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Socioeconomic Characterization, Identification and Prioritization of Major Constraints and Potentials in Tulu Harbuki Micro watershed, Lalo Kile District, Kellam Wollega, Oromia

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ABSTRACT

In many Countries, watershed development plays a significant role in rural development and natural resource management plans. The baseline survey study is crucial to address biophysical and socioeconomic-related issues before CALM P4R implements its community-based participatory integrated watershed management program at a chosen watershed. The goal of the study was to evaluate the socioeconomic situation, potential, and constraints of the chosen watershed, to evaluate the biophysical data of the model watershed that was documented, and to prioritize issues for interventions in the model watershed that were indicated in the Tulu Harbuki Micro watershed for further improvements to promote sustainable and productive livelihood through the integration of different watershed components in a participatory approach. Household interview and biophysical resources assessment followed by watershed mapping techniques were used for the data collection. Purposive sampling methods were used to select 36 households in the watershed. Descriptive statistics by frequency distributions means and percentage and diversity indices were used for data analysis. The findings showed that problems with soil erosion, deforestation, and soil fertility, as well as termites, were the main causes of land degradation. Crop diseases and a lack of agricultural inputs (fertilizers and better varieties) were two of the area's biggest issues. The following interventions were suggested as part of the watershed management programs: Soil erosion control measures, soil fertility enhancement activities, SWC practices, the planting of niche-compatible multipurpose trees, home garden Agroforestry, and other treatments. Once more, participatory integrated learning should be used to increase rural communities' awareness of and capacity for integrating natural resource management technology for effective soil and water conservation measures.

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INTRODUCTION

In many countries, watershed development is a crucial part of rural development and natural resource management methods. It may have started with any community-based participatory integrated watershed management program must be implemented in order to address linked biophysical and socioeconomic problems. This requires a thorough understanding of the concept of a watershed and the variables that contribute to its degradation. A watershed is defined by Langbein and Iseri (1960), and Kerr (2007) as any surface area where runoff from rainfall is collected and drained through a single confluence point. A watershed is formed by the natural resources in a basin, especially the components of the water, soil, and plants. A watershed is made up of people, their farming system, including their livestock, interactions with the resources of the land, coping strategies, social and economic activities, and socioeconomic cultural traits. Rapid population expansion and changes in land use have had a severe influence on Ethiopia's biophysical, socioeconomic, and institutional arrangements for the environment, resulting in watershed degradation (Tiffen et al., 1994; GOK, 2012). Watershed degradation was caused by dwindling soil fertility, poverty, deforestation, shrinking land holdings, and irregular rainfall patterns (Muriuk et al., 2005). According to (Wamalwa, 2009), land use practices and modifications, a large population, rising food demand, and rapid economic growth have a detrimental impact on biophysical, socioeconomic, and institutional arrangements and cause watershed degradation. As a viable unit of intervention for integrated natural resource management in rainfed systems, watershed management is becoming more widely acknowledged. Integrated management of soil and water resources is essential in marginal rainfed areas where the resource base has been degraded in order to increase agricultural output and boost human wellbeing. However, (Gebregziabher et al., (2016), and Kristin et al., 2015) asserts that the effectiveness of watershed development work depends on acknowledging the social components of watershed management as it brings about concerns relating to human development, such as poverty and sustainable livelihoods.

The baseline survey study for the CALM P4R program was carried out at a chosen watershed to determine the socioeconomic status, potential, and constraints, evaluate biophysical data, and prioritize issues for interventions in the Tulu Harbuki Micro watershed model for further improvements to promote Sustainable and productive livelihood through the integration of different watershed components in participatory approach. Data collecting methods included household interviews, a biophysical resource assessment, and watershed mapping techniques were used.

RESEARCH METHODOLOGY AND DESIGN

General description of the area

This study was conducted at Tulu Harbuki Micro watershed of Lalo Kile District, Kellem Wollega Zone of Oromia National Regional State (ONRS), Ethiopia (Fig. 1). The watershed is geographically located between 35^0 18' 21''& 35^0 17' 27'' E and 8^0 58' 53''&9^0 01' 36''N**.** It is found at the North of Lalo town, the capital of Lalo Kile district at the distance of 13.6 km.

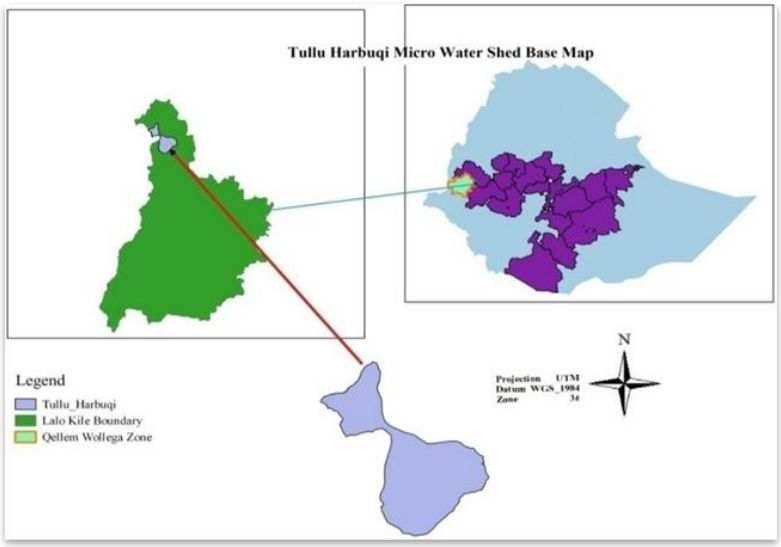

Figure 1. Tullu Harbuqi community watershed

Sampling procedures and sample size determination

Tulu Harbuki Micro watershed was purposely selected from Lalo Kile district. Households for interview were selected randomly in the watershed. Population size of the study was determined Sample size was calculated with the simple random sampling method based on proportional to population size using (Yamane, 1967) formula presented below-

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

n= sample size, N= population size and e=sampling of error (5%). Based on this technique, sample size of households was selected in the community watershed. Accordingly, total sample size 36 were selected and interviewed at Tulu Harbuki Micro watershed.

