

Baseline Survey for Identification and Documentation of Natural Resources Management Status, Challenges and Opportunities for Research Interventions, Case Study of Melokoza District, Southern Ethiopia

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Abstract

This baseline survey work was done mainly to identify the status of existing natural resources management, challenges and opportunities for research interventions in Melokoza district and specifically intended to identify and document existing natural resources management status of the special, the major constraints and challenges of natural resources management of Melokoza special district and finally to prioritize the researchable issues of natural resources management in the districts at different agro-ecologies. Different primary data collection techniques like: open ended interview, key informant discussion and field observation of events and secondary data collection techniques as referring different literatures, data from woreda water mines and energy office, agricultural and natural resources management office. To achieve the primary data collection clustering of the female headed and male headed households and youth group have been employed. Finally, the baseline document of challenges and opportunities was reviewed by different concerning bodies from different organizations by preparing need assessment validation work shop in Melokoza woreda. At the end of the work shop different challenges, opportunities and status of existing natural resources management have been identified, prioritized and researchable points were recommended in relation to soil fertility management, agroforestry and plantation, soil and water conservation and irrigation management by different concerning bodies of natural resources experts, researchers and other responsible bodies.

Keywords: Natural resources; Soil and water conservation; Soil fertility; Irrigation water

Introduction

Background and justification of the study

Ethiopia's natural resources base, its land, water, forests, wildlife and biodiversity are the foundation of any economic development, food security and other basic necessities of its people. Small holder agriculture is the dominant sector that provides over 85 percent of the total employment and foreign exchange earnings and approximately 47 percent of the Gross Domestic Product (GDP) [1]. Ethiopia has diverse agro-climatic zones. It has 18 major agro-ecological zones (AEZs) and 49 sub-agro ecological zones that are grouped under six major categories [2]. These agro-ecological classifications have important implications for strategies in development of appropriate technologies for agricultural and rural development and natural resources management (NRM).

Natural resources (land, water, forest, wildlife and biodiversity) are key assets for rural economic growth and generating a livelihood for millions of communities living in the rural and resource for those living in peri-urban. As an important asset, it constitutes a main vehicle for investment, wealth accumulation and transfer between generations. In many areas of the world, appreciation of land with increased population density is also a source of corruption, land

conflicts, and lack of transparency. For these reasons, the distribution of land and other productive assets will affect not only productive outcomes in rural areas but also the ability of the farming communities to make investments and accumulate assets by improving productivity.

Adverse climatic change (a series of droughts) combined with rapid population growth, declining land holding size, growing landlessness, environmental degradation [3] subsistence and rain-fed dependent agricultural production have resulted in a growing problem of drought vulnerability and food insecurity in Ethiopia [4,5]. Continued attempts to expand cropping frontier would entail accelerated deforestation, natural resource degradation; ultimately falling yields [6].

Irrigation contributes to livelihood improvement through increased income, food security, employment opportunity, social needs fulfillment and poverty reduction. Increase in agricultural production through diversification and intensification of crops grown, increased household income because of on/off/non-farm employment, source of animal feed, improving human health due to balanced diet and easy access and utilization for medication, soil and ecology degradation prevention and asset ownership are contributions of irrigation [7].

Population increment has a negative impact on subsistence agriculture. As population grows most of the best land will be brought under cultivation first, and then the additional population would have to seek their livelihood by expanding into uncultivated, poorer lands [8]. Meanwhile there would be pressure to use existing cultivated lands more intensively and without respite. Cultivation in the marginal lands

faces risks of diminished rainfall, less resilient soils, and a weakened population that might be more susceptible to disease [9].

Policy and legal issues that need further research and debate in relation to environmental and natural resources sustainable management include: (i) the inadequacy or ineffectiveness of environmental laws and procedures; (ii) redistribution of farm lands vis-à-vis the small land holding of the households and the pressure from the landless young,

rural communities; (iii) standardization of land valuation and compensation methods and procedures; (iv) using land rights as collateral for loans for investment; (v) institutional, technical and legal capacities of enforcing appropriate land use planning and proper uses based on the land capabilities in a watershed approach; (vi) creating strong institutions and developing human and logistic capacity is required to create an efficient, affordable and sustainable land administration at the district and sub-district levels, the reality at Wereda and Kebele levels; and (vii) establishment of a research institute to address the problems on land administration and use to recommend solutions.

