

## **Baseline Survey for Identification and Documentation of Natural Resources Management Status, Challenges and Opportunities for Research Interventions, Case Study of Basketo Special 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 Basketo special 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 Basketo special district and finally to prioritize the researchable issues of natural resources management in the special 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 Basketo special 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 facilitators.

**Keywords:** *Soil and Water Conservation; Soil Fertility; Irrigation Water; Agroforestry*

### **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. Smallholder 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 [2].

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 [9,10].

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 visa-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 Woreda and Kebele levels; and (vii) establishment of a research institute to address the problems on land administration and use to recommend solutions. The Basketo special 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 role, 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). There are also less practices of irrigation as alternative sources in addition to rain fed agriculture in high lands of the special woreda. The special 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 [11-13].

## **Objectives of the Study**

1. To identify and document existing natural resources management status of Basketo special district.
2. To identify the major constraints and challenges of natural resources management of Basketo.
3. 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.
4. To recommend appropriate researches to be conducted in each case of major natural resources management case.

## **Material and Methodology**

### **Description of the study area**

#### **General description of the study area**

The Basketo special district is found in Gamo-Gofa zone of SNNPR which is 310 km, 460 km and 626 km from Arba Minch, Hawassa and Addis Ababa respectively. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), this woreda has a total population of 56,689, of whom 28,532 are men and 28,157 are women. The four largest ethnic groups reported in Basketo were the name sake Basketo people (87.75%), the Wolayta (4.28%), the Amhara (3.73%), and the Konso (1.92%); all other ethnic groups made up 2.32% of the population. The altitude of the district is ranging from 780 - 2200 m.a.s.l.

#### **Topography of study area**

Topography is a major factor affecting irrigation, particularly surface irrigation. Of general concern are the location and elevation of the water supply relative to the field boundaries, the area and configuration of the fields and access by roads, utility lines (gas, electricity, water, etc.) and migrating herds whether wild or domestic. Field slope and its uniformity are two of the most important topographical factors.

Basketo special district is endowed with many rivers that are potentially good for small scale irrigation. However, undulating and rugged topography of the area made the rivers hardly accessible for surface irrigation. In some of the small scale irrigation schemes, problems linked with design of canals that bring water from the source (rivers) are lowering their performance and coverage.

#### **Climate**

Climate is a long period average weather condition of a defined geographical area. It is determined by altitude, latitude, prevailing winds, cloud cover, pressure and wind belts. Altitude is by far determinant factor for the spatial variation of weather and climate. Among the elements of weather and Climate, temperature and rainfall are important elements in determining the pattern of population settlement, the range of crops and vegetation that can be grown, soil formation processes and biodiversity and agro ecology of a given area [11]. The Climatic condition of the project area is very hot and there is no meteorological station to get climatic data of the project area. The project area is characterized by kola agro-climatic zone with shrubs and bushy vegetable types. The average annual rain-fall of the study district is 1200 mm (minimum 1000 mm and maximum 1400 mm) with minimum and maximum temperature of 15°C and 27°C respectively.

#### **Land use pattern**

The land use pattern of the command area is found to be combination of grass land, forest land, water body and woody land. The total land coverage of the district is 105,750.75 ha of which 19250 ha is covered by annual and perennial crops, 2,250 ha grazing land, 491.75 ha forest land, 103 ha water body, 566 ha bare land and 83090 ha others.

#### **Soil types**

The soil's moisture holding capacity, intake rate and depth are the principal criteria affecting the type of system selected. Sandy soils typically have high intake rates and low soil moisture storage capacities and may require an entirely different irrigation strategy than the deep clay soil with low infiltration rates but high moisture-storage capacities. Sandy soil requires more frequent, smaller applications of

water whereas clay soils can be irrigated less frequently and to a larger depth. The soils of the district classified as 18% clay, 52% loam and 30% sandy in all agro ecologies.

### 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 special woreda, Region 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 female headed and 25 male headed households) were selected for key informant purpose the woreda, experts of agricultural offices and developmental agents of kebelles were used.