Methods of data collection and type of data collected

The data was collected at the household level using structured questionnaires. Both secondary and primary data were collected and used in this study. The main sources of secondary data were published and unpublished documents and reports and past case study papers. Meteorological data obtained as well as web-based sources of reports, studies, journals and articles. Primary data were collected using various instruments such as key informant interview using semi-structured checklist, group discussion and expert interview, unstructured questionnaire and field observation of events in the different concerns of watershed management.

Data collection

The input of all inquiries from each individual and focus group checklists' data were collected for analysis. Information was collected from households using a questionnaire, which comprised nine modules: Basic information on household composition and characteristics were collected. Age, gender, HH size, land holding, level of education, marital status, role of HH, role of HH were collected. Land use pattern, farm and nonfarm asset ownership, crop production in the watershed like major crops grown in the watershed, general plot

information, input used, agronomic practices, crop marketing, livestock production and marketing: Livestock ownership, product and marketing, & livestock feed sources. Household income and livelihood diversification includes; household income sources and its share to the total contribution. Natural resource management (NRM), Extension service, information source and saving and credit access as well as Major Constraints and potentials/opportunities in the watershed were assessed.

Method of data analysis

The collected data were checked, arranged, coded and entered using Microsoft excel and analyzed using statistical Package for Social Science (SPSS version 26.0). Both quantitative and qualitative methods were used in analyzing the information collected using different instruments. Qualitative data obtained using semi-structured questionnaire; interview, observations, focal group discussion and document analysis were analyzed qualitatively using appropriate words and with other qualitative data analysis methods such as thematic analysis and others. For quantitative data, descriptive statistics such as percentages and frequency were employed to analyze the gathered data. Also, the data generated through quantitative method was organized and statistical computations were made to explore the inherent relationships among the different variables. The sample type frequency, summary statistics (mean, standard deviation, percentage, tabulation and others), and cross tabulation were displayed. Pair wise ranking also were used to analysis the farmers constraints in socioeconomic conditions and resource-use patterns of the watershed.

RESULT AND DISCUSSION

Socio-economic characteristics of the respondents

Table 1. Age, family size, land holding of sample household respondents (n = 36)

Variables		Total
House hold Age	Mean	36.32
Family size	Mean	4.5
Land holding	Mean	0.54 h

The age of the sampled household heads had a range from 20 to 60 years and the average age of the sampled household heads was 36 years (Table 1). This means that, on average, smallholder farmers in the study areas were relatively middle-aged household that participated in interviewed. Age of the household was found to be positively associated with adoption of watershed management program. This result in line with the study by (Menegaldo *et al.,* 2023) as Middle age strong labor required to maintain SWC activities than old one. The average family size of the sample farm households was 4.5. This result was relatively lower household size than national household average size of 5.1 members per household (CSA, 2007). Average land holding size of households in the study areas was 0.54 ha. As reported by sampled households of an area, Land shortage is among the priority problems faced by farmers at an area for agricultural production. With respect to gender of the household heads of an area, the result indicated that out of the total 36 sample respondents, 56.1% of them were male while the rest 43.9 % of them were female. The result revealed that the percent of male headed households of participated in watershed were higher than that of female headed households.

Table 2. Gender, marital status and educational levels of HH of respondents (n = 36) at Tulu Harbuki Micro watershed

Gender of HH	Percent%	Education level of HH	Percent%
Male	56.1	Uneducated	16.9
Female	43.9	Informal Education	17.5
Total	**100%**	Grade 1-4	19.5
Marital status of HH		Grade 5-9	18.5
Married	90	Grade >10	26.9
Widowed	6	**Total**	**100%**
Diverse	3	**Labor contribution**	
Single	1	100%	35.7
Total	**100%**	75%	10.9
Role of HH		50%	15.1
HH head	70	25%	16.4
Spouse	18	10%	20
Son /daughters	12	No	1.9
Total	**100%**	**Total**	**100%**

The mean of marital statuses of the married household Head was higher in percentage (90(%) at an area (Table 2). With respect to educational status of sample household head; of the total 36 respondents, 16.9% were uneducated, 19.5 % Grade 1-4, 8.5% Grade 5-9, 26.9% Grade >10 and 17.5% respondents were Informal Education respectively. A better educated farmer can easily understand and interpret the information transferred to them by development agents and others. With regard to own farm labor contribution of House hold Heads at an area 35.7 % of the respondents were own labor, the remaining others was family labor. Again, the role of house hold were 70% household head, the others were 18% Spouse and 12% were Son/ daughter. Results of this study indicated that the farming systems are mostly done by house hold head because of the responsibilities has given to head of household in the watershed families members and presented in Table 2 above.

Land use pattern, farm and non-farm asset ownership

Land ownership

The frequency distribution of respondents interviewed with regard to major land use patterns of study area indicate that 33.5% of land was allocated for annual crops, 20.2% perennial crops (especially coffee, and to some extent enset and khat), 13.0 % wet land, 9.8 % Rented out/ Shared out, 8.2 % fallow land, 6.1 % grazing, 5.7 %plantation (mainly Eucalyptus) and 3.4% was natural forest in the watershed (Table 3).

Table 3. Land use patterns of respondent households (n=36)

Land use patterns	Frequency	Percent (%)
Own land allocated for annual crops	12	33.5
Rented out/ Shared out	4	9.8
Land allocated for perennial crops (coffee, enset, khat…etc)	7	20.2
Fallow land	3	8.2
Land allocated for grazing	2	6.1
Wet land	5	13.0
Plantation/e.g. Eucalyptus/	2	5.7
Natural forest	1	3.4
Total	**36**	**100%**

Farm tools and non-farm assets ownership

Household assets are an indicator of household's wealth and resilience during shocks and crises. Household assets are usually as stocks of capital that are exploited when they are vulnerable to various shocks. For instance, during hunger months, farmers sell or exchange their household items for money and food. This predisposes further to biting and spiral poverty. The study indicated that most of selected household has corrugated roof house (86.1%), and more hoe (55.6 %), Hat roof house (50%) and axe (50%) at an area than other some assets. However, this study showed that all selected households at an area has no some household tools such as Motorized mill, Wheel barrows, Bajaj, Motor bicycle and Energy saving stove.

