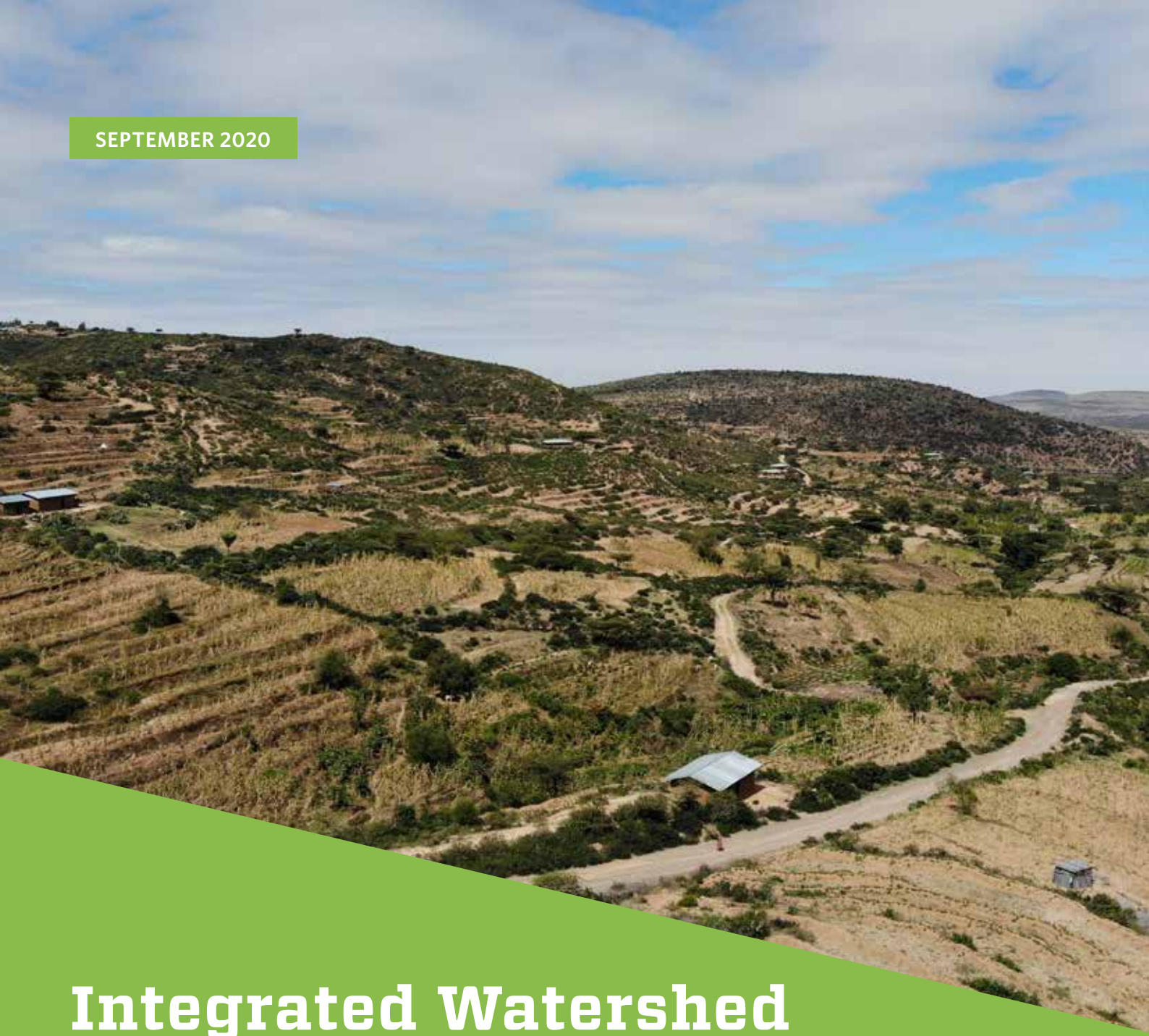

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Integrated Watershed Management (IWM) in Ethiopia: A baseline study in Dire Dawa, Deder and Zeway Dugdar

A FEINSTEIN INTERNATIONAL CENTER PUBLICATION

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Acronyms and Abbreviations

ASL	Above sea level
CBPWD	Community-based Participatory Watershed Development
CBPWDG	Community-based Participatory Watershed Development Guideline
CRGE	Climate-Resilient Green Economy
CRS	Catholic Relief Services
CSA	Central Statistical Agency
CWC	Community watershed committee
DA	Development agent
DEM	Digital elevation model
DFSA	Development Food Security Activity
DRR/EW	Disaster risk reduction and early warning
EC	Ethiopian calendar
ETB	Ethiopian birr
FAO	Food and Agricultural Organization
FFP	Food for Peace (USAID)
FGD	Focus group discussion
FHH	Female-headed household
FIES	Food insecurity experience scale
FTC	Farmer training center
GIS	Geographic information system
GoE	Government of Ethiopia
GTP	Growth and Transformation Plan
ha	Hectare
HCS	Hararghe Catholic Secretariat
HDDS	Household dietary diversity score
HEW	Health extension worker
HH	Household
IGA	Income-generation activity
IP	Implementing partner
IWM	Integrated watershed management
KII	Key informant interview
KWT	Kebele watershed (technical) team
l	Liter
LLPPA	Local Level Participatory Planning Approach
MERET	Managing Environmental Resources to Enable Transition project
MHH	Male-headed household
MoA	Ministry of Agriculture
NGO	Non-governmental organization
NRM	Natural resources management
PBS	Population-based survey
PLUP	Participatory Land Use-Planning
PSNP	Productive Safety Net Programme
QGIS	Quantum Geographic Information System

qt	Quintal
SFM	Soil fertility management
SILC	Savings and internal lending community
SWC	Soil and water conservation
t	ton
TLU	Tropical livestock unit
USAID	United States Agency for International Development
USLE	Universal Soil Loss Equation
WASH	Water, sanitation and hygiene
WASHCO	Water, sanitation and hygiene committee
WOoA	Woreda Office of Agriculture
WWT	Woreda watershed (technical) team
VSHG	Village sanitation and hygiene group

Executive Summary

Catholic Relief Services (CRS) is implementing a Development Food Security Activity (DFSA) program in Ethiopia, funded by the United States Agency for International Development (USAID). The DFSA is multi-year program with a goal to enhance resilience to shocks, and improve livelihood, and food and nutritional security for vulnerable rural households. The current DFSA is designed to reach 240,625 beneficiaries and is being implemented from 2016 to 2021 under the framework of the Government of Ethiopia's (GoE) Productive Safety Net Programme (PSNP).

CRS developed integrated watershed management (IWM) as a program strategy in Ethiopia in 2001. From 2002, CRS and partners have been implementing IWM in different projects and phases of the PSNP. IWM is one of the main strategies of CRS by which DFSA objectives are to be met. It aims to link PSNP planning to a unified three-to-five year watershed development plan.

Objectives and methodology

The overall objective of this study was to establish baseline information on climate change adaptation, mitigation, resilience and livelihoods, against which IWM interventions could be evaluated. Specific objectives were:

1. Establish socio-economic and biophysical baseline values for IWM intervention indicators.

2. Suggest strategies, approaches and metrics to improve and strengthen IWM interventions.

The study was conducted in three locations where CRS is implementing the DFSA, viz. Dire Dawa Administrative Council, and Zeway Dugda and Deder woredas in Oromiya Regional State. These locations have been PSNP implementation areas since 2005. The field data collection for the study was carried out in January 2020.

The main component of the study was a quantitative household survey. The survey was supported by a qualitative survey and a biophysical analysis. The quantitative survey involved 940 households, and the qualitative survey involved three woreda-level and nine kebele-level key informant interviews (KIIs), and nine community focus group discussions (FGDs). The biophysical analysis covered three watersheds per woreda (nine watersheds in total).

Main findings

- **Food security**

Food and nutritional insecurity are the main livelihood concerns in the study areas. Based on the food insecurity experience scale (FIES) for 12 month- and 30-day recall, 78% and 57% of households respectively were affected by moderate or severe food insecurity. On average, households experience food shortage for six months per year. A quarter of households also have a household dietary diversity score (HDDS) of only 3 out of 12 food groups based on 24-hour recall. Household food sources include own production, market purchase, PSNP support and humanitarian responses. However, the study results indicate that these food sources, including program support from PSNP, are inadequate or not timely.

- **Agricultural production and productivity**

The areas covered by the baseline study are characterized by low crop productivity relative to national averages. For instance, maize is a commonly grown crop in all three woredas but production averaged 16 quintal (qt)/hectare (ha) against a national average of 40 qt/ha. Low productivity was attributed to land degradation and climate risks, as well as limited access to agricultural inputs and extension services.

Households in the study areas cannot produce enough food to meet their needs. The average area of land cultivated was 0.54 ha per household, and crop productivity was low; these conditions contribute to a 38% household food deficit, to be filled from other sources or remain unmet.

It is common to keep livestock for food and income, and as a type of asset saving that can be sold in response to shocks. In the study areas, 62.1% of households own at least one animal, and the average household livestock ownership was 1.3 tropical livestock units (TLUs); this is equivalent to 1.8 cattle per household.[1] However, livestock ownership among female-headed households (FHHs) was only 0.8 TLU compared to 1.4 TLU for male-headed households (MHHs).

Most cattle were local breeds with the average milk productivity of 2.1 liters (l)/day; this was above the national average of 1.4 l/day. Although improved cattle breeds produced milk at 11.9 l/day, this production was achieved with higher input costs, e.g., with improved shelter, veterinary services and feed. Local breeds of chicken produced 40 eggs/year compared to 95 eggs/year from improved breeds. Again, improved chickens require higher input costs and are more susceptible to disease.

Despite the important role of livestock in livelihoods, livestock production in drought-prone rural areas of Ethiopia has various challenges, including shortage of feed and limited veterinary services. Only 44%, 50%, 57% and 48% of households reported adequate access to animal feed for cattle, sheep, goats and poultry respectively. Similarly, 56%, 60%, 60% and 46% of households owning cattle, sheep, goats and poultry respectively have access to veterinary services. As browsing animals, goats and camels have better access to feed than grazing animals (cattle and sheep) and poultry. The ownership of camels and goats over cattle and sheep is an important climate change adaptation strategy, where the ecology allows.

Beekeeping was not a traditional activity in the study areas, and only 2.5% of households kept bees. There was some indication that organized youth groups were provided with closed areas for beekeeping and other economic activities, but beekeeping is less widely practiced relative to other parts of Ethiopia with a comparable environment, e.g., parts of Amhara and Tigray Regions.

Access to weather information ranged from 30% to 63% of households, depending on woreda. There was wide variation in sources of weather information between woredas. In Zeway Dugda only 17% of households used Development Agents (DAs) for weather information, and only 12% used the CRS-DFSA project. Given the importance of using weather information in IWM, the reasons for low access and application require further examination.

- **Household expenditure and income**

The average annual household expenditure is Ethiopian birr (ETB) 13,021 (US$ 381)[2], with MHHs expenditure being 26% higher than FHHs. On-farm and off-farm income-generation activities (IGAs) are income sources for 61% and 29% of households respectively. The reliance on farm-related income sources means that households are susceptible to climate-related shocks, especially if land holdings and livestock ownership are low.

- **Access to socio-economic services and infrastructure**

A high proportion of households reported access to primary schools (97%), rural roads (82%) and farmer training centers (FTCs) (78%). In contrast, access to health posts (62%) and veterinary facilities (53%) was relatively low. However, all services were accessible within 30 minutes' walking distance. Despite variations by woreda, many households reported that all types of service are modestly or poorly functioning, due to the very poor condition of the infrastructure, shortage of materials and lack of skilled personnel.

In terms of coverage, 84% of households have access to safe drinking water. This level of coverage is well above the Ethiopian government's Growth and Transformation Plan II (GTP II) target of 51% for 2020 (National Planning Commission, 2016). However, the daily domestic water consumption in the study areas was only is 9 l/day/person, which is far below the GTP II target of 25 l/day/person. Similarly, drinking water sources are located at an

1. The commonly used TLU conversion factors are: 1 camel = 1 TLU; 1 cattle = 0.7 TLU; 1 sheep or goat = 0.1 TLU; 1 equine = 0.5 TLU; 1 chicken = 0.01 TLU (Jahnke, 1982).

2. **https://www1.oanda.com/currency/converter/** (accessed May 27, 2020); ETB 34 = US$ 1.

average distance of 1.8 km compared to the GTP II target of 1 km. The long distance to water sources and limited awareness of sanitation practices, such as frequent hand washing, were expected to be some of the reasons for the low rate of water consumption.

Only 10% of households use improved pit latrines with a slab cover. Ninety percent of households practiced open defecation or used pit latrines without a slab cover. Such poor access to domestic water and sanitation facilities is likely to substantially increase the risk of water-borne and other communicable diseases, indicating that CRS and partners should integrate water, hygiene and sanitation (WASH) into the IWM approach.

- **Status, management and benefits of natural resources**

On average a household has only 0.54 ha of land for farming. Land distribution is biased towards male-headed households (MHHs), who have 10% more land compared to female- headed households (FHHs). About 20% of households are landless, and 33% of FHHs were landless compared to 18% of MHHs. These findings indicate the need for alternative livelihood sources outside of crop farming, especially for landless FHHs.

