Feeding Source Characteristics in Ilasa Watershed: The major livestock feeding source in the selected Ilasa watershed were presented in Table 6. The feeding source in the study watersheds is dominantly crop residue (73.1%) followed by all source followed (Crop residue, grazing land and hay) which cover 17.9% of the total feed source in the area. The contribution of communal grazing land was lower these is because of shortages of grazing land occur due to expansion of crop lands due to increased population as well as degradation of the land current local community holds

The result (Table 8) indicated that farmers were allowed to rank the major constraint for animal productions were prioritized. Pair wise ranking methods was employed for further assess the main constraints existed in Ilasa watershed. Different constraints have been identified during this baseline survey as the factors challenging animal production. Among these Animal feed shortage, disease, marketing, lack of improved genotype and low animal by product are the common in the selected Ilasa watershed. It can be concluded that to overcame such problem farmers awareness creation on conserve feed resource and improved forage technology important, introduce improved forages, feed system and management like feed trumping techniques and multiplication improved forage from small to large scale farming for the community in Ilasa watershed important.

Beekeeping Status and Trend in Ilasa Watershed: The results (Table 9) of baseline survey was indicated that in Ilasa watershed, beekeeping was practiced by some farming community but much attention was not given in order to improve their income livelihood from the sale of honey and nutrition and employment opportunities. However the honeybee colony holding per household, trend of beekeeping and honey production became decreased. These changes were attributed due to reduction in honeybee floral resources, increase in agrochemicals and increase in pests and predators attack, lack of beekeeping equipments and lack of farmer's awareness in solving constraint of beekeeping at watershed level. Therefore, it can be concluded that the improvement of the beekeeping in the study sites demands the commitment and action of stakeholders (Farmers, development practitioners, researchers, policy makers, etc.) to change the influence of the various driving forces for the better.

Topography and Slope Characteristic of Ilasa Watershed: The effects of topography on land degradation depends on the effects of slope steepens and slope length. According to [21] reported that ground flat slope is important when considering overall transportation of soil particles. The size and shape of the drainage area and generally its slope major affect runoff rate and velocity.

Sub Watershed Characteristic in the Selected Ilasa Watershed: The baseline survey, mapping and delineation results (Figure 2) indicated that in Ilasa watershed covering 506ha divided into six sub watershed which helping in planning and understanding from which surface runoff potential enters the rive or its tributaries and also cause for land degradation as well as gully formation in the area.

Vegetations Cover Characteristics in the Selected Ilasa Watershed: Vegetation coverage great contribution in interception rainfall, keeping sediment loss and manage soil fertility. Juniperus procera, Eucalyptus, Olea europace, Hagenia Abyssnica, cordial africana, cuppressus and other shrub as well as bush encouragement are grown in the area. However most on

Table 6: Major farm animals' potential in the selected Ilasa watershed

	Total number owned by the household		
Livestock type	Minimum	Maximum	Mean
Cows	1	6	2
Heifers	1	3	2
Oxen	1	6	3
Sheep	2	20	7
Goats	-	10	3
Donkeys	1	5	2
Horses	-	5	2
Poultry	1	21	5
Beehives	-	14	4

Source: own computational result

Table 7: Characteristics of respondent on livestock feed system in the selected Ilasa watershed

Categories	Frequency	Percent (%)
Own grazing land		
Yes I have	42	62.7
No I haven't	25	37.3
Source of animal feed		
Grazing land	3	4.5
Crop residue	49	73.1
Fodder	1	1.5
Hay	2	3.0
Grazing land, crop residue	12	17.9
Feel enough animal feed		
I believe that feed is enough	3	4.5
I believe that feed is not enough	64	95.5
Feed shortage season		
dry season	21	31.3
wet season	18	26.9
All year	27	40.3
Reason for animal feed shortage		
Population	3	4.5
Degradation of grazing land	8	11.9
Agricultural expansion	45	67.2
Degradation of grazing land ,agricultural expansion	11	16.4
Reason for animal feed Sold		
Purchase of agricultural input (fertilizer, seed and hire labor)	23	34.3
Purchase of food grain for house consumption	5	7.5
Because of their low productivity (low milk yield)	4	6.0
Shortage of animals feed	18	26.9
House hold income (taxi, school fee)	5	7.5
Purchase of agricultural input (fertilizer, seed and hire labor), Purchase of food grain for house consumption and House hold income (taxi, school fee)	9	13.4