Statement of the problem

The Melokoza woreda has very wide variety of natural resources, forest resources soil and water bodies, but their vulnerability to the natural and human made factors are very high, and there is declining of soil fertility, due to soil erosion, compactness due to intensive ploughing without fallow system, crop rotation especially in high lands. There is high erosion due to expansion of eucalyptus trees in very narrow agricultural land and leaving of farm lands to grazing due to infertility caused by high erosion in rainy season, there is also less practices of introduced soil and water conservation technologies in three agro-ecologies, they do it by the enforcement of government rather than considering the impact on soil fertility improvement, ground water recharge increment, there is also across the slop plough of lands especially for the potatoes production (Focus group discussion), the farmers plough their land across the slope in major potato production kebelles especially Baltsa kebele (field observation)

There are also less practices of irrigation as alternative sources in addition to rain fed agriculture in high lands of the woreda. The woreda has different types of agroforestry practices and trees species in different agro-ecologies, but there is also no research interventions have taken place to reduce the alarming natural resources exploitation and production reduction due to soil infertility variation and irrigation practices and agroforestry system management (informal survey, research need assessment work shop and key informant discussion)

So, this study is mainly focus on identification and documentation of the major natural resources management practices, their challenges and opportunities for researches interventions, besides it also prioritizes, the major challenges in soil fertility management, agroforestry practices, soil and water conservation and irrigation and water management of the district and puts the researchable issues for the future.

Objectives of the study

- To identify and document existing natural resources management status of Melokoza district
- To identify the major constraints and challenges of natural resources management of Melokoza

- To prioritize the researchable issues of natural resources management in the districts at different agro-ecologies of the target areas in case of natural resources management and utilization
- To recommend appropriate researches to be conducted in each case of major natural resources management case.

Materials and Methodology

Description of the study area

General over view of Melokoza District: Melokoza is one of woreda located 661 km from Addis Ababa, 398 km from Hawassa, 348 km from Gamo-Gofa, Arbaminch, 96 km from Gofa-Sewula and 35 km from Basketo special woreda. Is bounded from north, south, west and east by, Dewuro, Basketo, Konta special woreda and Geze-Gofa and Demba Gofa respectively. Its average elevation from sea level 501-2500 m, latitude of 6.30-6.70 and longitude of 360-370. Melokoza woreda has total population of 191220 of which 25859 males headed and 3077 females headed. The woreda has total kebelles of 39, of which 37 rural and 2 are urban kebelles.

The district has three agro-ecologies Dega (21.73%) weyna, Dega (52.43%) and Kola (25.84%) with respectively. These soli of the district is mainly clay-loam (50%), sand-loam (35%) and clay (15%)

The district has two rain-seasons, 'Mehri' season (from July to Oct) and 'Belg' season (from last week of Jan to April). Maximum rainfall 600 mm, minimum 400 mm and average annual rainfall 500 mm and maximum temperature 27.5°C and minimum temperature 15.1°C. Its total land coverage is 168,180.93 ha, annual crops 47103.897 ha, perennial crops 31884.093 ha, grazing land 6885 ha, natural forest 33687.15 ha, constitutional land 33087.15 ha, private land 1044.02 ha, other reserved land 180548.19 ha, totally 78987.99 ha and cultivable land for farther 14015.95 ha (Table 1).

Potentialities that have been seen by agricultural sectors were: High water sources, Wide irrigation farm lands, Accessible farm land, Smart climatic condition, Huge forest coverage etc. (Figure 1).

S No	Land holding (ha)	Male headed	Female headed	Total	Remark
1	0.5 ha	256	458	714	
2	0.5-1 ha	719	20	935	
3	1-1.5 ha	857	73	530	
4	>2 ha	725	53	878	
Total		2557	604	3057	

Table 1: Farm land per house hold.