Table 4. Farm tools and non-farm assets ownership of selected households at study area (n = 36)

Items	Yes	No	Minimum	Maximum
Corrugated roof house	86.1	13.9	1	2
Hat roof house	50	50	1	2
Additional house at nearby town	8.3	91.7	0	1
Spade	38.9	61.1	1	2
Hoe	55.6	41.7	1	3
Axe	50.0	50.0	1	2
Machete	44.4	55.6	0	1
Water pump	2.8	97.2	0	1
Horse/donkey pulled cart	2.8	97.2	0	1
TV	2.8	97.2	0	1
Radio (Functional)	22.2	77.8	0	1
Mobile phone	38.9	61.1	0	1
Solar power	19.4	80.6	0	1
Knapsack spray	2.8	97.2	0	1
Water Can	5.6	94.4	0	1

Major crop production in the watershed

The Smallholder farmers in Tulu Harbuki community watershed grow a number of food crops per unit farm whether through simultaneous or sequential inter-cropping systems. Subsistence rain fed crop production is the main economic stay that the community makes its livelihood rely on. The major agricultural crops grown by most of the micro/community watershed selected farmers are Maize (100%), Finger millet (97.2%), Sorghum (94.4%) and Coffee (91.7%) (Fig.2). Except Coffee, those cereal crops are produced mostly for household consumption and have a minor share for market. Some farmers also produce Tomato (11.1%) through rain fed and traditional irrigation at study area. Apart from annual field crop and vegetable production, perennial crop (fruit trees) growing is accustomed particularly around homesteads. The major fruits produced in the watershed are Avocado, Banana and Mango. Coffee is also one of the major perennial crops produced in the selected watershed.

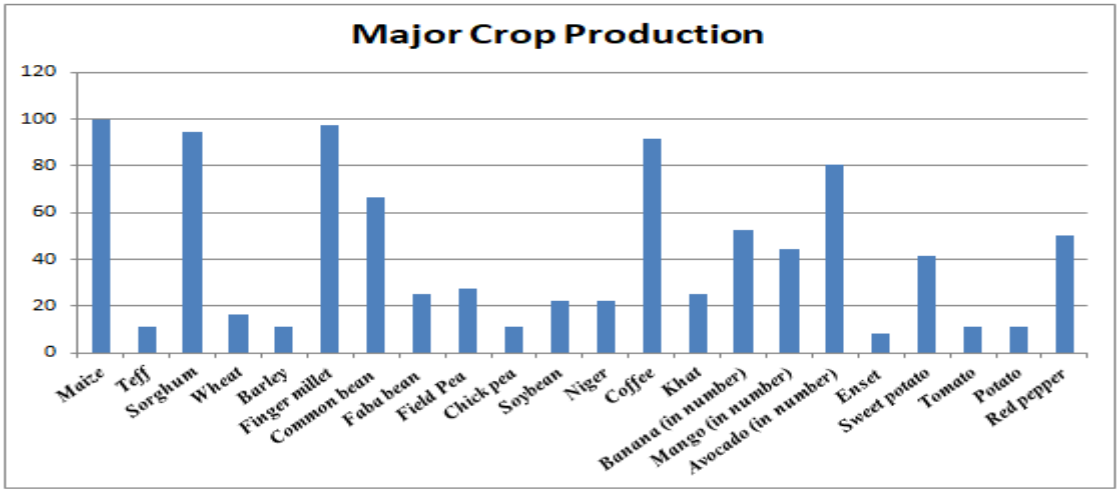

Figure 2. Major Crop Production

General plot information of farm in the watershed

Land ownership

The average land size owned by the selected households in the watershed is 0.54 ha. From these, about 82.7% is owned by household family villages. The rest (17.3%) was shared for farming in the selected watershed. According to selected farmer's perception in the watershed, the major soil color, slope, soil fertility and soil erosion of farms in the watershed were, red (90.6%), medium (57.4%), low (56.9%) and severe respectively (Table 5). This may indicate the need of intervention in the watershed.

Table 5. Plot information of farm in the watershed (n= 36)

Farm plot information		**Total**
Ave. land size(ha)	Variables	0.54 ha
Land ownership	Owned	30(82.7%)
	Shared/rented in	6(17.3%)
Total		36(100%)
Soil color	Red	33(90.6%)
	Black	3(9.4%)
Total		36(100%)
Plot slope	Flat	7(18.3%)
	Medium	20(57.4%)
	Steep	9(24.3%)
Total		36(100%)
Soil fertility	Low	20(56.9%)
	Medium	15(42.6%)
	High	1(.5%)
Total		36(100%)
Soil erosion	Slight	(10.4%)
	Moderate	(28.7%)
	Severe	(60.9%)
Total		**36(100%)**

Four (4) primary crops, including maize, sorghum, finger millet, and coffee, accounted for 65.2% or more of the farms in the watershed. Of which the local variety was grown in the watershed (80.7%). The average yield per plot, measured in kilograms, was 281.8kg.

Input used

Farmers in the watershed were more used local variety (80.7%) at an average of (17.7 kg) and some other improved technologies such as NPS (15.7kg) and Urea (14.8 kg) per hectare at an area (Table.6). Within their more practiced Conventional farm, farmers in the watershed also used Herbicide at an average of (0.576 lit). The higher Farmers use of local crop varieties in the watershed comprise of the total Shortage of cash, price of fertilizer, absence of credit facilities and timely provision of chemical fertilizer are among the factors that constrain the use of chemical fertilizer.