Source: own computational result

Table 8: Problem analysis constraint for animal production in the selected Ilasa watershed

Constraints	Rank
Animal feed shortage	1
Disease	4
Marketing	3
Lack of improved genotype	2

Source: own computational result

Table 9: Beekeeping characteristics in the selected Ilasa watershed

Categories	Frequency	Percent (%)
Whether the respondent practices beekeeping		
yes I have	11	16.4
No I haven't	53	79.1
Total	64	95.5
Types of beekeeping		
Traditional	10	14.9
Movable frame	2	3.0
Total	12	17.9

Source: own computational result

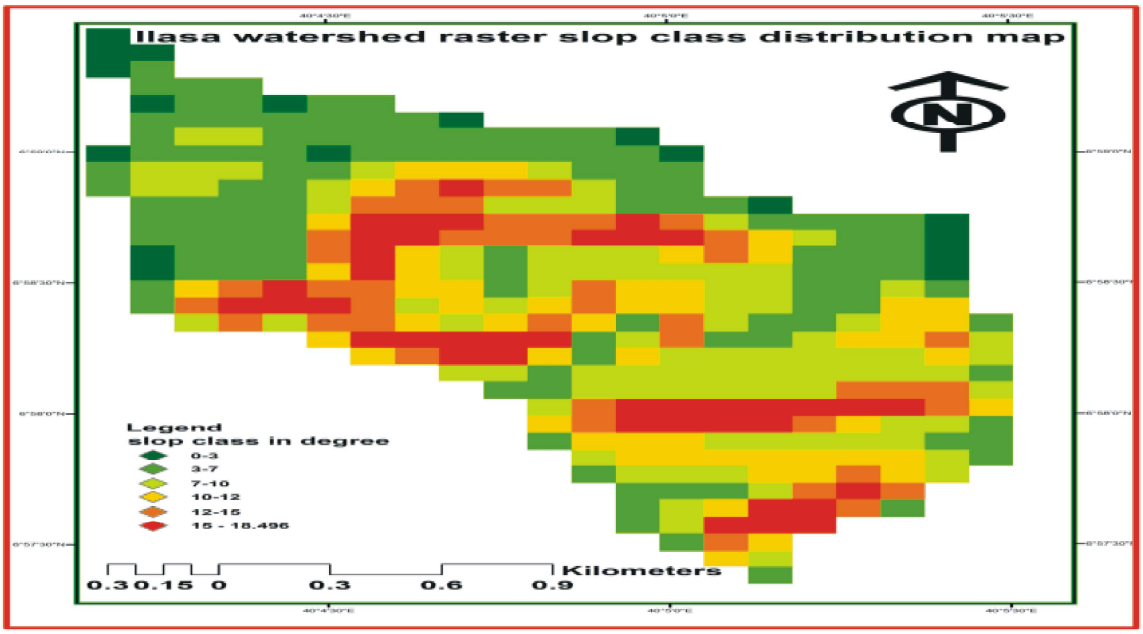

Fig. 3: Physical characteristics of slope class map in the selected Ilasa Watershed