Based on satellite images, 68% of the land in the study watersheds was being cultivated while nearly 30% had permanent vegetation cover (bushes and shrubs). Four out of nine sample watersheds have annual soil loss above the tolerable limit of 16 tons (t)/ha/yr. Severe land degradation is observed in watersheds in Deder compared to Dire Dawa and Zeway Dugda, mainly because of the slope factor in Deder, the rugged landscape and the need to farm on steep slopes.

About 66% of households use natural resources management (NRM) practices on their own land, and 87% of households acknowledged the presence of NRM practices on communal land. Regarding the maintenance and management of these practices, about 63% and 52% of households reported that soil and water conservation (SWC) works on private and communal lands respectively were well maintained. This indicates that up to 37% and 48% of SWC works on own farmlands and communal lands respectively were not well maintained or well managed. This finding shows a need for corrective actions to improve the maintenance and management of SWC works and reduce further loss of natural resources.

The benefits of previous IWM interventions related to NRM included creating access to protected areas for youths, enhancing land productivity and improving household food security. Some kebele administrations have started allocating areas protected through NRM initiatives to youths for apiculture and to start IGAs. However, this approach is not yet widely promoted.

SWC practices have contributed to increasing cropland productivity, especially when farmers are able to apply these practices to over 50% of their land. When coverage of SWC reaches over 75% of land, crop productivity was reported to increase by up to 30%, compared to land without or with under-50% SWC coverage.

- **Approach to IWM**

The Federal Ministry of Agriculture (MoA) in Ethiopia has a Community-based Participatory Watershed Development (CBPWD) Guideline that was issued in 2005. This Guideline outlines the roles and responsibilities of woredas, kebeles and community-level structures, and the steps and principles for the implementation of IWM in a participatory manner. All IWM implementers, including regional Bureaus of Agriculture (RBoAs) and non-governmental organizations (NGOs), have the responsibility to follow this Guideline in their IWM. CRS is supporting the implementation of watershed development in the form of capacity building, technical assistance, supervision and financial assistance. It also regularly organizes joint monitoring missions.

The most appropriate approach for CRS in the future implementation of IWM is to strictly follow the MoA CBPWD Guideline (CBPWDG), with related capacity building at woreda and kebele levels. Experiences from the Managing Environmental Resources to Enable Transition (MERET) project in Ethiopia indicate that the best way to adopt this guideline is to first select a few model watersheds per kebele within a woreda, and plan and implement IWM, strictly following the CBPWDG. This approach should also serve as on-the-job training for technical experts and community members.

The application of the principles and approaches of community-based participatory watershed development and the focus on community capacity building are viewed as a lesson from MERET in terms of improving the livelihoods of rural households that depend on degraded environments.

Chapter 1: Introduction

1.1 Background

This report presents the findings of a baseline study in selected areas of Ethiopia covered by the Catholic Relief Services (CRS) integrated watershed management (IWM) strategy. In Ethiopia, CRS supports IWM through a United States Agency for International Development (USAID)-funded Development Food Security Activity (DFSA) program, which is under the framework of the Government of Ethiopia's (GoE) Productive Safety Net Programme (PSNP).

CRS developed IWM as a program strategy in Ethiopia in 2001, and from 2002 CRS and its partners have been implementing IWM in different projects and phases of the PSNP. IWM has been one of the main strategies of CRS by which DFSA objectives are to be met.

1.1.1 Productive Safety Net Programme (PSNP)

The PSNP was launched by the GoE and a consortium of development partners in 2005 as a new way of responding to chronic food insecurity. This program was a point of departure from the cycle of annual emergency food aid appeals to a planned multi-year response. PSNP provides cash or food transfers to chronically food-insecure households (those receiving food aid annually prior to 2005) in exchange for labor-intensive public works, while labor-poor households receive unconditional "direct support" transfers. The public works component of the program covers about 80% of beneficiaries while the remaining households are under direct support. The public works participants receive transfers for six months per year whereas the direct support clients obtain transfers all throughout the year.

The public works component of PSNP focuses on the implementation of soil and water conservation (SWC) measures and the development of community assets such as roads, water infrastructure, schools and clinics. Therefore, PSNP is supporting IWM through improvements in rural infrastructure and watershed development (MoA, 2014).

1.1.2 Development Food Security Activity program (DFSA)

USAID's Office of Food for Peace (FFP) launched its 2016–2025 DFSA in Ethiopia in October 2016. The overarching strategic goal of DFSA is "food and nutrition security of vulnerable populations strengthened." The program goals are to enhance resilience to shocks and livelihoods, and improve food and nutrition security for rural households vulnerable to food insecurity. Under this goal there are objectives and results, which aim to institutionalize the concept of resilience and strengthen FFP's commitment to working with vulnerable groups (FFP, 2016). The two objectives of DFSA are: i) enhance resilience to shocks and livelihoods; and ii) improve food security and nutrition for rural households vulnerable to food insecurity.

The current CRS-DFSA in Ethiopia was designed to be implemented from 2016 to 2021 with integrated features to support PSNP IV and to meet the overall goal and objectives of the FFP Food Security Strategy in Ethiopia (CRS, 2018; Vondal, et al., 2018).

1.1.3 Integrated watershed management (IWM)

A watershed is an area from which the water run-off drains and flows through a common point in the drainage system. IWM is the process of managing human activities and utilizing natural resources on a watershed basis, taking account of social, economic and environmental issues, as well as community interests and benefits.

Watershed-based local development planning started in Ethiopia in the early 1980s. It gradually passed through different initiatives, and in 2005 experiences were captured in the comprehensive Community-based Participatory Watershed Development (CBPWD) Guideline, developed by the then-Ministry of Agriculture and Natural Resources Development (Desta, et al., 2005). Currently, GoE and partners such as CRS are attempting to apply this Guideline in the implementation of IWM activities.

1.1.4 Integrated watershed management in CRS Ethiopia

CRS began its IWM program in rural Ethiopia in 2001 to address the problem of recurring food insecurity and degraded livelihoods in a comprehensive manner (Hebert, et al., 2010). CRS drafted an IWM program strategy with the following six objectives:

1. To improve cash and food crop production, leading to food security;
2. To improve soil and water conservation, soil fertility and land management with the use of appropriate biological and physical measures and agricultural inputs;
3. To improve water supply for domestic, livestock and irrigation purposes (multiple uses of water (MUW);
4. To increase household income through diversification of agricultural and non-agricultural activities;
5. To empower communities to develop their resources in a sustainable manner through education, training and strategic linkages to government and non-government agencies; and
6. To address other priority needs of the community through integrating relevant sectors such as community-based health education, hygiene and sanitation, and savings, and to increase the status of women and girls within target communities.

Over time, CRS and its partners have applied this IWM strategy as a way of transitioning from relief to longer-term development by considering watersheds the primary focus for designing projects and directly working with communities and relevant government institutions. To address the six objectives in the IWM strategy, since 2002 CRS and partners have been designing projects using six major components, as well as sub-interventions under each component. These include:

1. Natural resources management;
2. Agricultural support and agro-enterprise development;
3. Multiple uses of water—irrigation, domestic water supply (human and livestock use);
4. Sanitation, hygiene and health education, and disease prevention;
5. Savings and internal lending communities (SILCs), and income-generation activities;
6. Cross-cutting: gender and partnership arrangements.

CRS drafted and piloted its first "Integrated Watershed Management Strategy" in Harbu Woreda, Amhara Region from 2002 to 2004 (Hebert, et al., 2010). CRS then implemented IWM as standalone projects, mainly through private funding, and as a strategy under the PSNP since 2005. IWM is one of the principal approaches used in the current CRS-DFSA (2016–2020). As per its design document, CRS-DFSA addresses drought and the other climate risks through a variety of risk management and adaptation measures at the watershed and household level, building adaptive capacity and improving links, relationships and networks (CRS, 2017). This program also links PSNP IV planning to a unified three-to-five year watershed management plan and community-managed disaster risk reduction planning process, with a view to increasing resources and assets available to the communities through public works interventions.

1.2 The IWM baseline study

1.2.1 Developing a conceptual framework for impact evaluation of IWM

As CRS has been supporting IWM in Ethiopia since 2002, a conceptual framework was developed to enable comprehensive impact evaluations of IWM during the current or future DFSA programs or similar programs. The framework was designed to cover IWM processes, outcomes and impacts. It provides a point of reference for the design of a baseline study and for any later studies that compare changes over time to the baseline. **The conceptual framework is described in detail in Chapter 2.**

1.2.2 The IWM baseline study

Using the conceptual framework, a baseline study was designed and implemented in selected CRS-DFSA locations. In line with the conceptual

framework, the baseline study covers economic, social and environmental factors that IWM activities might be expected to influence, and which in broad terms relate to climate adaptation, livelihoods and resilience. Field data collection took place in January 2020, and the study had two main objectives:

1. Establish baseline socio-economic and biophysical values in selected IWM intervention locations;

2. Suggest strategies, approaches and metrics to improve and strengthen interventions.

Under objective 1 it was recognized that the baseline values were not only applicable to IWM activities and impacts but also to a wider range of program activities under the DFSA.

The baseline study design and methods are described in Chapter 3, and the findings are presented in Chapter 4. General recommendations are given in Chapter 5.

Chapter 2: Understanding IWM Processes, Outcomes and Impacts: a Conceptual Framework

2.1 Integrated watershed management

2.1.1 What is a watershed?

Primarily, a watershed is a hydrological unit. It is an area from which water run-off drains and flows through a common point in the drainage system. However, watersheds also include all natural resources (e.g., water, soil and vegetation), people, farming systems, institutions and livestock, and the interaction among these components (Gadisa, 2016). Therefore, a watershed is not simply a hydrological unit but also a biophysical unit, and a socio-economic and political unit used for planning and implementing natural resources management and livelihood security programs, and sometimes to delineate administrative boundaries.

If a watershed is viewed as a geographical area drained by a watercourse, the concept applies at various scales, from for example, a farm drained by a creek (a "micro-watershed") to a large river basin (or a lake basin). According to the GoE CBPWDG, the size of a watershed should be based on the community or communities dependent on the watershed (Desta, et al., 2005). However, the Guideline recommends the size of community watersheds to be within the range of 200 to 500 ha. The basis for this recommendation is a human settlement pattern, which is seen as suitable for planning and resource management.

2.1.2 What is integrated watershed management?

The Food and Agriculture Organization (FAO) (1986) defines watershed management as the process of formulating and carrying out a course of actions involving manipulation of natural, agricultural and human resources on a watershed to provide resources that are desired by and suitable to a society, but under the condition that soil, water and vegetation resources are not adversely affected.

Integrated watershed management (IWM) is the process of managing human activities and utilizing natural resources on a watershed basis, taking social, economic and environmental issues, as well as community interests, into account to sustainably manage and protect environmental resources while addressing environmental challenges and climate risks.[3] For this, IWM must consider the social, economic and institutional factors operating inside and outside the watershed. In this way watersheds can be local planning and development units that recognize the natural and socio-economic determinants within and outside of the watershed and the hydrological boundary of consideration.

2.1.3 Delineating and measuring watersheds

A watershed must be strictly delineated and measured prior to any planning of interventions through IWM. Accurate delineation of a watershed plays an extremely important role in the management of the watershed. The delineated boundaries form the nucleus around which the management efforts such as land use, land change, soil types, geology and river flows are analyzed, and appropriate conclusions are drawn. The accuracy of delineation and measurement is, therefore, one of the factors that determines whether the IWM approach is correctly applied (see section 4.2.1 for delineation of watersheds using satellite images and geographic information system (GIS) in the baseline study).

2.1.4 Climate change adaptation and resilience

According to the Intergovernmental Panel on Climate Change (IPCC), climate change adaptation is the process of adjustment to the actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects (IPCC, 2014).

3 See **https://conservationontario.ca/fileadmin/pdf/policy-priorities_section/IWMFactSheet_PP.pdf** (accessed August 22, 2019).

People living in poor countries like Ethiopia, and whose rural livelihoods are principally dependent on agriculture, are most affected by changes in local precipitation, soil moisture and vegetation due to climate change. Climate change adaptation is one of the ways to ensure the livelihood security of these poor people.

IWM practices use different activities for managing natural resources (soil, water and vegetation) to address the ever-increasing vulnerability to climate risks. Therefore, watershed management could be one of the tools used to cope with climate change, managing loss and scarcity of water resource and degradation of soil and vegetation (Keshar, 2008).

There are various definitions and concepts of resilience in the development and humanitarian domains. Common features are the focus given to both ex-ante and post-disaster situations, people and systems, and natural and human-induced shocks (Ulrichs, et al., 2019; Gutu, 2017; FSIN, 2014). Adger defines resilience as the ability of people, communities or systems that are confronted by disasters or crises to withstand damage and to recover rapidly (Adger, 2000).