Table 6. Inputs used in the watershed

Inputs used	Total
Average seed (kg) used/ha	17.7 kg
Average NPS (kg) used/ha	15.7kg
Average Urea (kg) used/ha	14.8 kg
Conventional used	166.6%
Herbicide used	0.576 lit

Table 7. Agronomic practices in the watershed by farmers (n = 36)

Farmers perception on practices		Mean (%)
Inter cropping	Cereals –Pulse	55.9
	Cereal-cereal	1.7
	Others	42.4
Total		36(100%)
Mono cropping	Yes	13
	No	87
Total		36(100%)
Crop rotation	Cereals –Pulse	30.2
	Cereal-cereal	64.2
	Others	2.8
Total		100
Home garden	Yes	54.4
	No	45.6
Total		36(100%)
Sowing method	Row planting	(39.5%)
	Broadcasting	(65.9 %)
Total		36(100%)
Tillage practice	Conventional	(83.3%)
	Conservation	(16.7 %)
Total		36(100%)
Crop residue left	0%	(40.1%)
	50%	(52.0%)
	100%	(7.9%)

Agronomic practices

Mono cropping, inter cropping, crop rotation, home garden, sowing method, tillage practice, and crop residue left were used by respondents in the watershed (Table.7). Inter cropping practice of cereals–pulse (55.9%), Crop rotation (cereal-cereal (64.2%), Home garden (54.4%), Broadcasting Sowing method (65.9 %) and Conventional tillage practice (83.3%) were more practiced in the watershed. Monocropping and 50% Crop residue left were also used more in the watershed. According to farmer's perception on Inter cropping practices, Cereals (sorghum/maize)–pulse (common bean) are more used in the area. Cereal (sorghum, maize and finger millet) are more used in study area.

Soil and water conservation practices on farm land.

This study set out to determine the extent to which certain farmer households used self-initiated soil and water conservation methods on their farmland. The soil bund and cutoff drain were utilized by farmers on their fields in contrast to other methods of conserving soil and water (Table 8). On their farms, more than half of respondents did not adopt gully management, biological SWC practice of planting various grasses, and tree plantation, with the exception of a few trees planted for coffee shade. Farmers in the watershed reportedly used area closure (0.67(ha) hectares) as a practice for water and soil preservation due to excessive soil erosion and a lack of fertility issues. Therefore, to increase an area's production, effective gully management and biological SWC techniques like planting various grasses and crucial Agroforestry practices are required to reduce soil erosion and improve soil fertility.

Table 8. Soil and water conservation practices used by farmers at selected watershed

Soil and water conservation practices	Specification	Frequency Percentage (%)
Bund (m)	Soil bund	34 (94.5%)
	Stone bund	02 (5.5%)
Total		36 (100%)
Cutoff drain (m)	Yes	25 (70%)
	No	11 (30%)
Total		36 (100%)
Gully control	Stone Check dam	03 (9.1%)
	Brush wood	02 (5.5%)
	others	31 (85.4%)
Total		36 (100%)
Biological SWC: Planting Grass	Vetever grass	02 (5.5%)
	Elephant grass	04 (10.9%)
	Not used	30 (83.6%)
Total		36 (100%)
Tree Plantation	Road side	02 (5.7%)
	Farm boundary	04 (11.3%)
	Hedge row	01 (1.9%)
	Others	29 (81.1%)
Total		36 (100%)
Area closure (ha)	Ave. area (ha)	0.67 (ha)

Crop Consumption and marketing

In the study area about 52.1% of smallholder farmers were more marketing their crop production. About 47.9% of respondents were used their crops for their own household consumption. The major crops used for marketing were Coffee (10%), Maize (9.4%), Sorghum (9.3%) and Finger millet (8%) (Fig.3). The Smallholder farmers in the watershed use local seed for most agricultural production. As a result, production of those crops has dropped during these three decades due to diminishing land sizes and reduced soil fertility. Therefore up-scaling of the use of improved seed for those crops and other was potentially needed at an area.

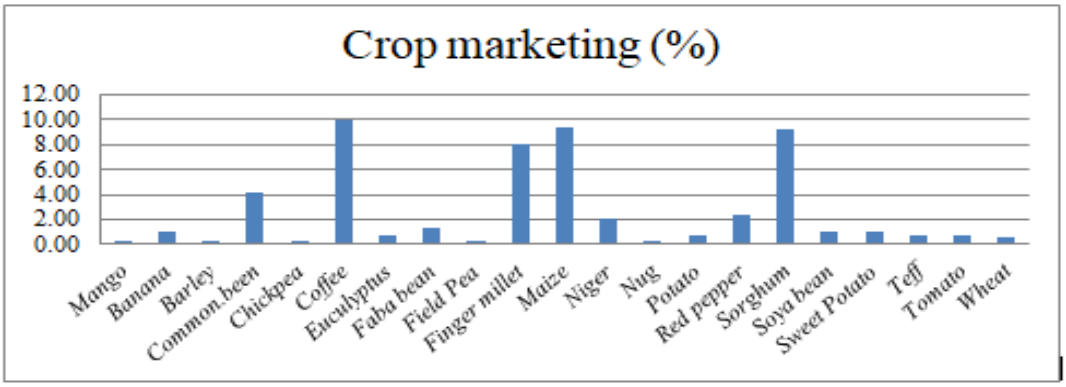

Figure 3. Households Crop Marketing in the watershed

Livestock production and marketing

Livestock ownership, product and marketing

The majority of the farmers in selected watershed were mixed crop-livestock producer. Livestock species Local chicken (13.11%), Ox (12.3%), Exotic chicken (10.7%) local cow (9%) and donkey (9%), and egg/poultry (7.4%) were the more popular stock kept by the selected households in the watershed (Figure 4).