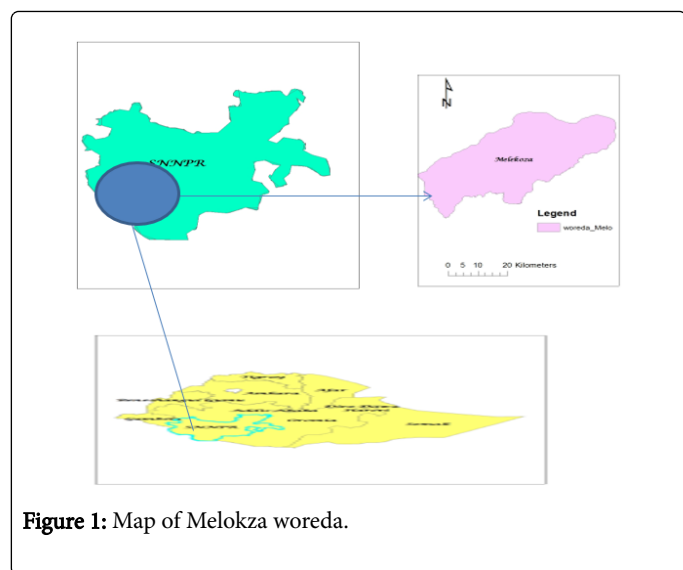


Figure 1: Map of Melokoza woreda.

Methods of data collection

The survey work included both a review of the literature on smallholder, agricultural and natural resources management, water and mine and energy offices of government field research. Both secondary and primary data were collected and used in this study.

Secondary data collection: The study started with brief review of the woreda, zone, regional and national policies, the policy and legal rights frameworks regarding irrigation, natural resources management, soil fertility and agroforestry practices. The main sources of secondary data were published and unpublished documents. These included policy statements, proclamations and regulations, project appraisal documents, reports and past case study papers on natural resources management and challenges.

Primary data collection: Primary data were collected using various instruments such as key informant interview using semi-structured checklist, group discussion, expert interview, unstructured questionnaire and field observation of events in the different concerns of natural resources management. Key informant interview was conducted to generate general understanding of the natural resources management, the major technical, institutional and natural challenges of natural resources management in the woreda. The key informant and open-ended interview was done by arranging cluster of female headed, male headed and youth of different agro-ecologies. Finally, after the completion of primary and secondary data collection the validation work shop was prepared and the issues were seen prioritized by different concerning bodies of woreda, zone and different Non-governmental organizations experts. Around 25 female and 25 male headed households and 25 youth were selected for the interview purpose in each agro-ecologies (i.e., 25 youth, 25 females headed and 25 males headed households) were selected for key informant purpose the woreda, experts of agricultural offices and developmental agents of kebelles were used.

Results and Discussion

The status of soil fertility, agroforestry, soil-water conservation and irrigation water management practices in high lands of Melokoza woreda

Soil fertility management in highland of Melokoza district: As the field observation interview and focus group discussion with farmers, developmental agents, district agricultural officer in the high land of the district there are different types of soil textural classes, mainly clay and followed by silt and sand respectively. Cracking of soil and compactness during rainy season, difficulties during land plough.

Soil characterization problem (physical and chemical properties) the acidity status did not determined the basic parameters of both soil physical and chemical properties like, soil pH, organic matter, cation exchange capacity, exchangeable cations, exchangeable acidity, exchangeable Al and Mn, Zn, Cu, Fe, soil particle size distribution, percentage acid and Al saturation and effective cat ion exchange capacity.

As the baseline indicates most of soil physical properties have not been determined in different kebelles. There is no analyzed parameters in kebele level, even though soil samples have collected from sample kebelles through developmental agents, but no result analyzed and provided to the respective kebelles. In addition to the above challenges there is no awareness for farmers about the use of inorganic fertilizer and other recently introduced blended fertilizers like (NPS, NPSB, NPSBCu) in terms of rate, type and ways of application on their farm.

Also, the use and preparation of organic fertilizers like farm yard manures (FYM) and compost is very poor. There is no demonstration works for fertilizer rate and types rather than distributing it in mass and no check of its expire date and compactness, there is load over farmers to take it without in-depth awareness creation regarding its nutrient enrichment for the soil.