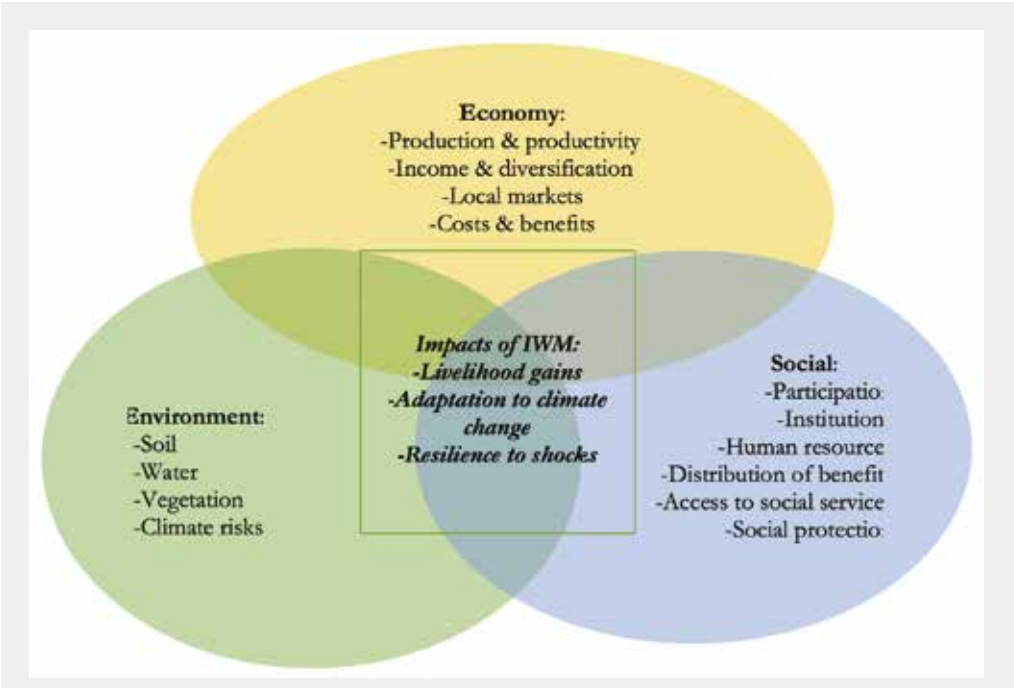
2.2 Conceptual framework

A conceptual framework for assessing IWM is shown in Figure 1.[4] The framework includes processes and outcomes related to IWM as well as IWM impacts, which can be economic, social and environmental. Based on the framework, the baseline study focused on providing values for relevant indicators for the process, outcome and impact of IWM interventions.

Environment: Environment constitutes natural resources and climate risks. The natural resources under environment include soil, water, vegetation and climate. Natural resources degradation is manifested by reduction or loss of quality and quantity of resources. The degradation of these natural resources is caused by two interlocking complex systems: the natural ecosystem and the human social system (Habtamu, 2011). Unless natural resources degradation is curbed through human interventions, such as integrated watershed management, it is a major threat to the livelihood of rural households.

Within the environment component of the framework, climate risks are created due to

Figure 1. Conceptual framework for understanding IWM processes, outcomes and impacts.



4 For the original framework see **https://conservationontario.ca/policy-priorities/integrated-watershed-management/** (accessed August 22, 2019).

vulnerability to shocks such as floods, droughts, pests, and livestock and human diseases. Such risks include loss of productive assets (e.g., land and water), and loss of production, assets and income. Biophysical measures to conserve natural resources and other actions are important elements of IWM. Biophysical measures are applied to reduce soil erosion, increase vegetation cover and increase water availability.

Economy: Economy within the concept of IWM has two dimensions. The first dimension is the cost of implementing and maintaining IWM interventions. The second dimension covers the benefits obtained from IWM in terms of income, and production and productivity using natural resources within a watershed. Any new technique or any new measure proposed for NRM through IWM has to be economically viable; otherwise the people will not accept it (Kemal, et al., 2005). Economic benefits can be gained from enhanced production and productivity or diversification of income sources. As part of the IWM system, households should have access to knowledge sources on improved practices and technologies, and market opportunities to buy production inputs and sell outputs.

Social: Social contexts affect IWM design, implementation and sustainability. The presence of supportive institutions, participation of local communities and skilled human resource capacity within and outside of the community are key for IWM. Access to social services such as health, education and water are important social aspects of IWM. In the context of Ethiopia, formal social protection is mainly in the form of the PSNP, which provides resource transfers to vulnerable people exposed to shocks; it also provides input resources for IWM by mobilizing labor and capital budget.

Impacts of IWM: The ultimate goal of the environmental, economic and social outcomes of IWM is to enhance the livelihood security of people and at the same time, enhance their adaptation to climate change and resilience to shocks. In this study, livelihood security relates closely to food and nutritional security at household level, and related issues such as ownership or access to key assets such as land and livestock, and non-farm income. The most effective contribution of climate change adaptation lies in providing residents of watersheds with tools and information. These tools can have environmental, economic and social aspects. The information is about forecast of local weather so that people and system actors can make proper decisions to reduce climate shocks.

2.3 The baseline study questions

Based on the conceptual framework and guidance from CRS on local contexts, nine main questions were identified for the baseline study (Box 1).

Box 1: Baseline study questions

1. What are the status and management practices of natural resources (soil, water and vegetation) and their contributions to household livelihoods improvement?
2. How is the coverage and access to social services (health, education, WASH, road, FTCs)?
3. How are watershed resources and services shared among different socio-economic groups (gender, wealth and age groups)?
4. What are the levels of agricultural production and productivity?
5. What is the status of household food and nutritional security?
6. What is household income size and source diversification (of agricultural and nonagricultural activities)?
7. What are the decision-making roles of different socio-economic groups (gender, wealth and age groups) in watershed resources and services development and utilization?
8. What are the existing local institutions and their capacity to sustainably support IWM interventions?
9. What is the most appropriate model for CRS for the implementation of IWM interventions?

Chapter 3: Research Design And Methods

3.1 Overview of research design

The baseline study involved three main components, viz. a quantitative household survey, qualitative research and biophysical analysis, which took place simultaneously. Each component is described in detail in sections 3.2 to 3.4.

During an inception phase, all data collection instruments used in the quantitative survey and qualitative research (household survey questionnaire, and key informant and focus group discussion guides) were developed and presented to CRS Ethiopia. After comments and discussion with CRS Ethiopia staff, the study team revised the data collection tools and field tested the household survey questionnaire in Zeway Dugda Woreda (one of the selected woredas for the study). The study team then presented the second version of the household questionnaire, updated based on the lessons from the field test, to CRS Ethiopia. CRS again gave detailed comments, including some adjustments to the objectives of the study and the study questions. Based on these comments, the study team revised the whole set of data collection tools and the study approach.

The use of biophysical data from satellite images and field observations was introduced by Feinstein/ Dadimos to add value to the study and to recognize the importance of clearly delineating watersheds when using an IWM approach (see section 3.4 and 4.2.1).

3.2 Quantitative household survey

3.2.1 Survey locations and timing

The quantitative survey involved household data collection in Dire Dawa Administrative, Deder Woreda and Zeway Dugda Woreda. These three areas were selected purposively by CRS Ethiopia based on their relevance to IWM interventions. Within these areas, 21 watersheds were sampled (7 watersheds per woreda).

Dire Dawa Administration is found in the eastern part of Ethiopia, latitude 9° 27′ 3″–9° 49′ 54″ N and longitudes 41° 38′ 6″–42° 19′ 17″ E, with 106,000 hectares of land. It is characterized by rugged terrain with altitude ranging from 500 to 2,500 meters above sea level (ASL). Over the course of the year, the temperature typically varies from 14°C to 33°C and is rarely below 12°C or above 36°C About 48% of this land falls under dry upper kolla.[5] See Figure 2 below.[6] Cereal, horticulture and livestock production are the main farming activities of rural households in Dire Dawa. *Chat*[7] is also commonly grown as a cash crop in the area.

Deder Woreda is one of 19 woredas in the East Hararghe Administrative Zone of Oromia Regional State. Geographically, Deder is located in the eastern part of Oromia Regional State between 9°09″N – 9° 24″ N latitude and 41° 16′ E – 41° 32″ E longitude. Vast areas of the woreda are characterized by undulated and rugged landscape. See Figure 3. Agro-climatically, the woreda encompasses highland (33%), midland (50%) and lowland (17%) areas with altitude ranging from 1,200 to 3,138 m ASL. Over the course of the year, the temperatures typically varies from 8°C to 26°C and is rarely below 6°C or above 28°C Agriculture is the major economic activity, and crop production and livestock rearing are the main source of livelihoods of the rural population. Maize and sorghum are staple crops produced in the area. Wheat and barley are also important food crops, produced in the highland part of the woreda. Legumes such as haricot bean and horse bean are usually intercropped with maize and sorghum (Elias, 2013).

Zeway Dugda Woreda is located in Easter Shewa Zone of Oromiya Regional State. It is located 8° 01′ to 8° 25′ latitude and 38° 32′ to 39° 04′ longitude. The area has an altitude that ranges from 1,600 to 2,020 m ASL. The total area of the woreda is

5 Ethiopia has six traditional agriculture zones. Kolla is one of these zones. It is lowland, between 500m to 1500m in altitude

6 The agro-ecological classification of study areas is made on the basis of Agro-ecological class for Ethiopia prepared by MoA (See Annex 7).

7 *Chat* or *khat* (*Catha edulis*) is a flowering evergreen shrub native to East Africa and the Arabian Peninsula. The plant contains two alkaloids, cathinone and cathine, which act as stimulants. See **https://www.livescience.com/37948-what-is-khat-cathinone.html** (accessed May 28, 2020).

Figure 2. Agro-ecological map of Dire Dawa Administration.

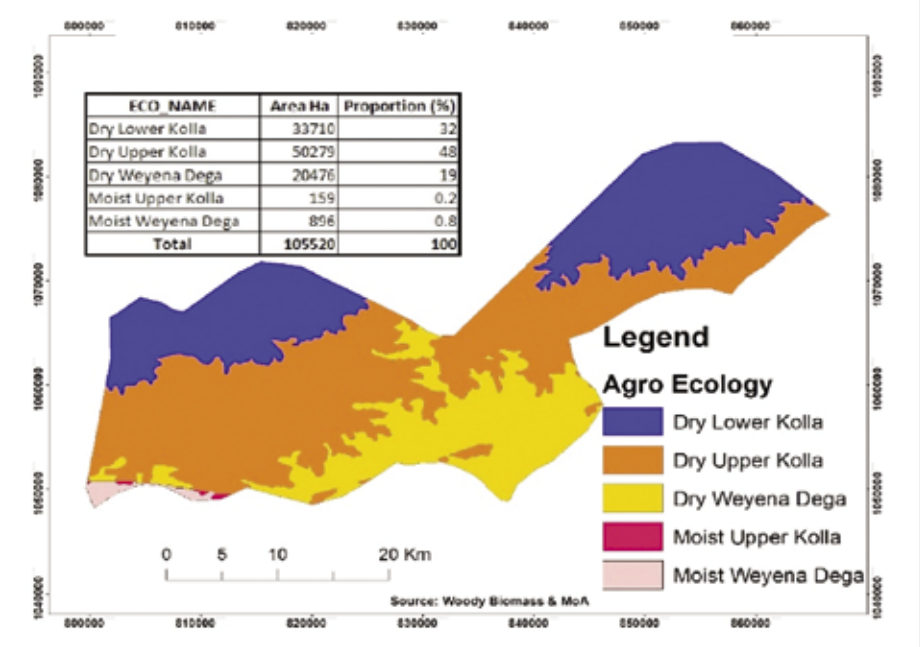


Figure 3. Agro-ecological map of Deder Woreda.