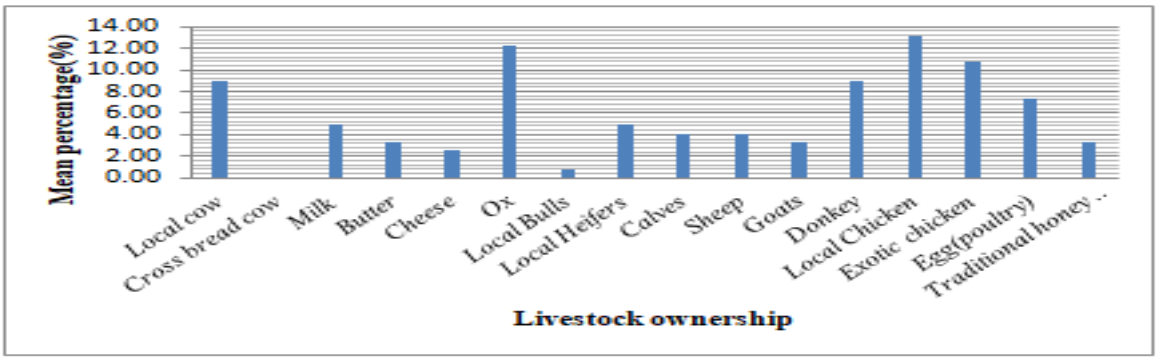

Figure 4. Livestock ownership in selected watershed

Livestock feed sources in the watershed

The Major feed resource for cattle at an area are grazing in the field, crop residues, Stubble grazing and Local beverage by-products, hay making, Green feed (cut & carry) and Concentrates of different types (Nug, cake) (Table 9). Based on their degree of use, grass from grazing land as well as crop residues are the main sources of fodder/feed in wet season. Other sources mentioned were grass preserved (as cut and carry – usually known as hay), crop residues and concentrates are employed in dry seasons. For this, crop residues

are the main sources to be used in both seasons in which are dry and wet seasons. Apart from this as free grazing is also being practiced and well observed along the transect lines; it can be regarded as one of practices to look for fodder. Spring, river and pond are reported as major source of water for livestock. All the reported sources of water are within the range of half a kilometer and less. However, the productivity of livestock has been decreasing substantially due to increasing constraints of feed and fodder, Animal disease and grazing system at an area. Therefore, use of improved feed and fodder, as well as improved grazing management system (cut-and-carry) were broadly identified solutions.

Table 9. Livestock feed sources in the watershed

Feed type	**Farmers feedback in %**		**From Yes feedback feed Sources**					**Rank of feed sources**
	Yes	No	Zero (0)	Own	Purchased	Gift	Communal land	
Grazing in the field	61.1	38.9	37.1	37.2	0	0	25.7	1
Green feed (cut & carry)	8.6	91.4	90	6.7	0	0	3.3	5
Hay making	11.4	88.6	87.1	9.7	3.2	0	0	4
Crop residues	51.4	48.4	48.5	51.5	0	0	0	2
Concentrates of different types (Nug cake,	2.9	97.1	96.6	0	3.4	0	0	6
Improved forages/fodder	0	100	100	0	0	0	0	7
Local beverage by-products (Atala)	23.5	76.5	73.3	13.3	6.7	6.7	0	3
Stubble grazing	23.5	76.5	74.2	19.4	0	0	6.5	3

Household annual income sources

The higher important income sources of households in the watershed were obtained from Crop production (Cash and food crop production) (45.2%), Daily labor (17.7%) and Livestock and Livestock product (12.9%) while the lower was on both Vegetables and root crops (1.6%) as well as Fattening (1.6%). Coffee, Maize, Sorghum and Finger millet are the major known cash crops s most commonly grown at an area.

Table 10. Household income sources in the watershed

Main sources of HH income	**Mean (%)**
Crop production	45.2
Fruit production	9.7
Vegetables and root crops	1.6
Livestock and Livestock product	12.9
Trees plantation	6.5
Daily labor	17.7
Fattening	1.6
Petty trade	4.9
Total	**100%**

Natural resources management (NRM)

Conservation structures using physical structures

This study set out to determine the extent to which particular farmer households utilized their own self-initiated soil and water conservation practices in the selected watershed on their holdings. More than 50% of respondents were not employing physical structures on their farms in the chosen watershed for a variety of reasons. In the chosen watershed, a higher percentage of respondents reported being unaware of the consequences and having insufficient material (Table 11). These findings demonstrate how crucial it is to raise public awareness of various technological applications for using physical structures in order to better manage the watershed's natural resources.

Table 11. The average proportion of respondents who do not use physical structures in the watershed (n=35)

Reason to not using physical structures	Frequency	Mean percentage (%)
Not aware of Conservation	11	36.7
Lack of material	11	36.7
I don't have labour to make physical structure	3	10
My farmland is fertile and no need	5	16.6

Tree species existed in the watershed

In the study area, *Eucalyptus camaldulensis* (10.7%), *Cordia africana* (10.4%), *Croton macrostachyus* (10%), *Albizia gomifera* (8.7%) and *Acacia sieberiana (5.4%)* were the more existed tree species found in the watershed (Figure 5).