Agro forestry and plantation forestry in high land of Melokoza woreda: In three agro-ecological zones, there are different indigenous tree species like (*Juniperus procera*, *Prunus africana*, *Milletia ferruginea*, *Ficus sur*, *Croton maycrostachyus*, *Cordia africana*, *Podocarpus falcatus*, *Syzygium guineense*, “awabi”, “agoga”, “Ela” and “kalasho”). Among these *Cordia africana*, *Milletia ferruginea*, *Syzygium guineense* and “kalasho” are multipurpose trees for the area than others according to the key informants. *Cordia africana* ranks first in terms of soil fertility improvement and economic contribution. Besides these indigenous tree species there are also some exotic species like *Cupressus lusitanica* and *Grevillea robusta* in the woreda. The major challenges of agroforestry and plantation forestry in case of Melokoza high land are

- Deforestation of natural forest for expansion of agricultural land fuel wood.
- Awareness gap on spacing of multipurpose trees species.
- Lack of well-established nursery site for existing tree species.
- Limitation of awareness on production and use of bamboo and other high land trees.
- Limitation on integration of multipurpose trees with annual crops.

Soil and water conservation in high land of Melokoza woreda: In this agro-ecology of the woreda there are some soil erosion problems that needs the conservation measures in the areas. The major causes

(factors) for soil erosion in this high land agro-ecology of Melokoza are listed below

Climatic and bio physical factors: High amount of annually rainfall and run off, presence of steep slope, presence of mountains and hillside topography, the textural class of the soil is more susceptible to erosion, existence of bare land or no vegetation covers and other factors that aggravate gully erosion.

Anthropogenic factors (Human factors): Backwardness of tillage practice like along slope ploughing, i.e., the plough system of community is not contour based, high over grazing in communal and farm land, destruction of forest for charcoal and fire wood, Improper land use. This practice is very high in in potential areas for potato production.

So, the major types of soil erosions are existing in areas sever (large) gully, medium gully, small gully, rill erosion, sheet erosion, steam bank erosion and others. These all soil erosion problems and land degradation led to the decline of soil fertility, available plant nutrients at the end reduce product and productivity of the famers. The practices of introduced as well as indigenous soil and water conservations are very low (Figure 2).



Figure 2: Photo of potato production across slope ploughing.

Irrigation and water management in high land of Melokoza woreda: The sources for irrigation are river and spring, as the discussion with focus group by arranging of cluster of (female, youth and male) responded that the habit of irrigation practice along the ecology is very poor. The farmers in the ecology did not use irrigation as means for agricultural productivity enhancement rather than practicing by the

enforcement development agents and woreda's expert. They did not use other sources of water for irrigation rather than using Natural River and springs the major challenges of irrigation development across the agro-ecology. Even the farmers practice irrigation apply water by very traditional way, that is watering by can dominantly and to some extents furrow irrigation system is being practices near to spring and Small River for cabbage and garlic production. As the survey result and communication with woreda agricultural office and households indicated the major irrigation development challenges of the area are

- Lack of awareness regarding practicing of irrigation in wide range of farm land rather than in garden areas, especially irrigation scheduling and application systems.
- Topographic challenge, there is undulating features of land and no water pumping equipment for household as well as no economic capacity to purchase by their own.
- Absence of water harvesting structures like pond, reservoirs and geo-membrane for water harvest for dry spell.
- No modern irrigation schemes construction.

The status of soil fertility, agroforestry, soil-water conservation and irrigation water management practices in mid lands of Melokoza woreda

Soil fertility management in mid lands of Melokoza woreda: The fertility status is more or less good enough, but recently there is occurrence of yield reduction due to soil moisture stress and climate variability, the soil has not been characterized and inorganic and organic fertilizers use habit is very poor.as the farmers in the areas forwarded the application blended fertilizers and organic fertilizers uses are very insignificant, for major cereal crop productions, emphasis should be given by government or other bodies in introducing of different blended fertilizers and improved maize and mid land Teff varieties which resist logging problem, as opportunity the mentioned there is large agricultural lands to produce different cereal crops for house hold consumption and market purpose, Even though the market price is low because of no organized cooperatives and merchants to take the product from the farmers.