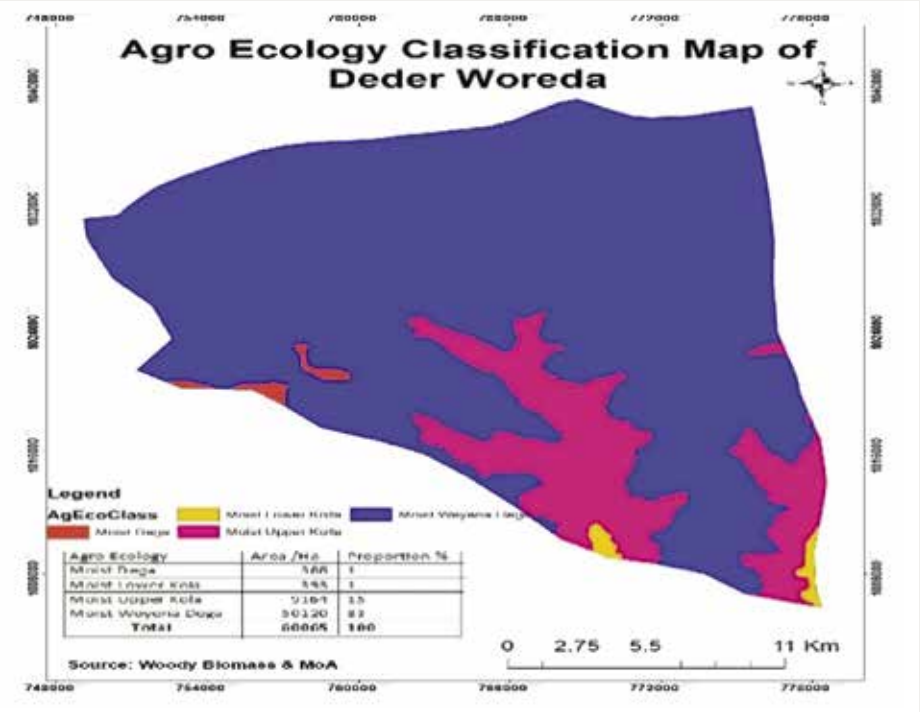
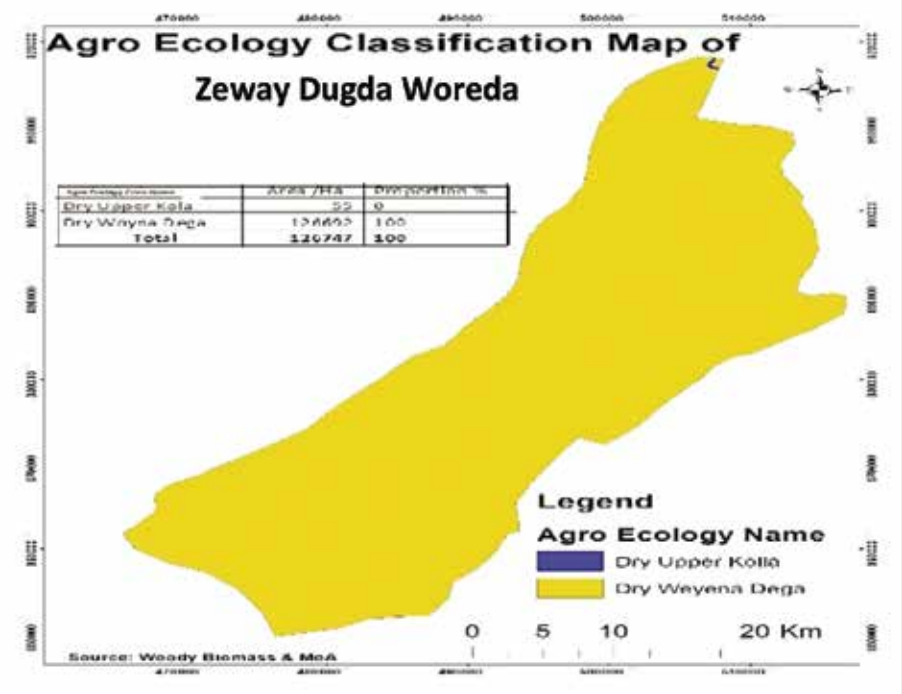


Figure 4. Agro-ecological map of Zeway Dugda.



95,945 hectares. Its topography is uniform compared to the other two study woredas. The two major types of soil in the woreda are sandy loam (59%) and clay loam (41%). See Figure 4. The mean annual temperature is 22 degrees C to 28 degrees C, and annual rainfall ranges from 700 to 800 mm. The major crops produced include vegetables, cereals and pulses, integrated with livestock production. Even though there are inadequate irrigation facilities, vegetable crops (onion, tomato, cabbage, green pea and chilli) are largely planted and harvested two to three times a year using Zeway Lake, Meki River and underground water as sources of water, characterized as a traditional irrigation system (Miruts & Ejersa, 2019).

3.2.2 Data collection

Information was collected from households using a questionnaire, which comprised ten modules:

1. Module A: Identification;
2. Module B: Household/respondent's profile;
3. Module C: Household's PSNP status;
4. Module D: Natural resources management (NRM);
5. Module E: Agricultural production and productivity;
6. Module F: Multiple uses of water (MUW);
7. Module G: Access to financial services (saving and credit) and income-generating activities;
8. Module H: Household income and livelihood diversification;
9. Module I: Household food and nutrition security status;
10. Module J: Benefits to and empowerment of women and girls.

Further details are provided in Annex 2.

The data collection took place from January 9 to 17, 2020. The questionnaire was administered by trained enumerators, with the questionnaire loaded on to tablets. The Census and Survey Processing System (CSPro), a public domain software package from the US Census Bureau, was used for entering and editing survey data.

The household survey data from different enumerators and watersheds were converted into one CSPro data file and exported to the Statistical Program for Social Scientists (SPSS) for further editing and analysis.

3.2.3 Sample size determination

The study used a descriptive, population-based survey (PBS) that only required running a single episode of survey data. To determine the total number of sample households, a standard sampling formula was used (Cochran, 1977); this is also suggested by Feed the Future Population-Based Survey Sampling (FTF-PBS) Guide (Diana, 2018):

$$n_{\text{int}} = d_{eff} \times \left[\frac{Z^2 p(1-p)}{MoE^2}\right]$$

Where:

n_{int} = initial value of sample size.

d_{eff} = design efficiency, a factor that provides a correction for loss of sampling efficiency resulting from the use of cluster sampling instead of simple random sampling. This study used the deff values of different indicators in CRS operational areas, obtained from a DFSA baseline survey conducted in 2017 (USAID, 2018).

Z = standard normal deviation, 1.96.

p = prevalence rate of variable. The p value is taken from the DFSA baseline survey.

MoE = margin of error, 5%.

Different indicators with values of prevalence and design efficiency were obtained from the 2017 DFSA baseline (USAID, 2018) and were used to calculate the number of sample households (n_{int}) required for the survey. From seven indicators in the DFSA baseline that were judged as relevant to study, the indicator *percentage of households using an improved drinking water source* had the highest n_{int} of 846 households; this indicator was selected as the key indicator to determine household sample size (Table 1).

Table 1. Sample size required to undertake the PBS

Indicator in DFSA baseline (USAID, 2018)	d_{EFF}[1]	Z	p (%)[1]	MoE	n_{int}	N_{final}
Prevalence of moderate or severe food insecurity based on 30-day recall (FIES)	2.3	1.96	79.1	0.05	584	677
Prevalence of moderate or severe food insecurity based on 12-month recall (FIES)	2.2	1.96	83.7	0.05	461	534
Percentage of households using an improved drinking water source	**2.8**	**1.96**	**22.3**	**0.05**	**746**	**864**
Percentage of households that can obtain drinking water in less than 30 minutes (round trip)	2.6	1.96	19.6	0.05	630	730
Percentage of households using a basic sanitation facility	1.8	1.96	52.0	0.05	690	799
Percentage of farmers who used financial services in the past 12 months	1.4	1.96	17.5	0.05	311	360
Percentage of farmers who used at least three sustainable NRM practices and/or technologies in the past 12 months	1.8	1.96	20.6	0.05	452	524

The final household sample size was calculated by inflating the initial value by a non-response rate and a probability of tertiary sampling units occurring within the secondary sampling units. A 10% non-response rate was used as suggested by the FTF-PBS Guide (Diana, 2018). According to the DFSA baseline (USAID, 2018), in 4.1% of households there was a possibility of losing or not accessing female adult household members. Therefore, as indicated in Table 1, the n_{int} is inflated by 10% and 4.1% to calculate the N_{final} values for the different indicators. Therefore, the final sample size for the IWM study was calculated as follows:

$$N_{final} = \frac{n_{int}}{(1-0.1)(1-0.041)}$$

In the IWM study, a watershed was considered a cluster for sampling purposes. To estimate the number households per cluster, different literature was reviewed. The FTF-PBS Guide (Diana, 2018) recommends the use of a range of 20–75 households/cluster, while the United Nations used up to 50 households per cluster (Department of Economic and Social Affairs, Statistical Division, 2008). It is important to use take a logistically reasonable number of households per cluster without compromising statistical efficiency by inducing a reasonable d_{eff}. Therefore, as this research was conducted in only three woredas and carried out under strict supervision of field data collection, 43 households per cluster were used (Table 2).

3.2.4 Selection of watersheds and households

Watersheds are both clusters for the household quantitative survey and geographic units for the biophysical analysis (see section 3.4).

CRS staff and the study team jointly delineated watersheds in the areas where the DFSA supported NRM activities. Using a Digital Elevation Model embedded in an application called Quantum GIS, 65 watersheds were identified in the three woredas: 24 in Deder; 23 in Dire Dawa and 18 in Zeway Dugda. Twenty-one watersheds were then randomly selected using fractional interval systematic sampling (FISS); the list of sampled watersheds and location kebeles is shown in Annex 5.

To select households within the sampled watersheds, an ordered list of households was prepared on the basis of their geographic location within the watersheds. As this survey was a PBS, all households were listed regardless of gender, age or PSNP status. Using the ordered list, households were randomly sampled using FISS.[8] This approach enabled an even geographic distribution of sample households.

3.2.5 Data analysis

Both descriptive and inferential statistical methods were applied to analyze the quantitative data generated from the household survey. The descriptive analysis included presentation of survey findings using percentages, count distributions and/or central tendencies by geographic areas and socio-economic groups of respondents.

Table 2. Number of watersheds and sample households—quantitative survey

Woreda	Number of households	Number of watersheds
Deder	347	7
Dire Dawa	302	7
Zeway Dugda	301	7
Total	950	21

8 The ordered list of households should include households that are residing, or not residing but having livelihood source (e.g., plot of land), within the sample watershed. Direct support PSNP clients should be excluded from the ordered list as they are not targeted for livelihood interventions. If these beneficiaries are included in the primary list, the enumerators should go to and do the interview with the household in the ordered list.

3.3 Qualitative research

Qualitative research was used to collect information to support the quantitative household survey and biophysical analysis. The qualitative methods were as follows:

- Key informant interviews (KIIs) with three woreda Office of Agriculture staff responsible for watershed management, nine development agents (DAs) at kebele level and staff of CRS partners;
- Community focus group discussions (FGDs) in three kebeles per woreda (total of nine FGDs);
- Direct observations and transect walks.

Both KIIs and FGDs were conducted at field level alongside the household survey, and in the same kebeles covered by the household survey. The data from KIIs and FGDs were transcribed from voice to text format for analysis. Further details on qualitative methods are presented in Annex 3.

For analysis, qualitative data were organized by thematic areas. The information from different sources on similar themes was contextually interpreted and is presented in the report together with the findings from the household survey and biophysical data analysis, as appropriate (see Chapter 4).

3.4 Biophysical analysis

Biophysical analysis was conducted in 3 randomly selected watersheds per woreda (total 9 watersheds) using the same list of 21 watersheds as for the quantitative household survey (see section 3.2.4). The assessment was done mainly to provide information the level of soil loss in the 3 woredas. Thus, it involved a rapid ground assessment and application of remote sensing and GIS technologies to collect data to calculate soil losses. The rapid ground assessment involved primary data collection using a transect-walk method while the remote sensing methods used IRS-ID LISS-III satellite data images for the year 2020, analyzed using Quantum Geographic Information System (QGIS) 3.4 and ArcGIS 10.5 software.

A Semi-Automatic Classification Plug-in in QGIS was applied to produce the existing land use/land cover maps of the sample micro-watersheds. In doing so, before the supervised classification was carried out, region of interests (ROIs) had been selected. The ROIs were typically used to extract statistics for classification, masking and other operations. In this study all land under permanent vegetation cover (bushes, shrubs and forests) was classified as vegetation (as bushes, shrubs and forest have the same C factor, described below); land used for farming was classified as cultivated land; and areas in which people lived were classified as settlement areas.

The study employed the Universal Soil Loss Equation (USLE) model to estimate soil loss from the study watersheds. USLE is based on a mathematical formulation that uses various environmental and climatic effects, and landscape features to estimate soil erosion rate. Wischmeier and Smith developed this model in the late 1950s to be geographically universal. It estimates both sheet and rill erosions on areas where forest management and agricultural activities expose the soil surface to rainfall impact and runoff (Krauer, 1988). According to USLE, the soil loss is dependent on the following factors:

1. Rainfall erosivity, R factor;
2. Soil erodibility, K factor;
3. Slope gradient, S factor;
4. Slope length, L factor;
5. Land cover, C factor; and
6. Land management, P factor.

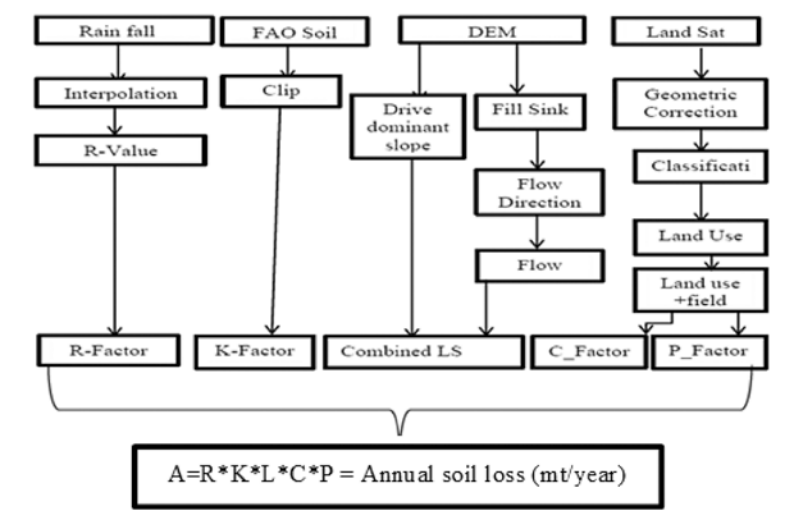
Once the numerical values of these soil erosion factors are analyzed, using the protocols indicated in Figure 5, the minimum and maximum erosion rates of the study watersheds and mean annual soil losses of the watersheds have been calculated using the formula for ULSE:

Soil loss (A) = RKLCP.