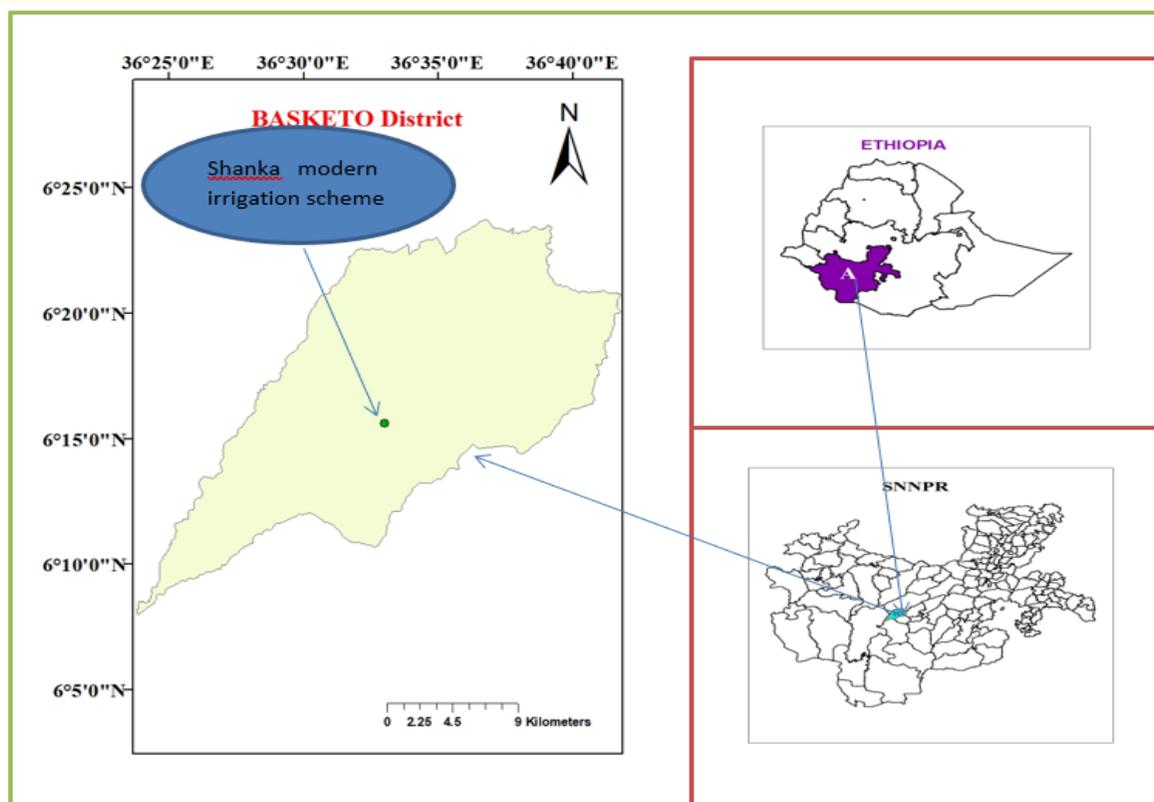


Figure 1: Map of Basketo special district.

## **Result and Discussion**

### **The status of soil fertility, agroforestry, soil-water conservation and irrigation water management practices in high lands of Basketo Special woreda**

#### **Soil fertility management in highland of Basketo special district**

In this ecology the soil fertility status declines from time to time due high erosion and intensive farming system, the soli of the ecology is acidic as the respondents replied that hinder the crop productivity. The chemical as well as physical status of the soli is not identified. To escape from acidity problems farmers use deep plough by locally called as 'kaso' to but after one harvest the soil returns to its infertility status. They tilt soil up to three to four times but the yield still unsatisfactory. The farmers did not use any acidity reclaiming measures to over-come soil acidity; there is no practice of lime application and other organic fertilizers use. Farmers use farm yard manures around their garden, but did not apply across the wide farm lands, there is also gaps in use inorganic fertilizers, in terms of rate and ways of application.

#### **Major challenges in high land of Basketo special woreda**

- Soil compaction during rainy season.
- Drainage problem, during the time high rain fall occurrence, which in turn brings water logging.
- Stunted growth of crops, like barely, wheat mainly and Faba bean to some extents.
- Difficulty in plough time.
- Limited use of organic fertilizers.
- Absence of bio fertilizers.
- No practice of compost use, in most kebelles.
- No habit of lime use in extremely acidic soil.
- Decline of soil fertility due to soil erosion and overgrazing.
- Lack of soil and water conservation, due to this case highly removal of top fertile soil and fertility reduction.

#### **Soil and water conservation in highland of Basketo special district**

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 is 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 and the extents of erosion is high in farm land than that of communal land as high land kebelles' respondents implied.

#### **Challenges in high land ecology**

- Erosion problem on communal and farm land.
- Soil and nutrient loss through runoff.
- Sever gully and sheet erosion.
- over grazing and shallow frequent tillage.
- Watershed practice is only on communal land but not private land.
- Back filling of bunds.

- Products and productivity of major crops are decline.
- No habit of maintaining physical structures.
- Lack of sustainability of constructed soil and water conservation structures.
- Lack of awareness on water harvesting structures.

#### **Agro forestry and plantation forestry in high land of Basketo special woreda**

Tree species found in this agro-ecology includes *Croton macrostachyus*, *Prunus africana*, *Juniperus procera*, *Cordia africana*, *Ficus sur*, *Millettia ferruginea*, *Ficus vasta*, *Podocarpus falcatus* and “kalasho”. From these species *Cordia africana*, *Ficus sur* and *Millettia ferruginea* have higher contribution in soil fertility improvement and better shading effect on coffee and korerima.