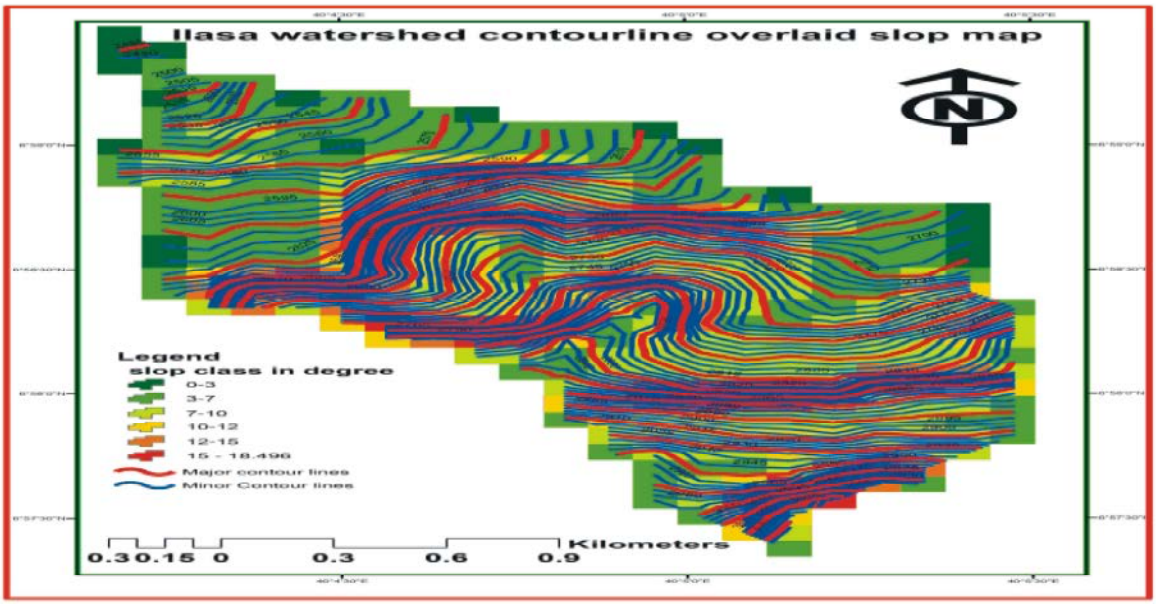

Fig. 4: Physical characteristics of slope class map with contour line in Ilasa Watershed