Rainfall Erosivity Factor (R): The ability of erosion agents to cause soil detachment and transport is

Figure 5 illustrate the linkages of the USLE variables and processes of soil loss computation (Kayet, et al., 2018).

Figure 5. Illustration of USLE.



Source: (Kayet, et al., 2018)

erosivity. The erosivity factor was calculated using the equation given by Hurni (1985) and derived from spatial regression analysis (Hellden, 1987) for Ethiopian conditions: R = -8.12+ (0.562*P), where P is the mean annual rainfall in mm. The mean annual rainfall was estimated using the FAO local climate estimator, and the spatial analysis of IDW (inverse distance weighted) used ArcMap 10.2, which generated an erosivity factor map for each watershed.

Soil Erodibility Factor (K): Soil erodibility is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. It depends on the physical and biochemical properties of soils and ranges from 0 to 1. Helden (1987) developed a USLE for Ethiopian conditions and proposed the K values of the soil based on their color (Box 2).

During the field transect walks, the soil types were identified using FAO's standard soil classification protocol. Then the K factor was set corresponding to the soil types shown in Box 2. The shape files generated from the transect walk, containing the K factor, were converted to grid files with a 100 x 100 meter cell size to produce the soil erodibility maps.

Slope Length Factor (L): Slope length is the distance from the point of origin of overland water flow to the point where either the slope decreases enough for deposition or the runoff water enters a well-defined channel. Generally, the greater the slope length, the higher velocity of runoff water and the higher the expected erosion rate. The values of flow accumulation and slope gradient were derived from a digital elevation model (DEM). Contours at 20 m intervals were produced using a spatial data analyst tool, and from this, contour Triangular Irregular Networks (TINs) were created and converted to DEM (raster) with 100 m output cell size. Finally, slope length value was calculated using the formula developed by Griffin, et al. (1988) in the raster calculator of Arc GIS 10.2 software:

Box 2: Helden's soil erodibility factor color chart

Soil color	Black	Brown	Red	Yellow	Grey	White
K factor	0.15	0.2	0.3	0.25	0.35	0.40

$$L = ([\text{FlowAccumulation}] * \text{Resolution}]/22.13^{0.4}) * (\sin[\text{Slope}]/0.0896)^{1.3}$$

Land Cover (C) Factor: Land cover or cropping factor (C) is the ratio of soil loss under a given land cover/land use to that of the base soil from cultivated, continuous fallow on identical soil and slope with the same rainfall (Morgan, 1994). A land use/land cover map from 2019, which was derived from sentinel satellite data, was used to generate the cover factor for the USLE model. Based on Hurni (1985) the C value for cultivated land is 0.17, for forest land 0.02, for grassland 0.01, for built-up/settlement 0.05 and for bare land 0.6. The classified image format was changed into vector format and a corresponding C value was assigned to each land use/land cover class using the editing menu of ArcGIS 10.5 software, and using the C values for the USLE model (Hurni, 1985).

Support Practice (P) Factor: The support practice factor is the ratio of soil loss for a given practice to that of up and down slope farming. P values range from 0–1 depending on the soil management activities employed on the specific plot of land. These management activities highly depend on the slope of the area. Wischmeier and Smith (1978) calculated P values by delineating the land into two major land uses, viz. agricultural land and other land, and then divided the agricultural land into six classes based on the slope percent to assign different P values (Box 3).

Based on the information obtained from the rapid ground assessment by transect walks and from Goggle Earth, the P factors for land units in the sample watersheds were determined.

Erosion rate, soil loss and sediment yield: Using the USLE model, the maximum and minimum erosion rate and the mean annual soil loss of each watershed were estimated by taking each parameter into account, and by multiplying each input (cell by cell) using the raster calculator in a GIS environment. Moreover, sediment yield was estimated for each watershed using the following empirical formula:

$Sy = E^*(1/A^{0.2})$: Where, Sy = sediment yield (ton) at a watershed outlet; E = total erosion (ton); and A = watershed area (ha).

To prepare the mean annual soil loss maps of the nine study watersheds, we calculated the erosion severity index and created the classification in Box 4.

Box 3: Support Practice (P) Values

Soil loss category	Soil loss in tons/ha/year
Very slight	0–5 t/ha/year
Slight	6–15 t/ha/year
Moderate	16–30 t/ha/year
Severe	31–50 t/ha/year
Extremely severe	> 50 t/ha/year

Box 4. Classification of land by P factor

Land use type ->	Agricultural land						Other land use
Slope %	0–5	5–10	10–20	20–30	30–50	50–100	All
P factor	0.08	0.1	0.12	0.17	0.2	0.28	1

3.5 Assumptions/risks

The study was affected by a number of unforeseen events, to which it had to navigate and adapt. Contemporary and localized political/ethnic conflicts, and restrictions due to the coronavirus pandemic were the most significant constraints. Localized conflicts forced the field team to change sample watersheds and travel dates. The coronavirus pandemic also restricted joint face-to-face meetings among the team members to work together. Specifically, the team members who participated in the qualitative data collection could not come together and hold a joint data analysis event at one place.

Chapter 4: Findings

4.1 Demographic characteristics

The total number of people in the sampled households (n = 950) was 4,974; 51% were male and 49% were female (Table 3). The average household size was 5.2 people, which was above the national average of 4.9 (Central Statistical Agency (CSA) [Ethiopia] and ICF, 2016). Over 20% of households were FHHs. Zeway Dugda Woreda had more FHHs than Deder or Dire Dawa.

The mean age of a household head was 42 years, with the youngest being 18 years and the oldest being 96 years. Most household heads were aged between 25 and 54 years (Table 4). There are no child household heads, aged below 18 years.

As shown in Table 5, nearly 88% of all households were married. Women led about 20% of households. Notably, from these women about 52% were married but had husbands who were absent or who had chronic illness or disability. Also, about 44% of FHHs were headed by widows.

Table 3. Sex of household heads, household members and mean household size

Population unit	Deder		Dire Dawa		Zeway Dugda		Total		
	Male	Female	Male	Female	Male	Female	Male	Female	Both
Households heads	81.3% N = 281	18.7% N = 65	84.8% N = 256	15.2% N= 46	72.1% N = 217	27.9% N= 84	79.5% N = 775	20.5% N = 195	100% N = 950
Members of HHs	49.9% N = 1,916	50.1% N = 1,916	52.1% N = 1,616	47.9% N = 1,616	51.5% N = 1,442	48.5% N = 1,442	51.1% N = 4,974	48.9% N = 4,974	100% N = 9,948
Mean household (HH) size	5.5		5.4		4.8		5.2		

Table 4. Age distribution of household heads (percentage)

Age in years		Deder	Dire Dawa	Z/Dugda	Male	Female	Total
Age group	≤ 24	0.6	2.6	2	2.0	.5	1.7
	25-34	19.9	14.6	22.3	19.2	17.9	18.9
	35-44	48.7	37.1	31.9	39.7	39.5	39.7
	45-54	21.3	30.8	21.3	24.0	25.6	24.3
	55-64	6.3	11.6	9	9.0	8.2	8.8
	65-74	3.2	3.3	13.6	6.1	8.2	6.5
Mean		40.6	42.5	44.6	42.2	43.6	42.5
Minimum		20	19	18	18	23	18
Maximum		75	78	96	96	95	96

Table 5. Marital status of household heads

Status	Deder	Dire Dawa	Zeway Dugda	Proportion by sex		By marital status		Total
				Male	Female	Male	Women	
Married	91.9	88.1	84.4	88.1	11.9	97.7	51.8	88.2
Single	0.9	0	2.0	77.8	22.2	0.9	1.0	0.9
Divorced or separated	1.2	0.3	1.0	25.0	75.0	0.3	3.1	0.8
Widowed	6.1	11.6	12.6	8.5	91.5	1.1	44.1	9.9
Total	100.1	100.0	100.0	79.5	20.5	100.0	100.0	100.0

4.2 Status of natural resources and NRM practices

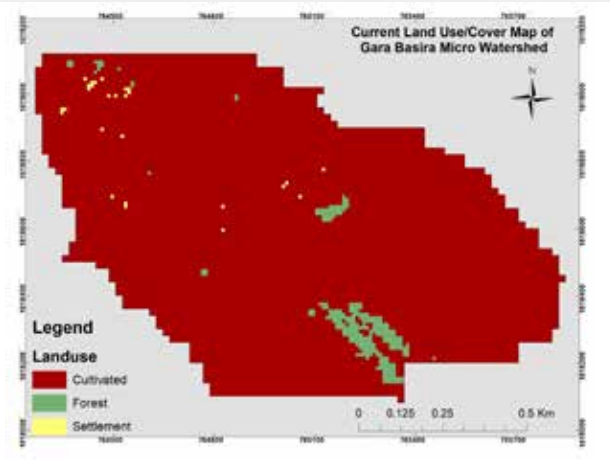
4.2.1 Biophysical condition of watersheds

4.2.1.1 Land use/land cover of watersheds

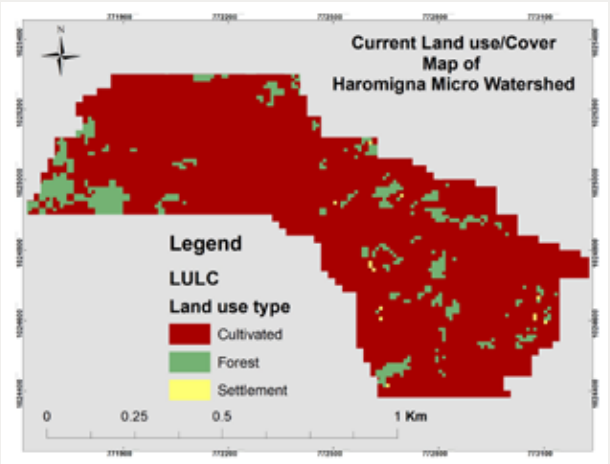
The analysis showed that 68% of the land in the watersheds was cultivated, while nearly 31% was vegetation, including bushes, shrubs and forest. As these watersheds were located in rural areas, the proportion of land used for settlement is very low (1%). The study showed there are no distinct grasslands in the study watersheds. However, the lands classified under vegetation are used as pasture lands and fodder sources. The land use/land cover maps are presented in Figure 6.

Figure 6. Watershed land use/land cover maps

Gera Basira (Deder)



Haromigna (Deder)



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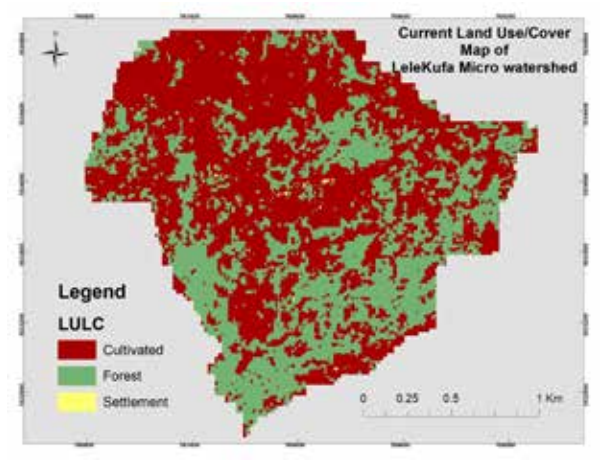
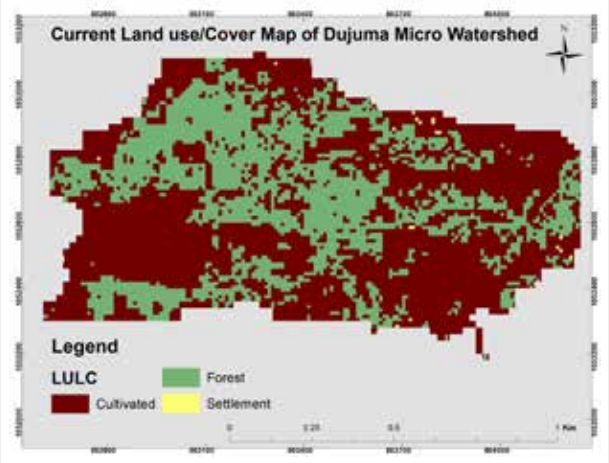
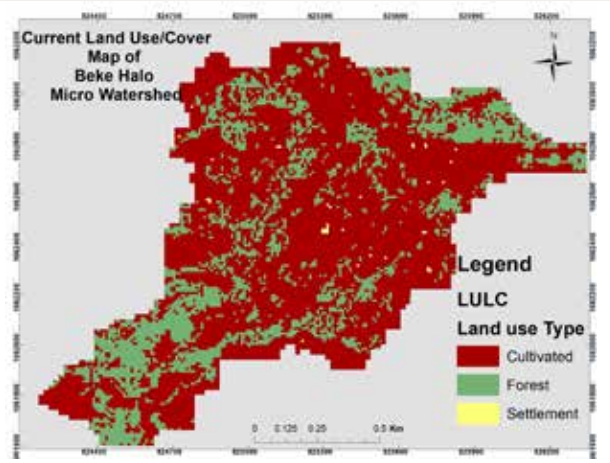
Lelekufa (Deder)