#### **Over all challenges in this ecology**

- Lack of well-established nursery site for multipurpose tree species.
- Lack of demonstration works that provide technical knowledge in FTC or other visitable areas.
- Firing of limited forest resources.
- Land degradation due to forest resources clearing.
- Lack of characterization of multipurpose tree species advantages in clear manner.

#### **Irrigation water management in high land of Basketo special woreda**

The sources for irrigation water here are springs and rivers and to some extent roof top water harvesting, which farmers use only for garden areas to produce onion, tomato carrot head cabbage and others. They irrigate by fetching and water mechanics for vegetables. there is one small modern irrigation scheme which called ‘amo’ irrigation scheme, from which farmers near to the scheme get advantages, this scheme gives services for limited number of house-holds near the scheme, the farmers are in challenge of water shortage even the scheme gives service throughout the year due to mismanagement of irrigation water at scheme and farm level, within this scheme farmer use furrow irrigation system. The rest of the farmers are out of the use of modern irrigation scheme.

#### **Challenges in high land of Basketo special woreda**

- No irrigation scheduling for major vegetables and other.
- No wide application of Furrow irrigation system.
- Lack of awareness on water harvesting technologies.
- Lack of provision of motor pump for lifting of water.
- No modern irrigation technology like drip irrigation.
- Lack of modern irrigation scheme.

## **The status of soil fertility, agroforestry, soil-water conservation and irrigation water management practices in mid land of Basketo Special woreda**

### **Soil fertility management in mid land of Basketo Special woreda**

The soil fertility status decreases, from time to time. Soil acidity problem to some extent occurs (no teff yield due to this problem). Soil characterization problem. Both soil physical and chemical properties are not determined. Low use of organic fertilizer like manure and other decomposed wastes in cereal production. And also not use recommended rate of organic fertilizers. No use of bio fertilizers.

- Soil compaction during rainy season.
- Drainage problem in some parts of the ecologies.
- Stunted growth of crops like, teff and maize etc.
- Limited use of organic fertilizers.
- No practice of compost use.
- Limitation of experience to intercropping, mulching, crop rotation in order to enhance soil fertility.

### **Soil and water conservation in mid land of Basketo Special woreda**

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 is 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 and the extents of erosion is high in farm land than that of communal land as high land kebelles' respondents implied.

### **Challenges in mid land of Basketo Special woreda**

- Erosion problem on communal and farm land.
- over grazing and shallow frequent tillage.
- Watershed practice is only on communal land but not private land.
- Back filling of bunds.
- No habit of maintaining physical structures.
- Lack of sustainability of constructed soil and water conservation structures.
- Lack of awareness on water harvesting structures.
- Inappropriate design and spacing of soil and water conservation structures (L, W, H) and slope.

### **Agro forestry and plantation forestry in mid land of Basketo Special woreda**

In this agro-ecology, the coverage of plantation forest is around (20%), natural forest (50%), cultivated land (25%) and cultivatable land (5%). In this agro-ecology there are different tree species like *Juniperus procera*, *Prunus africana*, *Croton macrostachyus*, *Cordia africana*, *Podocarpus falcatus*, *Syzygium guineense* and kalasho. *Cordia africana* has high soil fertility improvement and economic contribution than others as respondents responded.

### **Challenges in mid land of Basketo Special woreda**

- Awareness shortage on multipurpose tree spacing.
- Lack of well-established nursery site for existing species.
- Awareness gap on production and use of bamboo and other high land trees.
- Shortage of awareness for communities in planting multipurpose trees with coffee and 'korirema' crops.
- Knowledge gap on spacing of agroforestry trees which have the contribution for shading effect and soil fertility with coffee and "Korirema".

### **Irrigation water management in mid land of Basketo Special woreda**

the sources for irrigation water here are springs and rivers, farmers use mainly for garden areas to cultivate, onion, tomato carrot, head cabbage and others. They irrigate by fetching and water mechanics for vegetables. there is no modern irrigation scheme, from which farmers did not get any advantages of irrigation, this has high capacity to irrigation but still now no diversion work has been done scheme gives services for the farmers are in challenge of water shortage even the river could give service throughout the year due to, the rest part of kebele's did not have any access to yearly flowing river and other opportunities, farmers in the vicinities have the intension to practice irrigation, because there is high variability of climate.

### **Challenges in mid land of basketo special woreda**

- No irrigation scheduling for major crops.
- Lack of provision of motor pump for lifting of water to lift up water from sources.
- No modern irrigation technology like drip irrigation for areas where there is inadequate rainfall distribution.