Soil and water conservation in mid lands of Melokoza woreda: There is little to no introduced and indigenous soil and water conservation structures farmers in this ecology plough their lands for long period without fallow expose it to degradation and leave it in spite of rotating crops mulching its residue and constructing structures to prevent soil loss and land degradation, most of the plants that have allelopathic and other impacts on soil and other species, from the survey result following problems were highly exist in mid land, lack of soil and water conservation measures (physical, biological, inappropriate tillage, agronomic and management practice), land degradation especially due to erosion and unwise farming practices, cultivation of steep slope land without any use of conservation measures, inappropriate design and spacing of soil and water conservation structures (L, W, H) and slope, which were constructed by mass movement of the communities.

Agro forestry and plantation forestry in mid lands of Melokoza woreda: The coverage of plantation forest is around (25%), natural forest (50%), cultivated land (25%) and cultivatable land (25%). There are different tree species like *Cordia africana*, *Syzygium guineense*, *Juniperus procera*, *Prunus africana*, *Croton maycrostachyus*, kalasho, *Podocarpus falcatus*, in midlands of the woreda. Among these *Cordia*

africana, *Syzygium guineense* and “kalasho”, are multipurpose tree species than others. In terms of soil fertility improvement and economic contribution *Cordia africana* has high contribution than other multipurpose tree species. From the survey result the following challenges were prioritized in mid land agro-ecologies.

- Spacing problems of multipurpose trees on home garden.
- Lack of well-established nursery site for existing species.
- Awareness gaps on production and use of bamboo and other high land trees.
- Awareness limitation of communities in planting multipurpose trees with coffee and ‘korerima’ crops. ‘Korerima’ is very potential underground medicinal plants in this agro-ecologies but the production system is not integrated as field observation and focus group discussion with producers.
- Knowledge gap on spacing of agroforestry trees which have the contribution for shading effect and soil fertility with coffee and “Korerima”.

Irrigation water management in mid lands of Melokoza woreda:

Most of the key informants said that the farmers did not use any pumping methods and water harvesting techniques for irrigation purpose rather than, waiting natural rivers and springs. The following problems were identified as major challenges to be addressed by research interventions: in this ecology.

- Land topographic alignment is not suitable for irrigation, that meant most of the river water is not suitable for surface irrigation methods due to undulating features of the land and farmers were faced with problems in some parts.
- No habit of irrigation water use even though there is yearly flowing rivers and springs.
- No access of irrigation water diversion, Irrigation water scheduling problem.
- Lack of canals to bring irrigation water from the source.
- Lack of root top water harvesting techniques to use in dry spell.

The status of soil fertility, agroforestry, soil-water conservation and irrigation water management practices in low lands of Melokoza woreda

Soil fertility management in low lands of Melokoza woreda: The fertility status is more or less good enough, but recently there is occurrence of yield reduction due to soil moisture stress and climate variability, the soil has not been characterized and inorganic and organic fertilizers use habit is very poor, besides these, the habit of use of organic and bio fertilizers is zero, farmers did not awareness on organic fertilizer preparation in wide range, application on large farm land.

Soil and water conservation in low lands of Melokoza woreda: In this agro-ecology of the woreda there are some biological and physical soil and water conservation structures, biological such as mulching of crop residuals, planting grasses which resist erosion in most hilly lands and physical structures like soil bunds and micro basins in flat land, but constraints in this ecology are that there is degrading of land by high gully erosion main rain season and washing away of fertilizers and chemicals from the farm land, the plough system of community is not contour based, and which aggravates the soil erosion and large range of land that is not rehabilitated in this agro-ecology the extents of erosion is high in communal land than that of farm land in high land kebelles as respondent implied.

The major challenges in this agro-ecology of the woreda are

Climatic and biophysical factors: This are lack of proper rainfall, lack of vegetation cover, droughts, site effect of sedimentation and flooding from high lands, due to the susceptibility of the soil texture loss of soil by winds and runoff and etc.

Anthropogenic or manmade problems: This are clearing of forest for charcoal and fire wood, improper tillage practice that aggravate gully in farm land, inadequate land management, free grazing.

These all factors and others are the major constraints for soil fertility and natural resource managements. Besides to these there are different forms soil erosion impacts in this agro-ecology like large gully, medium gully, small gully, rill erosion, sheet erosion, rain drop and steam bank erosion.