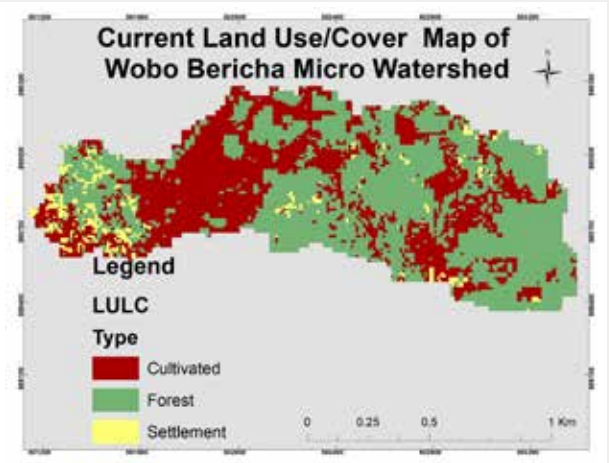
Dujuma (Dire Dawa)



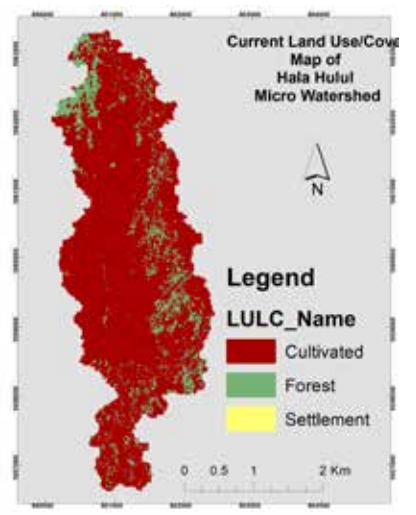
Bekehalo (Dire Dawa)



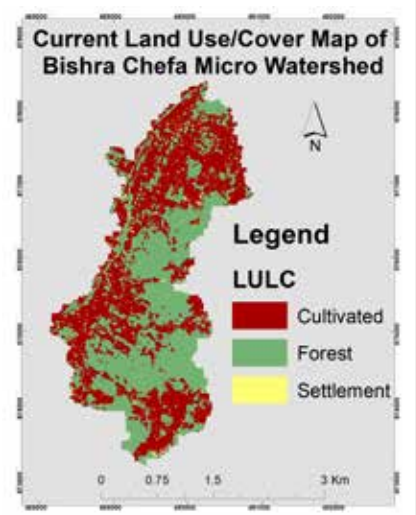
Wobo Bericha (Ziway Dugda)



Halahulul (Dire Dawa)



Bishra Chefa (Ziway Dugda)



Dimtu Rareti (Ziway Dugda)

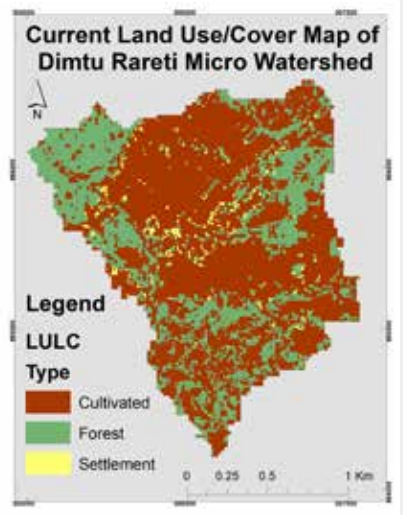


Table 6 shows the distribution of land use/land cover for each watershed. The vegetation covers of Gera Basira (2%) and Haromigna (9%) watersheds in Deder and all the three watersheds in Dire Dawa are lower than the 15.7% national forest cover. Only two out of nine watersheds, i.e., Lelekufa in Deder (16%) and Bishra Cheffa in Zeway Dugda (40%), have vegetation cover near or above the national average forest cover taken from Tongul and Hobson (2013). The Lelekufa vegetation cover is found to be relatively higher than the other two watersheds in the woreda.

4.2.1.2 Soil loss and sediment yield of the research watersheds

Soil erosion is widely recognized as one the main environmental concerns in Ethiopia, with direct negative impacts on livelihoods of rural households and on the overall national economy. The soil erodibility analysis shows that most of the watersheds had a lower erodibility factor, as the lands were dominated by black and brown soils. For instance, Bekehalo and Dujuma watershed in Dire Dawa were mainly black soil, which has a low erosivity factor (0.15). Gera Basira and Haromigna in Deder and Dimtu Rareti and Wobo Bericha in Zeway Dugda have low to medium erodibility factors (average 0.2), as they are characterized by brown soil.

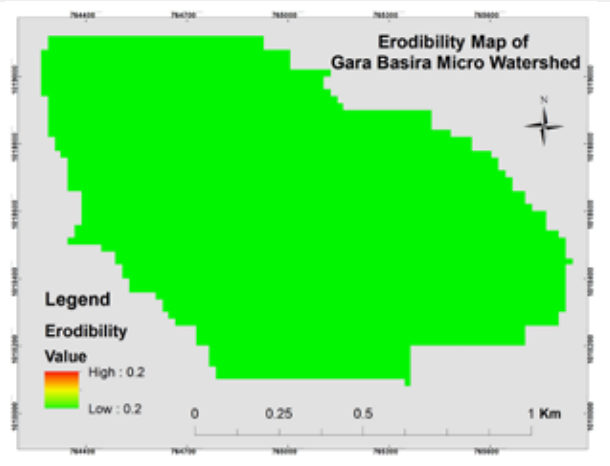
In contrast, the erodibility factor was higher (about 0.25) in the northern and western parts of Bishra Chefa (Zeway Dugda), where the soil is dominantly yellow in color. Likewise, on the southern and southeastern edge of Lelekufa (Deder), the soil erodibility factor is medium (0.2), as the soil is brown (Figure 7).

Table 6. Status of land use/land cover of sample micro-watersheds in 2020

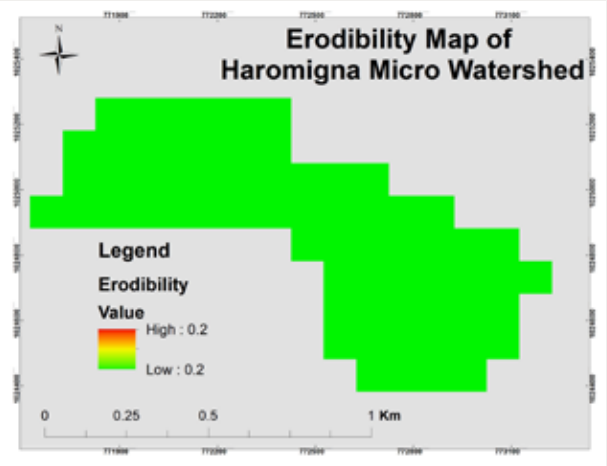
Woreda	Watershed	Cultivated		Vegetation cover		Settlement		Total area (ha)
		ha	%	ha	%	ha	%	
Deder	Gera Basira	108	5.7	2.7	0.3	0.3	1.1	111
	Haromigna	60	3.2	6	0.7	1	3.7	67
	Lelekufa	210	11.1	141	16.4	1	3.7	352
	Sub-total	378	71.3	149.7	28.2	2.3	0.4	530
Dire Dawa	Bekehalo	115	6.1	46	5.4	0.4	1.5	161
	Dujuma	55	2.9	48	5.6	0.2	0.7	103
	Halahulul	782	41.3	115	13.4	4	14.9	901
	Sub-total	952	81.7	209	17.9	4.6	0.4	1,165
Zeway Dugda	Bishra Chefa	338	17.8	345	40.2	9	33.5	692
	Dimtu Rareti	178	9.4	85	9.9	6	22.3	269
	Wobo Bericha	48	2.5	70	8.2	5	18.6	124
	Sub-total	564	52.0	500	46.1	20	1.8	1,085
Total		1,894	68.1	859	30.9	26.9	1.0	2,780

Figure 7. Soil erodibility factor maps for the watersheds.

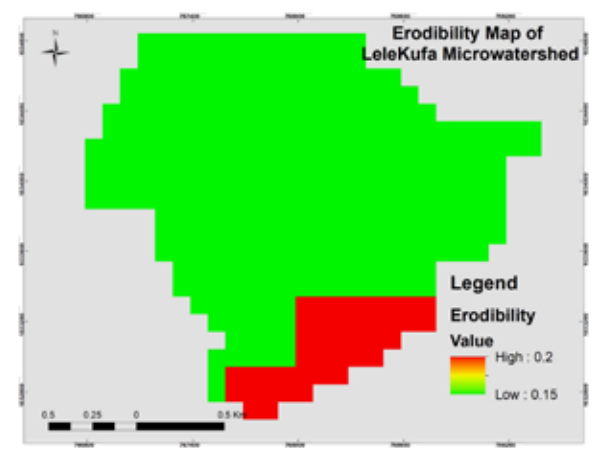
Gera Basira (Deder)



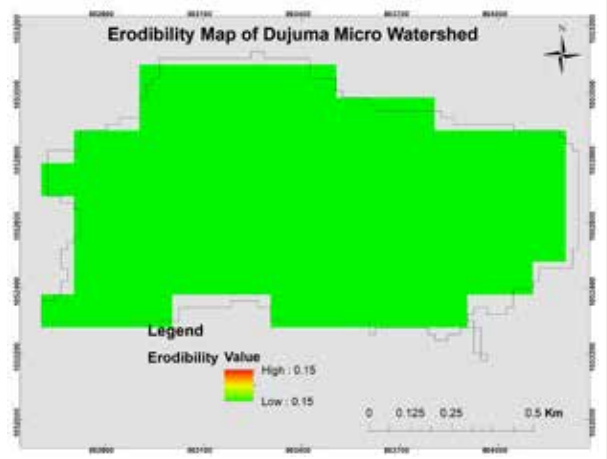
Haromigna (Deder)



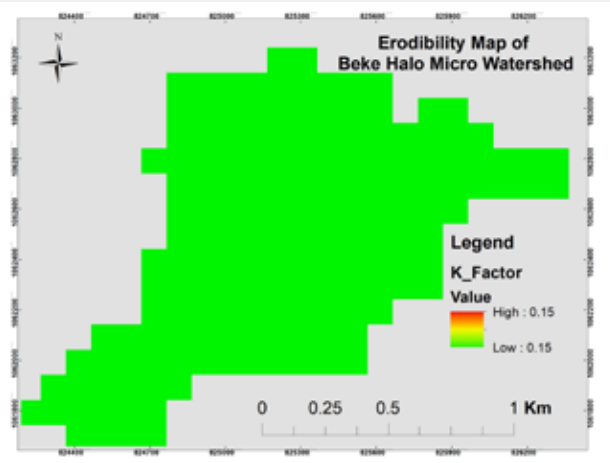
Lelekufa (Deder)



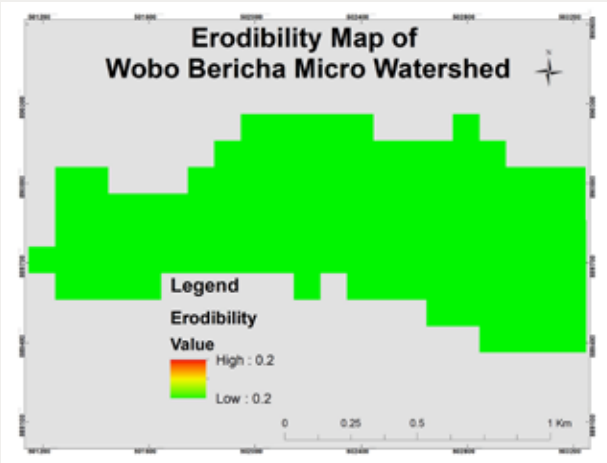
Dujuma (Dire Dawa)



Bekehalo (Dire Dawa)



Wobo Bericha (Zeway Dugda)



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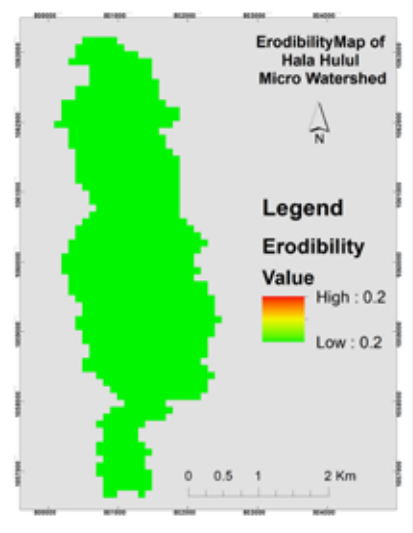
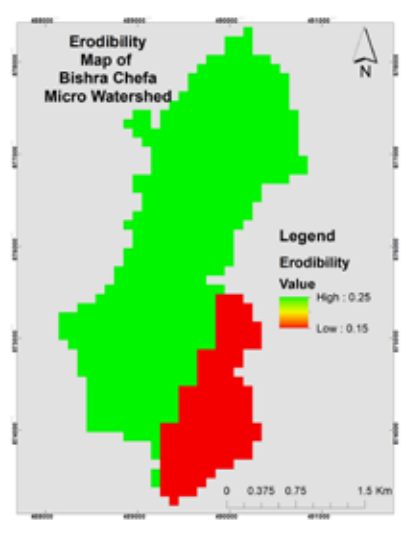
Halahulul (Dire Dawa)