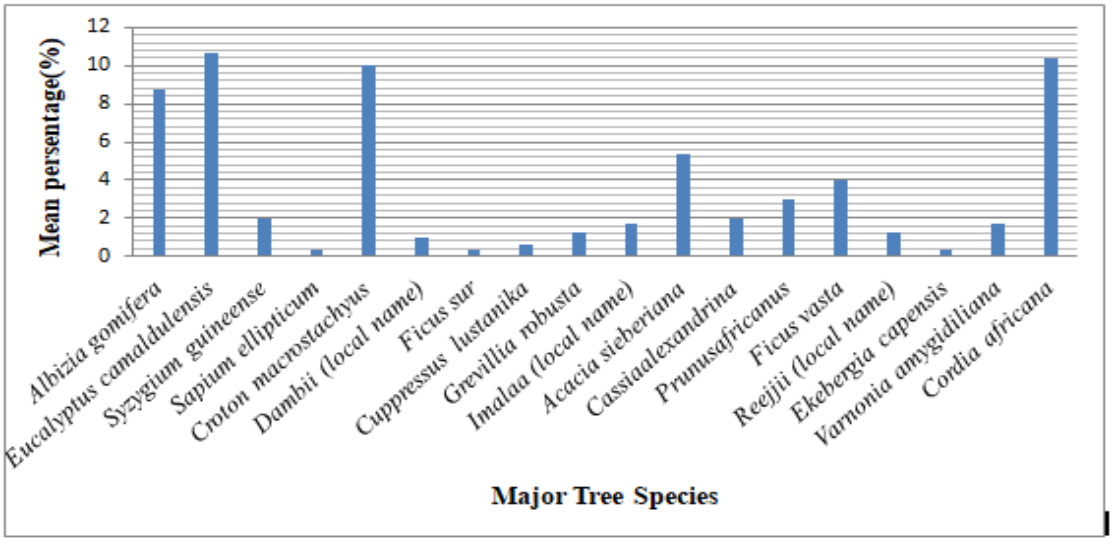

Figure 5. Major Tree Species in selected watershed

In the watershed, tree species were distributed more sporadically (68.4%), with medium abundance (43.9%) (Table 12). According to local opinions, the presence of several significant tree species in moderate abundance may be related to the species' preference for trees for coffee shade, soil conservation, and enhancement of soil fertility in their farms. The farmers may be influenced to plant trees like (*Eucalyptus camaldulensis*) that are more suitable for construction because some natural forests in the watershed, where one can easily obtain construction timber, are rapidly disappearing.

Table 12. Distribution of tree species in the study area

Forms of existed tree species		Percent (%)
Distribution	Scattered	68.4
	Dense	31.6
Total		100
Abundance	High	24.6
	Medium	43.9
	Low	31.6
Total		100

Tree species extinct in the watershed

According to selected households' responses, *Podocarpus falcatus*, Dambii (local name), *Olea africana*, *Ficus sur*, *Aningeria altissima* and *Ficus vasta* were the more tree species extinct in the watershed. These related more to Population growth (47.8%), Deforestation (31.8%) and Termite (14.3%) of the area (Table 13).

Table 13. Causes of extinct Tree Species in the watershed

Causes of extinct Tree Species in watershed	Percent (%)
Deforestation	31.7
Population growth	47.8
Termite	14.3
Others	6.2
Total	**100**

Wild life existed in the watershed

As to selected households' perception, *Ape*, *monkey*, *Pig*, *Colobus monkey* and *Deer* were the more existed Wild life in the watershed (Fig. 6).

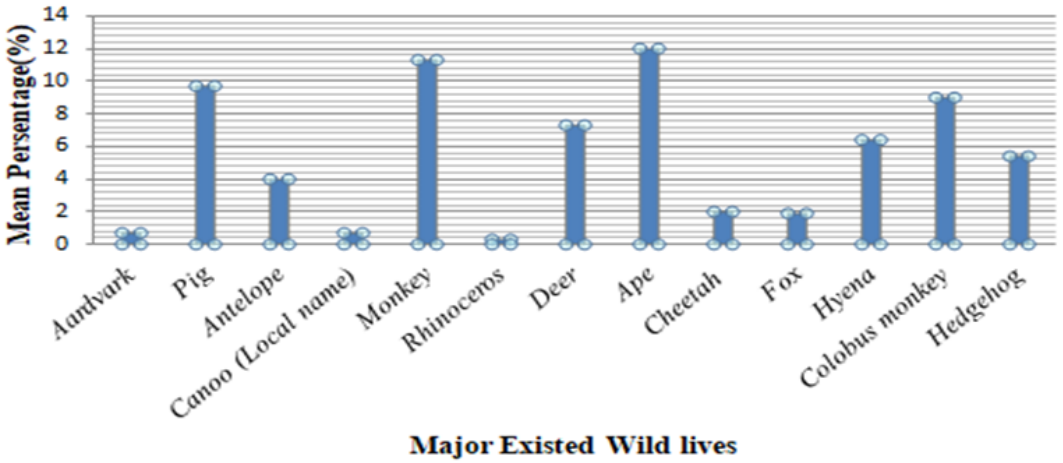

Figure 6. Major wild life existed in the watershed

The distribution of the major wild life found in the watershed were more in dense pattern (51.0%) with Medium abundance (42.0%) (Table 14). This might be due to their life pattern that those wild lives were more living in group. On the other hand, according to local community perceptions, the existence of some wild life species in medium abundance in the watershed might be due to the existence of coffee and tree species for coffee shade.

Table 14. Forms of existed wild life

Forms of existed wild life		Mean Percentage (%)
Distribution	Scattered	48.6
	Dense	51.4
Total		100%
Abundance	High	38.7
	Medium	42.0
	Low	19.3
Total		100%

Wild life extinct in the watershed

According to selected household's perceptions, cheetah, Buffalo, Lion and Borofa (Local name) were the wilder life's extinct from the watershed. These related more to Population growth (54.3%), Deforestation (37.1%) and Hunting (5%) of the area (Table 15).

Table 15. Causes of extinct wild life in the watershed

Causes of extinct wild life	Mean Percentage (%)
Deforestation	37.1
Wetland utilized for Irrigation	2.9
Population growth	54.3
Hunting	5
Others	0.7
Total	100%

Extension services, information sources and saving and credit access

Saving and credit access

Access to credit is an important constraint to farmers while making technology choices for maintaining reasonable consumption levels in the face of risk and managing variability in income over time. For small farmers, the use of improved inputs like fertilizer and new varieties and investments in land and water management options highly depends on timely availability and cost of credit. Once credit is available, the cost of capital (rate of interest) influences its use. When the rate of return from the adoption of a new practice is higher than the cost of borrowing, the use of credit from a given source becomes economically attractive. Farmers also face special problems in accessing credit for consumption and medium-to-long-term investments, as many credit institutions prefer to extend credit for short-term productive activities. Farmers gain credit access from various sources, formal and informal. The formal sources of credit in the watershed comprised mainly the WALQO. The remaining 69.4% borrowed from informal sources (village moneylenders, relatives, and friends) (Table 16). In terms of accessibility of credit, 52.8% of the sample farmers did not utilize the credit at all.