Agro forestry and plantation forestry: In this agro-ecology there is high density of naturally existing tree species than plantation and the tree species have no more contribution for soil fertility management. The area coverage of plantation forest is very low in this agro-ecology. In the very low land areas of the district farmers cut and clears forest for woods and wood products.

The major challenges in this ecology of the woreda are

- Deforestation and land degradation due to unwise use of existing forest resources.
- Firing of grasses and trees in winter season for clearing purposes.
- Lack of nursery site for major trees in vicinities.
- Clearing natural forest for timber, charcoal, firewood and household equipment.

Irrigation and water resources management: In this there are many rivers that flow constantly throughout the season, some farmers who have farm land near to the river use irrigation by diverting from the river, but the rest did not use river due to lack of awareness and lack of intension Land topographic alignment is not suitable for irrigation, that meant most of the river water is not suitable for surface irrigation methods due to undulating features of the land and farmers were faced with problems, in some parts of the kebelles.

- No habit of irrigation water use even though there is yearly flowing rivers and springs.
- No access of irrigation water diversion, irrigation water scheduling problem.
- Lack of canals to bring irrigation water from the sources.
- Lack of root top water harvesting techniques to use during dry spell.

Conclusion

This study has been identified different opportunities challenges and existing natural resource management practices in Melokoza woreda and finally different prioritized the problems in relation to soil fertility management, irrigation water management, agroforestry and plantation forest practices and soil and water conservation concerns across three agro-ecological zones of the woreda and has put the researchable issues in the following manner for interventions, across different agro-ecologies of the woreda different challenges and opportunities of natural resources management have identified and different researchable ideas of soil fertility management, soil and water conservation, irrigation water management and agro-forestry and plantation forest have identified, documented and prioritized.

Recommendations

Research interventions suggested to be conducted in Melokoza woreda across different agro-ecologies

These intervention points in each case were prioritized and recommended by preparing baseline survey validation work shop in Melokoza woreda with different concerning bodies from woreda, zone, researchers of different concerns from Agricultural Researcher Center, the following points were prioritized as the reseach proposals to be conducted across each agro-ecology of the woreda considering the identified challenges and opportunities in each ecology.

Soil fertility management:

- Classification and characterization of soil chemical and physical properties and parameters of the area.
- Introducing of recommended blended fertilizers for major crops.
- Introducing of organic fertilizers preparation and application system to increase integrated use of organic and inorganic fertilizers use.
- Promotion of bio fertilizers and verm-compost technologies to enhance soil fertility.
- Providing awareness creation training for farmers, woreda's experts and DAs on preparation of organic fertilizers.
- Developing of drainage improving technologies in the areas with drainage problems.
- Acid soil management techniques for improving agricultural production and productivity based on the agro-ecologies.

Soil and water conservation:

- Rehabilitation of degraded lands by different factors, over grazing and erosion.
- Based on their agro-ecology promotion different introduced agronomic and physical soil and water conservation measures.
- Promotion of integrated conservation agriculture and low-cost gully and degraded land rehabilitation.
- Introduction of model water shed development program for enhancement of soil fertility.
- Creating awareness on maintenance of damaged soil and water conserving structures to increases their sustainability.
- Introducing different water harvesting technologies for low lands.
- Demonstration and Awareness creation on farm in-situ water harvesting practices.

Agroforestry and plantation forestry:

- Establishment of nursery for multipurpose tree in all agro-ecologies.
- Introduction of agroforestry practices across coffee producing areas.
- Integration of multipurpose trees with coffee and Korerima production.
- Awareness creation on effects of deforestation and forest degradation on climate change.
- Demonstrating of multipurpose tree integration with other cash crop like coffee and Korerima.

Irrigation water management:

- Development of irrigation regime for major cereals, vegetables and fruits.
- Development of furrow irrigation system.
- Construction small scale modern irrigation schemes in the areas. Where there is no schemes, especially in the low land.
- Demonstration of on water harvesting technologies (roof top water harvesting, hand dug well development).
- Awareness creation on contribution of motor pump for lifting of water.
- Promotion of pressurized irrigation technologies.

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