Bishra Chefa (Zeway Dugda)



Dimtu Rareti (Zeway Dugda)

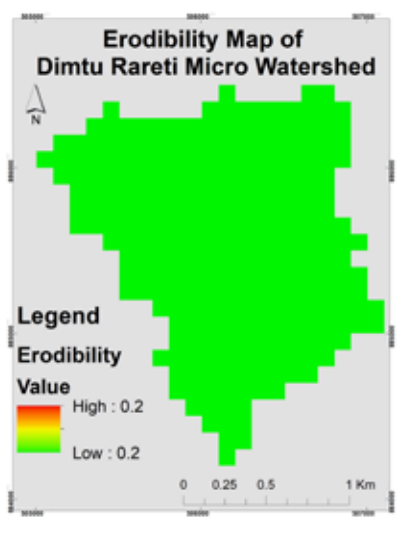
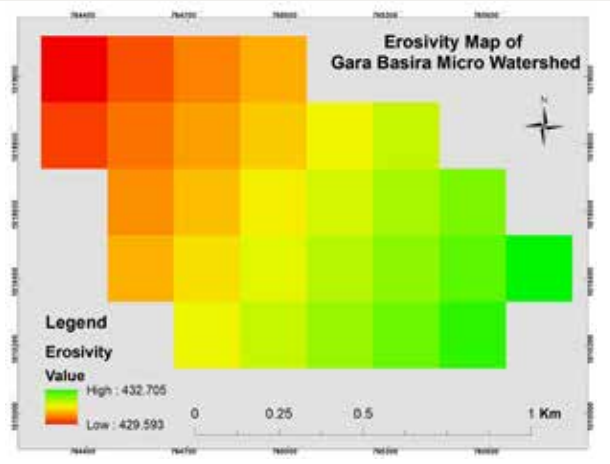


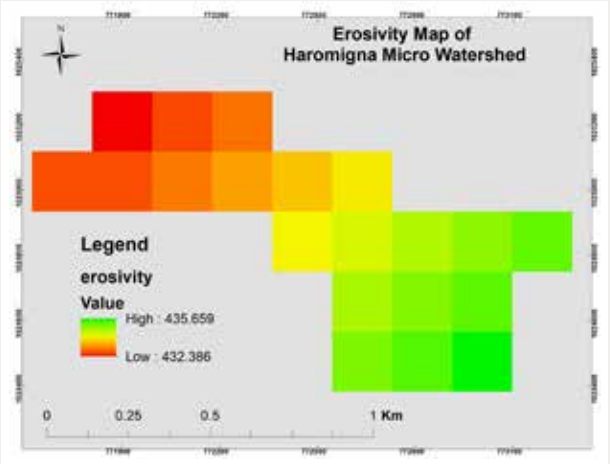
Figure 8 below presents the erosivity maps for the watersheds and associated values.

Figure 8. Erosivity factor maps for the watersheds.

Gera Basira (Deder)
R= (430 -433)



Haromigna (Deder)
R= (432 -436)



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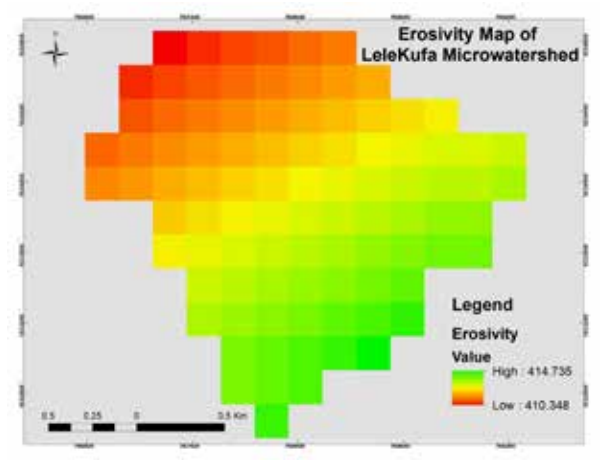
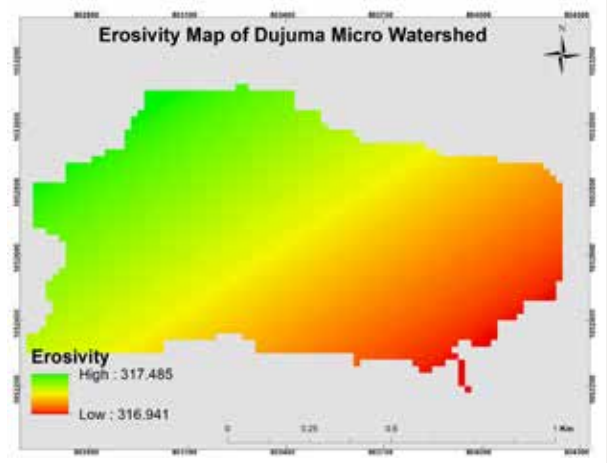
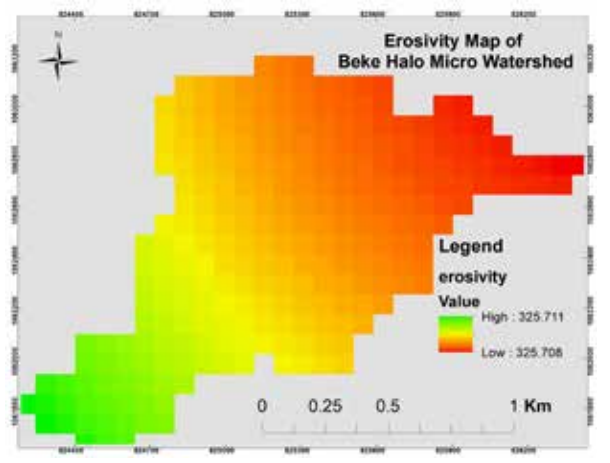
Lelekufa (Deder)
R= (410 -415)



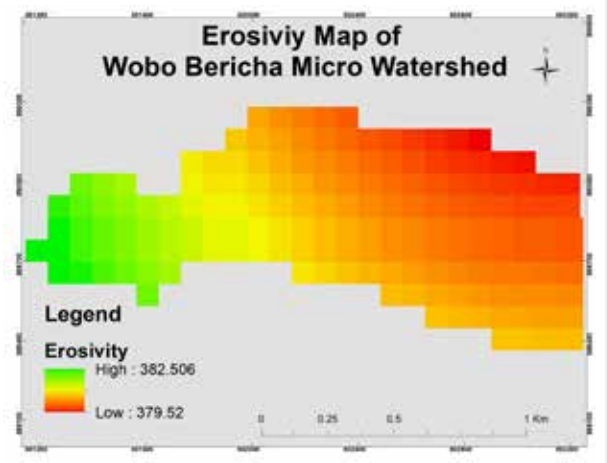
Dujuma (Dere Dawa)
R= (325-326)



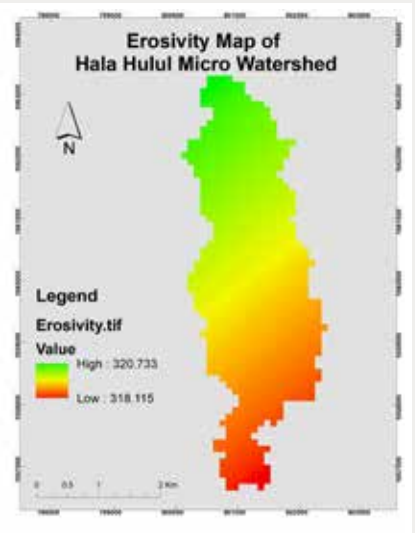
Bekehalo (Dere Dawa)
R= (325-326)



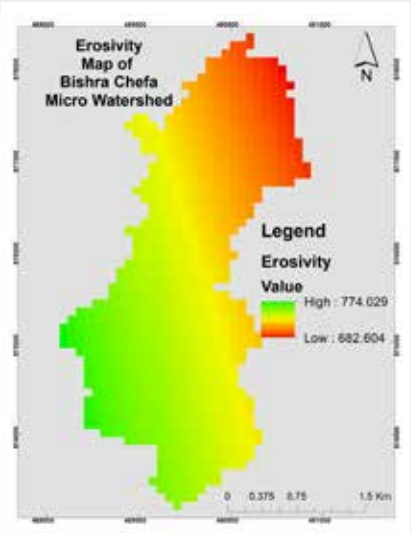
Wobo Bericha (ZiwayDugda)
R= (410 -415)



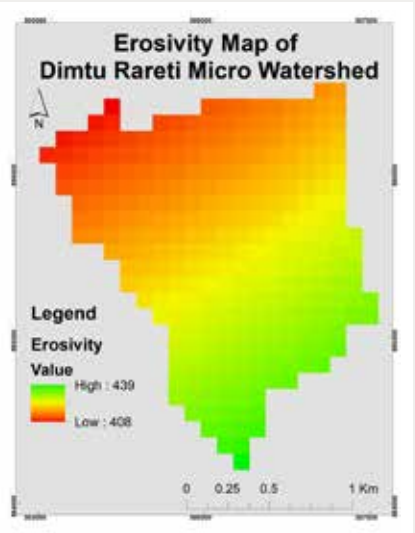
Halahulul (Dere Dawa)
R= (319-321)



Bishra Chefa (Ziway Dugda)
R= (683-774)



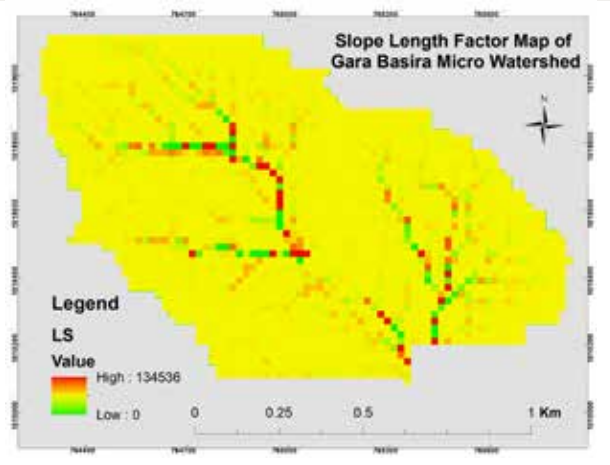
Dimtu Rareti (ZiwayDugda)
R= (408-439)



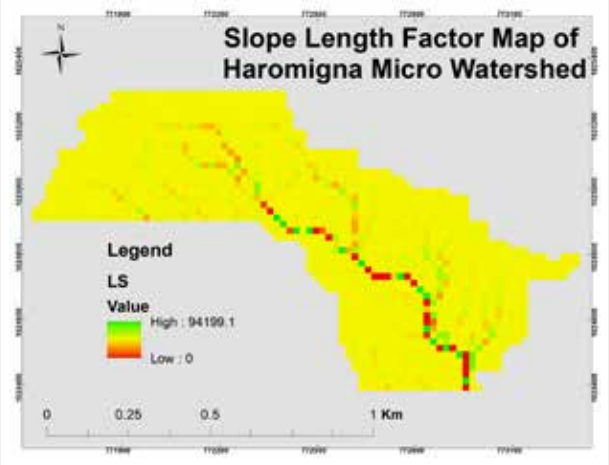
The slope length factor maps for the watersheds and associated values are depicted in Figure 9 below.

Figure 9. Slope length factor maps for the watersheds.