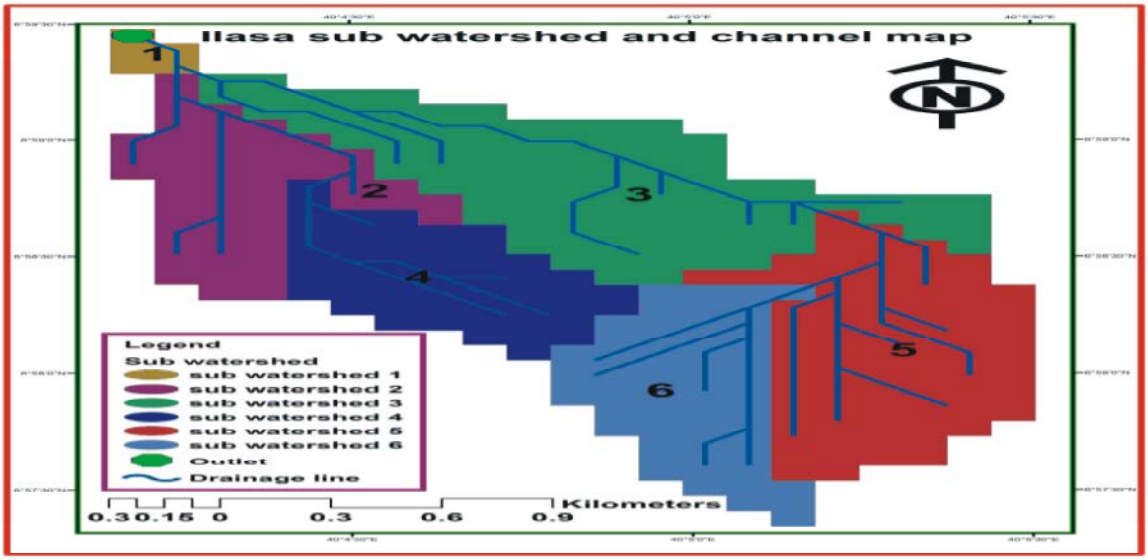

Fig. 5: Physical characteristics of Sub watershed map in Ilasa Watershed

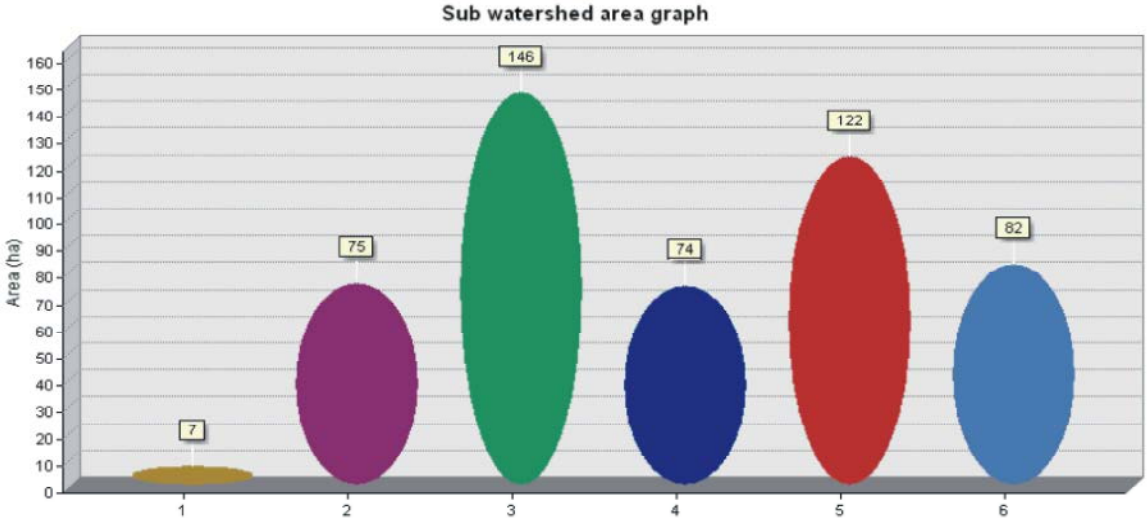

Fig. 6: Sub watershed characteristics area coverage in Ilasa Watershed

the indigenous tree exposed to deforestation for fire wood, construction and agricultural expansion. According [22] assessment reported show that globally around 13 million hectors of forest were converted to other uses or loss through natural as well as anthropogenic activities that cause reeducation in forest area coverage and indigenous species.

Land Degradation and Cause of Land Degradation Characteristics in the Selected Ilasa Watershed

Soil Erosion Characteristic in Ilasa Watershed: The rates of soil erosion become serious due to topography land features and anthropogenic factor that particularly related to farming activity that carried out without proper management practices as well as deforestation. According to [23] reported that land degradation encompasses the whole environment but includes individual factors concerning soils, water resources (Surface, ground), forests (Woodlands), grasslands (Rangelands), croplands (Rain fed, irrigated) and biodiversity (Animals, vegetative cover, soil). Similarly this survey indicated that in Ilasa watershed, soil erosion is regarded as one of the major and most widespread forms of land degradation, which is a severe limitation to sustainable agricultural land use. The results (Table 11) indicated that the main causes for soil erosion were both natural and anthropogenic

activities such as poor farming system, grazing, topography and deforestation are the main cause of soil erosion in the watershed. In addition to identification of major land degradation cause farmers were allowed to rank the major causes for land degradation were prioritized. Pair wise ranking methods was used for further assess the main causes existed in Ilasa watershed. Different causes have been identified during this baseline survey as the factors challenging production and productivity in the area. Among these poor farming system, deforestation, lack of soil and water conservations measure and topography are the common cause for land degradation in the selected Ilasa watershed.