Table 16. Sources of credit access for farmers in the watersheds

Sources of credit access	Mean Percentage (%)
WALQO	27.8
Sinqe Bank	1.8
Informal Sources	69.4
Total	**100**

Sources information for farmers

Information sources used to disseminate agricultural research findings to farmers for on farm activities include extension officers, knowledgeable farmers and mass media. The information obtained can help farmers identify efficiencies that lead to higher productivity and profitability, lower input costs, and optimized fertilizer use. Most farmers in the watershed have got the new technology information through DA and zone /district agricultural office (75%) and Fellow farmers (11.2%) (Table 17).

Table 17. Source of information on technologies

Source of information on technologies	Frequency	Mean Percentage (%)
Fellow farmer	4	11.2
Zone/district agric.ext. agent	27	75.0
Research center	2	5.5
Media (Radio, Television)	3	8.3
Total	**36**	**100**

Extension services for farmers

Agricultural extension services include interventions/activities by government that facilitate the access of farmers, their organizations, and other value chain actors to knowledge, information, and technologies and assist them to development. According to respondents only 27.8% of farmers were hosted agricultural technologies in the watershed. They have got the extension services by DA and zone /district agricultural office; on crop management (31.48%), dairy and livestock management (26.7%), natural resource management (33.7%) and others like health extension (8.15%) (Table 18). Natural resource management services; Bund formation and Plantation, Crop management services; Land Preparation, use of improved seed, fertilizer application, and sowing method (Row planting) were the major service given in the watershed. However, according to farmers perceptions due increasing problems; mainly Population growth, Deforestation and Termite on natural resource, use of local variety and lack of availability of fertilizers on crop management and, constraints of feed and fodder, Animal disease and grazing system on dairy and livestock management at an area the agricultural product and productivity were increasing from time to time in the watershed.

Table 18. Extension services by DA and zone /district agricultural office in the watershed

Extension services	Percent (%)
On crop management	31.48
on dairy and livestock management	26.7
On natural resource management	33.7
On others	8.15
Total	**100%**

Considering the farmers' food security that produced their own production and all income sources in the watershed the rate their family's food security in the last 12 months was 48.6% food shortage up to 3 months and No surplus and no food shortage in year about (37.1%) in the watershed (Table 19).

Table 19. family's food security in the last 12 months

Food	Frequency	Percent (%)
Food surplus	1	2.9
No surplus and no food shortage in year	13	37.1
Food shortage up to 3 months	17	48.6
Food shortage above 9 months	4	11.4
Total	**35**	**100**

Bio-physical Resources Survey

Topography of watershed

The selected watershed landscape constitutes of four major slope range classes: Flat (0-2%), gentle slopes (2.1-8%), moderately slope (8.1-16%), sloppy (16.1-32%) and steep (32.1-50%) (Fig.7)

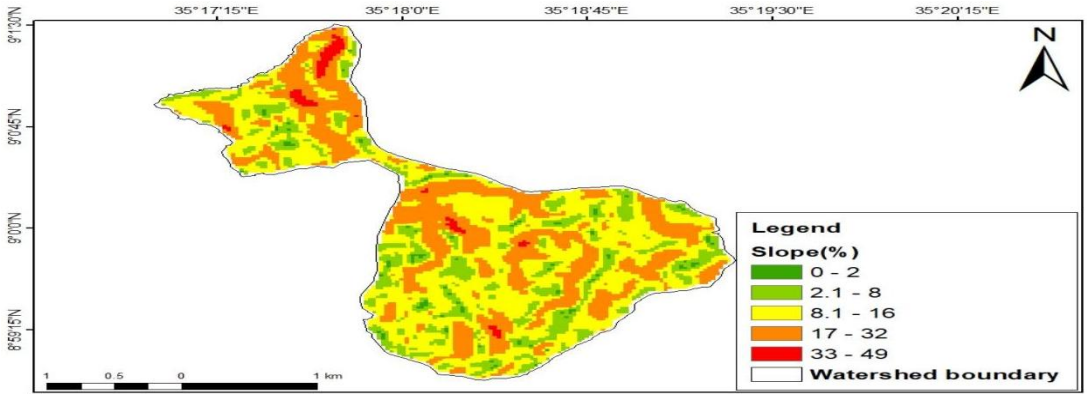

Figure 7. slopes of watershed

The four major slope range classes of an area cover about 1.05 % is flat, 16.43 % undulating, 44.1% rolling; 34.37 % hilly and 5.5 % steep (Table 20).

Table 20. Slope to Land use type distribution of Tullu Harbuqi micro/community watershed

Slope category	Area covered by (ha)	Percentage (%) covered
0-2	7.7	1.05
2.1-8	120	16.43
8.1-16	322	44.1
16.1-32	251	34.37
32.1-50	40	5.5

Land use land cover pattern of watershed

The selected watershed sizes to a total of about 729 ha. Cropland comprises about 65.29%, Settlement 0.68%, grazing/shrub land 7.95%, bare land and eroded area 8.92% and Forestland 17.15% (Table 21).

Table 21. Land use land cover pattern of watershed

Land use	Area(ha)	Proportion (%)
Cropland	476	65.29
Settlement	5	0.68
Forestland	125	17.15
Bare land and eroded area	65	8.92
Grazing and shrub land	58	7.95
Total	**729**	**100.00**