### **The status of soil fertility, agroforestry, soil-water conservation and irrigation water management practices in lowland of Basketo Special woreda**

#### **Soil fertility management in low land of basketo special woreda**

As the farmers responded the soil has extent of cracking during dry season and compaction during wet season, the fertility status decreases from time to time as there exists rain fall shortage, there is high prevalence of weeds during onset of rain fall burning of cereal crops during flowering season, the use both organic and inorganic fertilizer is very poor, the land is unsuitability to be plough by oxen and to clean the hoes, there is high drainage problems during rainy season.

#### **Major soil fertility management constraints in low land of basketo special woreda**

- Mainly poor soil fertility.
- Lack of awareness on preparation of organic fertilizers on farm lands.
- No use of bio fertilizers and,
- Lack of proper inorganic fertilizers recommendation for sesame and other cash crops.
- Highly reduction of yield because improper management of soil and water.

#### **Soil and water conservation low land of basketo special woreda**

There is high erosion existence on this agro ecology due to, thus is due to sloppy features of the topography the extents of erosion is high in farm land than other forest covered lands. There are no indigenous soil and water conservation structures in this ecology, even

the introduced also did not practiced in wide aspect, because the farmers practice shifting cultivation practices. They expose the land to sheet erosion and then developed to high gully erosion. In the areas almost all little to no biological soil and water conservation practices done by farmers.

#### **Challenges in the low land ecology**

- Absence of water harvesting structures.
- Cracking and coursing property of the soil.
- Sedimentation and deposit effect on water bodies and farm lands.
- Lack of appropriately design of soil and water conservation structures in over grazed lands.
- High erosion occurrence from cultivatable lands but un-cultivated lands.
- No distribution of erosion resistant grasses by development agents and woreda agricultural office.
- Un sustainability of structures done by farmers due to soil cracking during dry seasons.

#### **Agroforestry and plantation forestry low land of basketo special woreda**

In this agro ecology there high density of naturally existing tree species than planted by existing communities and the tree species have no more contribution for soil fertility management. The areal coverage of plantation forest is very low in this agro ecology. In the very low land areas of the district farmers cut and clear forest for fire wood and wood products purpose.

#### **The major challenges in low land of basketo special woreda**

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

#### **Irrigation water management in low land of basketo special woreda**

In this agro-ecology there high water potentials from there are, rivers flowing from year to year. but which are un accessible to the farmers, due to lack of pumping device, the farmers settled in the upper side the rivers and which cannot be accessed by gravity system. There is UN even distribution of rainfall across the ecology across the season. The farmers are exposed to food insecurity due to rainfall shortage and un-seasonal heavily rainfall occurrence in this consecutive three years. Almost all there is no irrigation practices across the ecology.

#### **Challenges in low land of basketo special woreda**

- Lack of modern irrigation scheme in most kebelles, Except sanka irrigation scheme, which can irrigate around 120 ha (Angila-03 kebele), this scheme was constructed by regional irrigation agency and maintained by AGP-I and again by AGP-II project, this irrigation is functional but the farmers are not practicing irrigation for major market oriented crops. There is also one diversion irrigation scheme in buna basa kebele, which is intended to irrigate 500ha but it is not giving function to nearby farmers because its command area is out of dwellers settlement area, they cannot access water by gravity system.
- No pump supply from government or other non -governmental organization.
- No water harvesting practices, especially for dry spell.
- Even no pure drink water access, especially in Buna wolaita kebele.

## Conclusion and Recommendations

### Conclusions

This study has been identified different opportunities challenges and existing natural resource management practices in Basketo special 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 Basketo special woreda across different agro-ecologies:** These intervention points in each case were prioritized and recommended by preparing baseline survey result validation work shop in Basketo special woreda with different concerning bodies from woreda, zone, Researchers of different concerns from Agricultural Research Center, the following points were prioritized as the research 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.
- Providing awareness creation training for farmers, woreda's experts and DA's on preparation of organic fertilizers.
- Developing of drainage improving technologies in the areas with drainage problems for improvement of vertisol.
- Acid soil management techniques for improving agricultural production and productivity based on the agroecologies.

#### 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.
- Awareness creation on effects of deforestation and forest degradation on climate change.

### **Irrigation water management**

- Development of irrigation regime for major cereals, vegetables and fruits.
- Development of furrow irrigation system places where there is the practice of fetching and watering by can.
- Construction small scale modern irrigation schemes in the areas where there is no schemes, especially in the low lands with irregular features of rain fall distribution.
- Demonstration of water harvesting technologies (roof top water harvesting, hand dug well development).
- Awareness creation on contribution of motor pump for lifting of water and preparing ground for its provision.
- Promotion of pressurized irrigation technologies, especially drip irrigation for water scarce areas of low land with low cost water harvesting technologies like roof top water harvesting.

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