Table 10: Characteristics of respondent on tree planting in the selected Ilasa watershed

Categories	Frequency	Percent (%)
Practices tree planting		
Yes	39	58.2
No	28	41.8
Purpose of tree planting		
Fire wood	2	3.0
Construction	20	29.9
Source of income	5	7.5
Environmental mgt	2	3.0
Construction, source of income	5	7.5
Fire wood, construction	5	7.5
Place the farmer plant tree		
Farm land	5	7.5
Homestead	20	29.9
live fence /boundary planting	10	14.9
Homestead, Live fence	4	6.0
Tree species the farmer prefer		
Juniperus procera	4	6.0
Eucalptus	10	14.9
Olea europace	1	1.5
Hagenia, cordia, Junpers, olefera	6	9.0
Juniperus procera and Olea europace	7	10.4
juniporus, Haginia, fodder & frut trees	10	14.9
Plan to plant more tree		
Yes	40	59.7
No	1	1.5
Major challenge on natural forest		
Deforestation for fire wood, Tiber and construction	40	59.7
Agricultural expansion	5	7.5

Table 11: Characterization and analysis causes for land degradation in the selected Ilasa watershed

Constraints n	Rank
Poor farming system	1
Deforestation	3
Lack of SWC measure	2
Topography of land	4

Source: own computational result

Characterization of Erosion Types Exist In the Selected Ilasa Watershed: In Ilasa watershed, there are three types of soil erosion which include sheet erosion, rill erosion and gully erosion occurred in the area that covered different percentage as indicated (Figure 7) the result shows that rill erosion cover large portion which is 46.3% that changed to “master rills” results gullies formation in the area which is one of the major land degradation in the area followed by gully erosion which covered 31.3 % of soil erosion type occurred and the other on is Sheet Erosion which covered (19.4%). According to [24] report rill erosion is a result of surface runoff and associated sheet wash, which selectively removes fine material and organic matter that are very important determinants of land productivity. Therefore to overcome such problems improved individual responsibility around the issue of soil degradation (Planting of trees and grass waterway in individual homesteads, farm field and hill side) very important

Gully Characteristics in Ilasa Watershed: In Ilasa watershed the gully type was increased both the length and density over time and shows severities in the watershed. Most gullies were on cultivated and steep slope areas and along the natural drainage routes.

Soil and Water Conservation Intervention: Sample households started to practice soil and water conservation measures in their cultivated land. Soil band was the most common type and followed by check-dam. The implemented soil and water conservation measures were not that much effective in reducing soil erosion. This is mainly due to poorly constructed structures and absence o soil water conservation structure on the upper stream of the watershed and the constructed structure were not supported by biological measures, many of them have collapsed. This study also similar with [25] who reported that the Ethiopia highlands have been exposed to soil fertility decline and severity of soil erosion due to intensive farming on steep slope of land.

Participation: Community participation in any development work is one of the most factors assumed for the fruitful work. These baseline surveys during planning phase (I) also give much attention on participatory problem, opportunity and interest of local community involvement in the implementation phase (II) identifications through group discussion, field visit and interview in during planning phase (I) of these study.