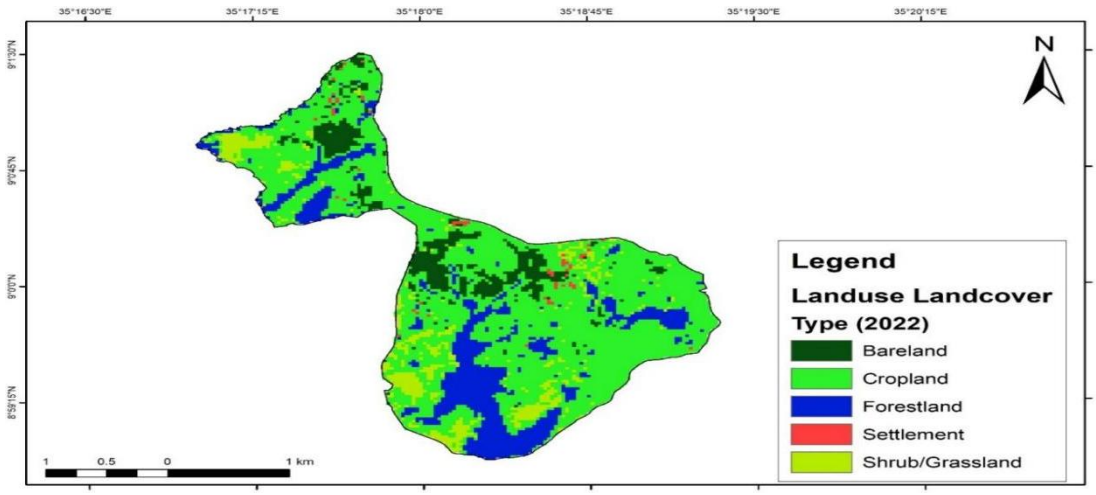

Figure 8. Digitized land use *land cover map* of Tulu Harbuki community watershed

Major soil types of *Tulu Harbuki community watershed*

The type of soil observed in the area is mainly loam (20 %) and Sandy loam (80 %) by texture, and black and red by color. In many parts of the area, and particularly at hill sides and sloppy areas, sever soil erosion was observed.

Major Constraints in the Watershed

The major constraints to agricultural production of households identified in Tulu Harbuki Micro watershed were: Natural Resource related constraints; deforestation, soil erosion and soil fertility, Termite and land shortage, production related constraints; agricultural inputs (time, price, fertilizer etc), crop disease and crop productivity, Institutional and infrastructure related constraints; Credit access, drinking water and Electricity, Livestock related constraints; Feed, fodder and Animal disease, and grazing system, and Socio-economic related constraints such as Inflation, peace and Employment Opportunity (Table. 22).

Table 22. Major constraints in the watershed arranged from most frequently cited problems to least cited problems

Natural Resource related constraints	Frequency	Percent (%)	Rank in order of importance
Soil erosion	7	19.7	1
Soil fertility	7	19.7	1
Land shortage	5	14.1	3
Deforestation	7	19.7	1
Climate change	4	10.9	4
Termite	6	15.9	2
Production related constraints			
Agricultural Input	8	22.2	1
Crop disease	8	21.6	2
crop productivity	8	21.6	2
wild life	7	20.4	3
storage pest	5	14.2	4
Institutional and infrastructure related constraints			
Drinking water	6	16.2	2
Credit	7	18.2	1
Market	3	9.7	4
Road accessibility	5	13.6	3
School	1	2.6	8
Health Center	2	5.2	5
Animal Clinic	2	4.5	6
Cooperative	3	9.7	4
FTC	1	3.9	7
Electricity	6	16.2	2
Livestock Related constraints			
feed and fodder	12	33.0	1
Animal disease	12	33.0	1
Grazing system	11	29.7	2
Others	1	4.4	3
Socio-economic related constraints			
Human disease	5	14.0	3
Population disease	5	13.0	4
Energy	4	10.9	5
Peace	5	15.0	2
Employment Opportunity	5	15.0	2
Other income source	5	14.0	3
Inflation	7	18.1	1

Major potentials/opportunities in the Watershed

The watershed offers significant potential and development options. Potentials related to natural resources; Appropriate agro ecology and production potentials; labor force availability, institutional, and infrastructure-related limitations; The main opportunities and potentials identified in the watershed included a health facility, an informal institution, a school (both elementary (1–8) and secondary (9–12), and a livestock clinic (Table 23).

Table 23. Major potentials /opportunities in the Watershed arranged from most frequently cited opportunities to least cited problems

Natural resource	Frequency	Percent (%)	Rank in order of importance
Forest	6	15.9	2
Sand and coble stone	2	5.6	4
Permanent river	5	13.5	3
Artificial lakes	2	5.6	4
Suitable agro ecology	21	59.4	1
Socio-economics			
Availability of labor force	16	44.2	1
Source of seed	1	3.9	5
Market access	8	22.1	2
All weather road	2	6.5	4
Transport service	1	2.6	6
Drinking water	5	14.3	3
Electricity	2	6.5	4
Socio-economic related constraints			
Farmer cooperative	5	12.7	3
School	7	20.9	2
Heath center	8	21.6	1
Livestock clinic	7	20.9	2
Saving and credit institution	1	2.2	4
Youth and women associations	1	0.7	5
Informal Institution	7	20.9	2

CONCLUSION AND RECOMMENDATION

Using a number of the methodologies mentioned in the paper, the socioeconomic characterization, identification, and prioritization of major constraints and opportunities were examined in the Tulu Harbuki Micro watershed. Accordingly, the micro/community watershed was threatened by land degradation, which was mostly caused by significant soil erosion, deforestation, and termite problems. Agricultural inputs and crop diseases were all major issues in the watershed. Crop diseases are particularly prevalent in the region, mostly as a result of the effects of lack of disease tolerant improved crop types, which in turn leads to a decline in crop output and productivity. The absence of extension services in the area made it difficult to acquire and use agricultural technologies and sustainable land management techniques. Farmers' awareness of adopting new technologies is low due to inadequate access to technology.

This calls for an emphasis on integrated soil fertility management, which includes lime, vermicompost, FYM (farmyard manure), organic and inorganic fertilizers, and integrated biological and physical soil conservation measures. The watershed also requires coordinated termite management and efficient management of the utilization of land resources. Increased focus should be given to diversifying important crops, incorporating forage trees and shrubs with crops, and using diverse Agroforestry techniques in certain watersheds. To address the selected watershed production-related issues, disease-resistant and enhanced varieties must be introduced. It is also suggested that FTC be developed with community cooperation to make the delivery of extension services easier were all recommended in the watershed.

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Conflict of interest

There is no conflict of research interest.

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