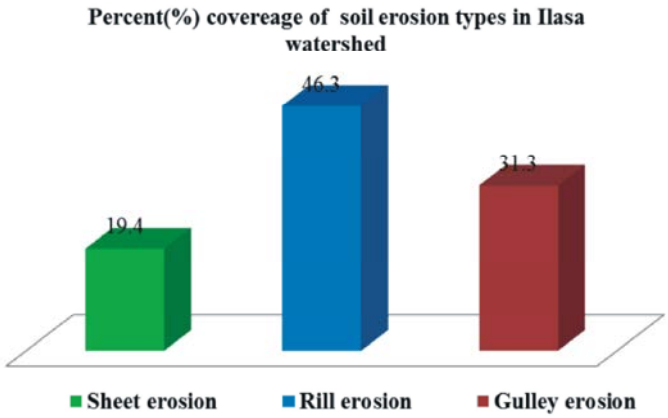

Fig. 7: Soil erosion type percentage coverage in Ilasa watershed

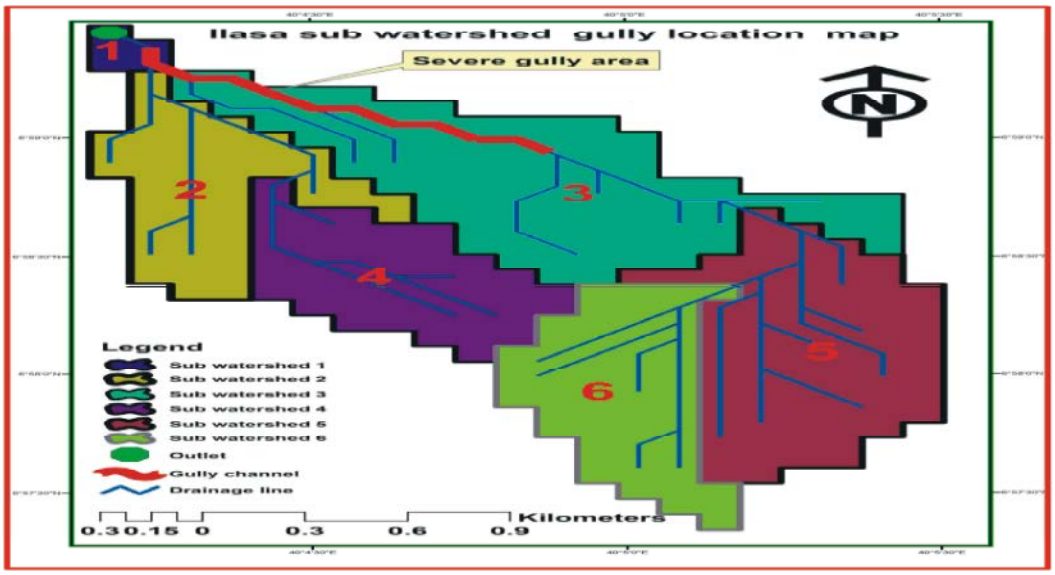

Fig. 8: Gully characteristic map of Ilasa watershed

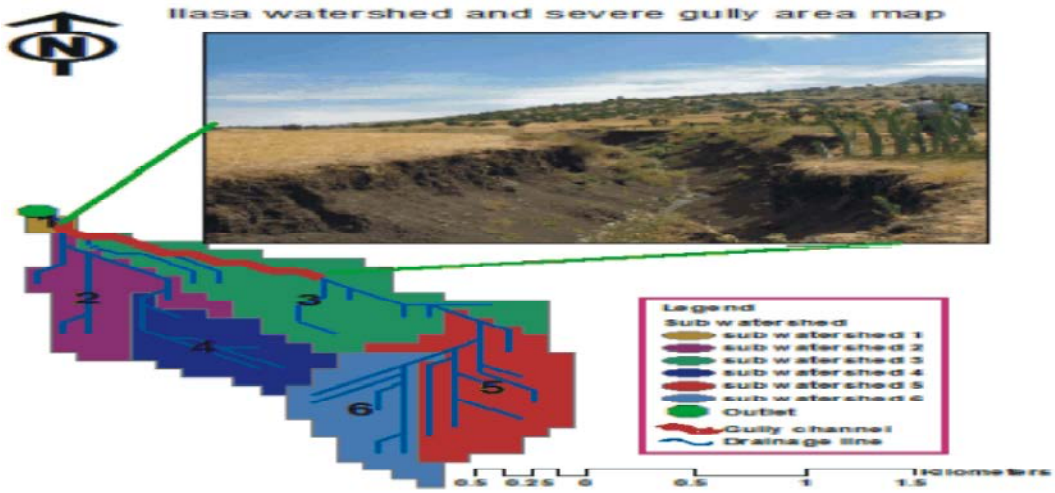

Fig. 9: Gully severity and channel characteristics map of Ilasa watershed

Table 12: Farmers' characterization on capacity building and whether apply swc

Categories	Frequency	Percent (%)
Farmer sources of information on agricultural technology		
From experience	4	6.0
Neighbors	2	3.0
Development agent (DA)	18	26.9
Research center	3	4.5
NGO	2	3.0
Agricultural office	27	40.3
From experience, Neighbors, DA, Research center , NGO	10	14.9
Contact of Farmer with development agent (DA)		
Limited	38	56.7
Good	22	32.8
very good	7	10.4
Whether the farmer participate on training		
Yes I take training	34	50.7
No I haven't take any training	33	49.3
Partner give training for the farmers		
Agricultural office	23	34.3
Research center	10	14.9
NGO	3	4.5
Whether Apply SWC measure on his farmland		
1. Yes	12	17.9
2. No	55	82.1

Source: own computational result

Table 13: Farmers' perception on adoption of the newly introduced technology

Categories	Frequency	Percent (%)
I will pay to use the new techniques very quickly	45	67.2
I will prefer to stay with the old techniques for a few years until other farmers have tried it	18	26.9
I am always reluctant to switch to the new techniques even if other farmers have proved its usefulness	4	6.0
Total	67	100.0

Fig. 10: Group discussion with local community at Ilasa FTC

The results (Table 13) indicated that among the sampled of 67 household the respondent (67.2%) will pay to use the very quickly the newly will be introduced integrated watershed management technology in Ilasa watershed. Involvement of farmers in problems, gap and opportunity identifications at watershed levels increases their awareness on natural resource management in the watershed which is similar founding was reported [26] who stated that participation of farmers in mapping soil erosion at catchment level creates farmers awareness on soil conservation.

CONCLUSION AND RECOMMENDATION

The cause and impact of land degradation in Ilasa watershed had been investigated using various techniques highlighted in the study. It was observed that in addition to the nature of the topography of the land anthropogenic (Human induced) factors were a great contribution the land degradation that challenging the residents properties and their livelihoods. Field observation during these studies indicated that runoff, that cause server gully formation hinders the production

and productivities of the local community. It can be concluded that Watershed assessment play a vital role in identifying major problems, its causes , intervention as well as come up with possible recommendations for the success of any development works on these watershed. Overall the results concluded that land degraded and biodiversity los was a serious concern and watershed management programs needed to be continued and strengthened, an immediate short-term actions could be taken particularly participatory integrated watershed management were recommended.

Recommendation: Awareness creation and strength capacity on improve the livelihood of the rural communities through integrating crops, livestock and natural resource management technologies while sustaining the natural resource base such as soil and water conservation measure, planting multi propose tree, grass stripping, improved forage grass, conserve animal feed resource and use of modern beehives in order to improve beekeeping trend that improve the livelihood of the community.

Participatory Implementation of degrade land rehabilitation in the watershed particularly construction of integrated physical and biological soil and water conservation measure such as Cutoff drains, graded Stone Bunds, Graded soil bunds, grass waterway planting of multipurpose trees through participatory approach

Participatory Gully Rehabilitation and reclamation for sustainable watershed management construction and gully treatments such as cutoff drain, waterways, gully reshaping and filling, Brushwood check- dam, loose stone check- dame, Gabion check- dam, sand bag check- dam and gully bed and sidewalls plantation with water loving or moist tolerant tree, shrub and grass.

Organizing young and land less in the watershed on beekeeping practices and support both technique as well as also finically to ensured integrated improved beekeeping as income initiation for watershed management in addition to their improve their livelihood.

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