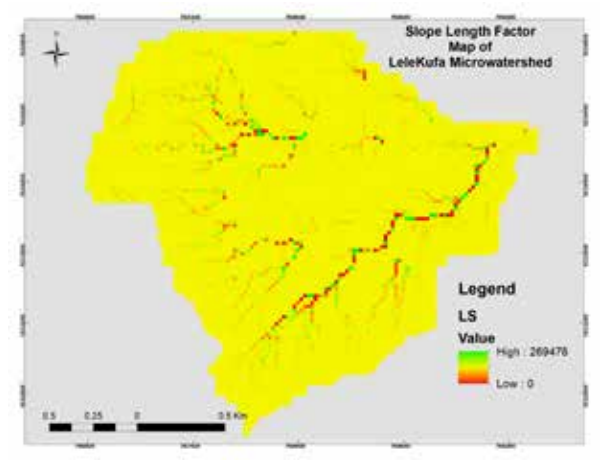
Gera Basira (Deder)
SL= (0-134,536)



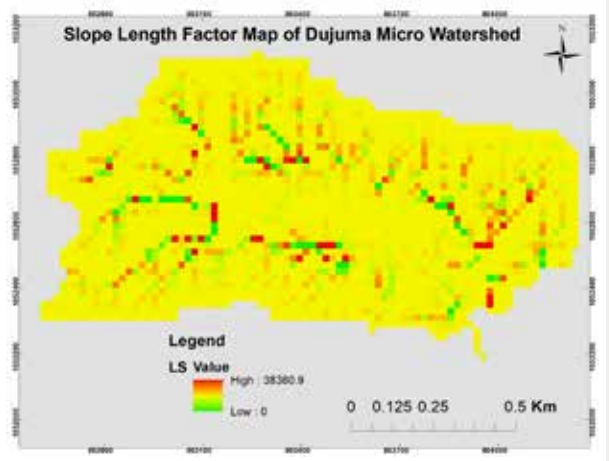
Haromigna (Deder)
SL= (0-94,199)



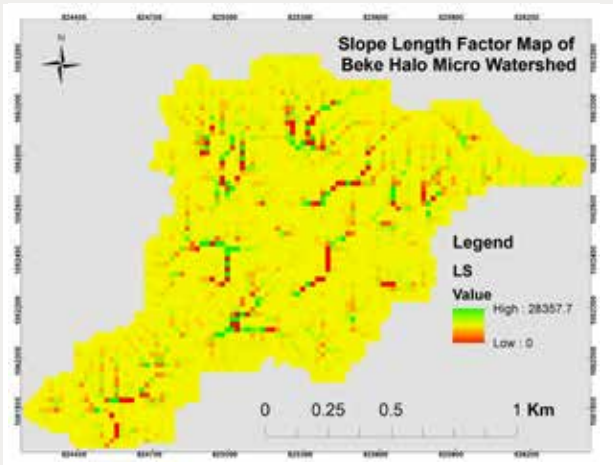
Lelekufa (Deder)
SL= (0-269,476)



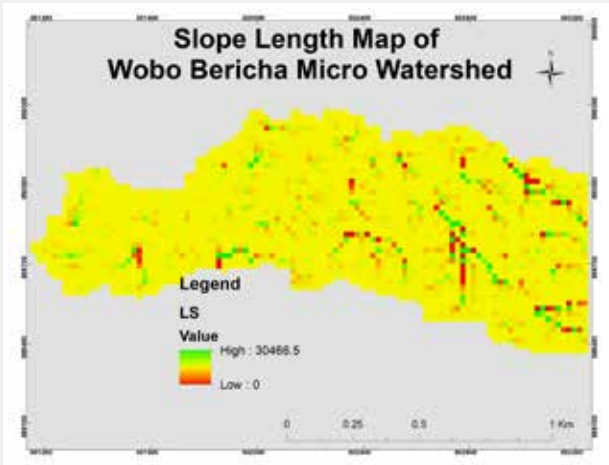
Dujuma (Dire Dawa)
SL= (0-28,358)



Bekehalo (Dire Dawa)
SL= (0-38,381)



Wobo Bericha (Zeway Dugda)
SL= (0-30,467)



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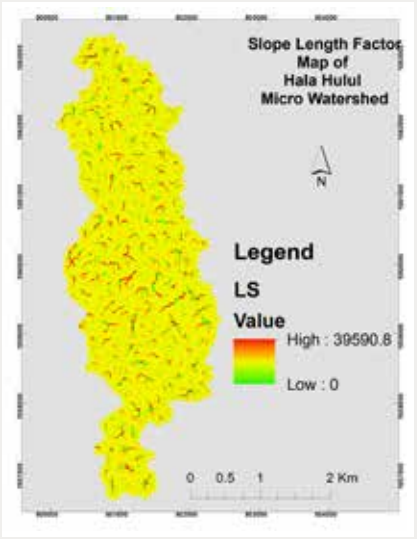
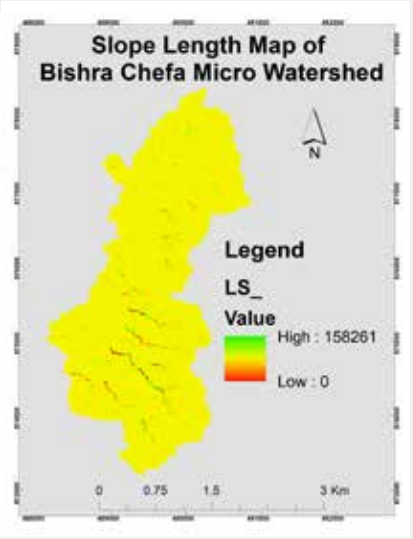
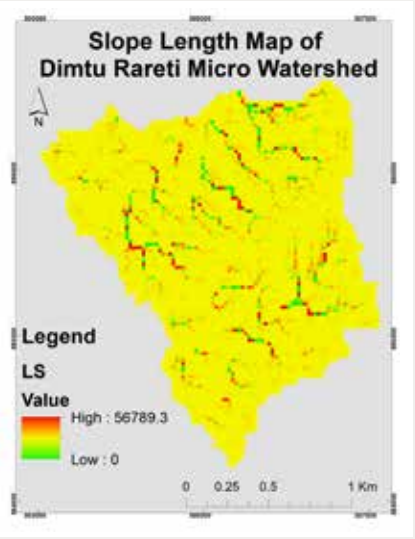
Halahulul (Dire Dawa)
SL= (0-39,591)



Bishra Chefa (Zeway Dugda)
SL= (0-158,261)



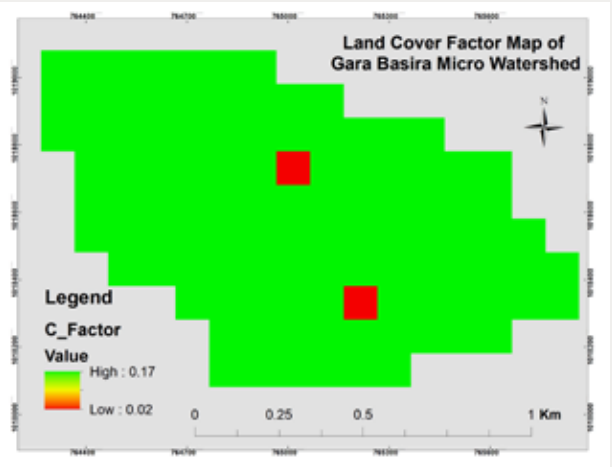
Dimtu Rareti (Zeway Dugda)
SL= (0-56,789)



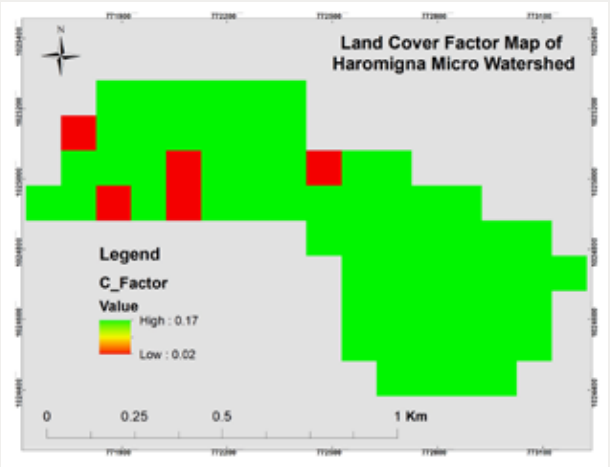
The major land use/land cover types described in the study watersheds are cultivated (C = 0.17), forest (C = 0.02) and settlement (built-up) (C = 0.05) lands, and the major crops grown are both perennial and annual crops (Figure 10).

Figure 10. Land cover factor maps for the watersheds.

Gera Basira (Deder)
C = (0.02-0.17)



Haromigna (Deder)
C = (0.02-0.17)



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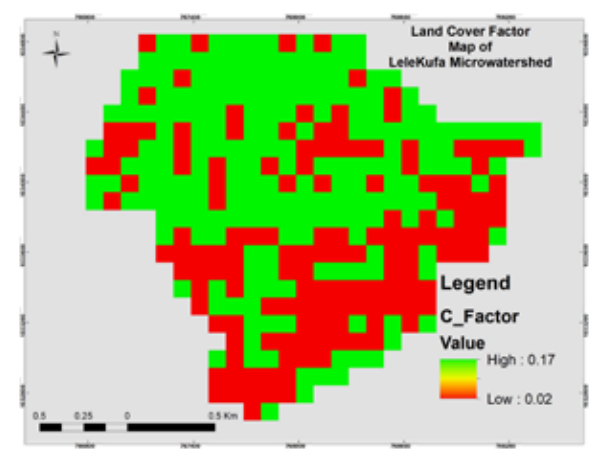
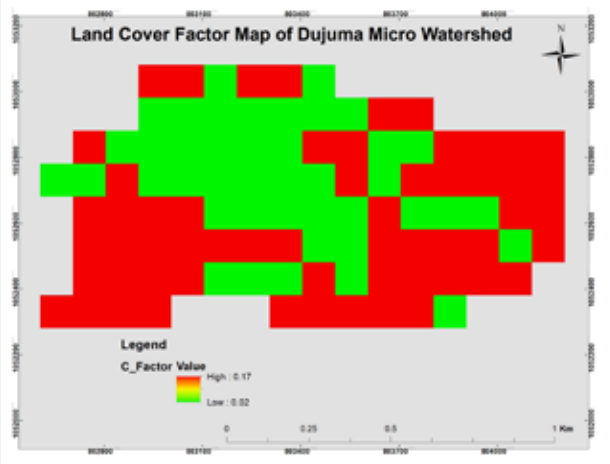
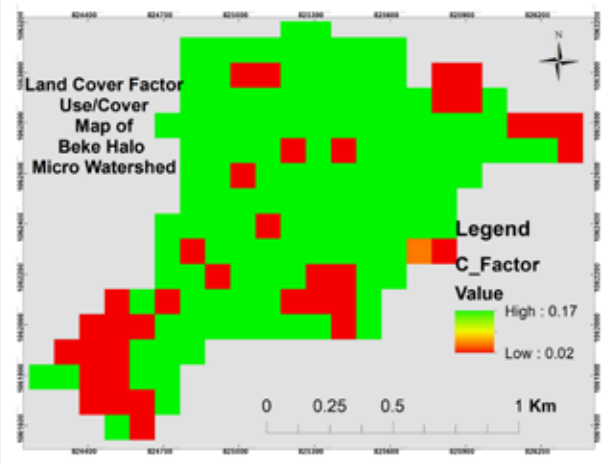
Lelekufa (Deder)
C = (0.02-0.17)



Dujuma (Dire Dawa)
C = (0.02-0.17)



Bekehalo (Dire Dawa)
C = (0.02-0.17)



Wobo Bericha (Zeway Dugda)
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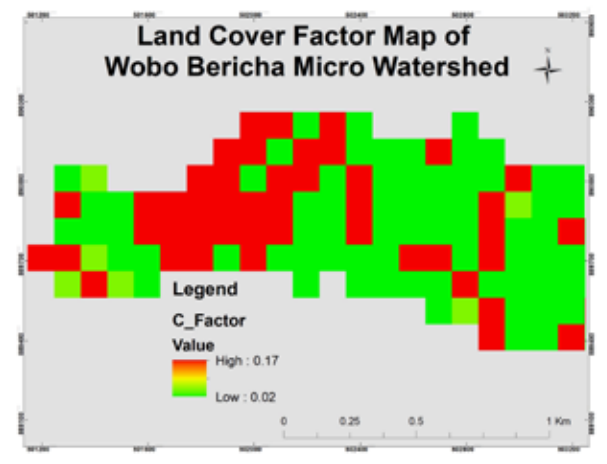
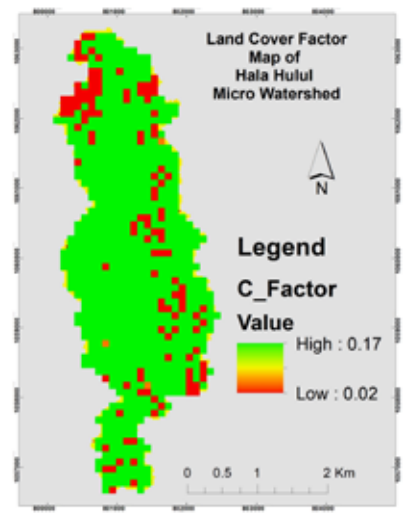


Halahulul (Dire Dawa)
C = (0.02-0.17)



Bishra Chefa (Zeway Dugda)
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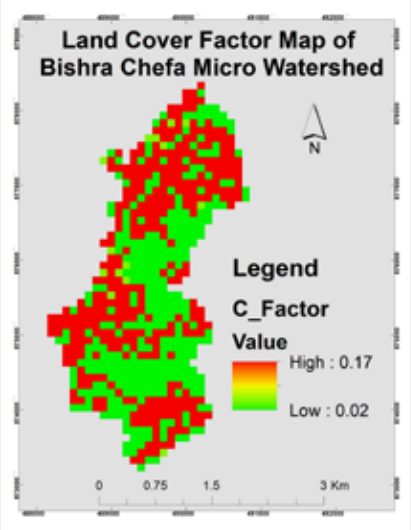


Dimtu Rareti (Zeway Dugda)
C = (0.02-0.17)

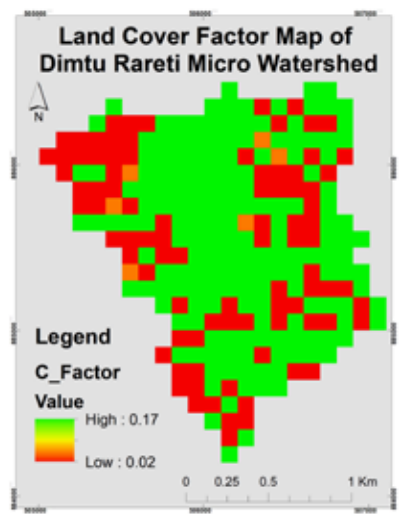
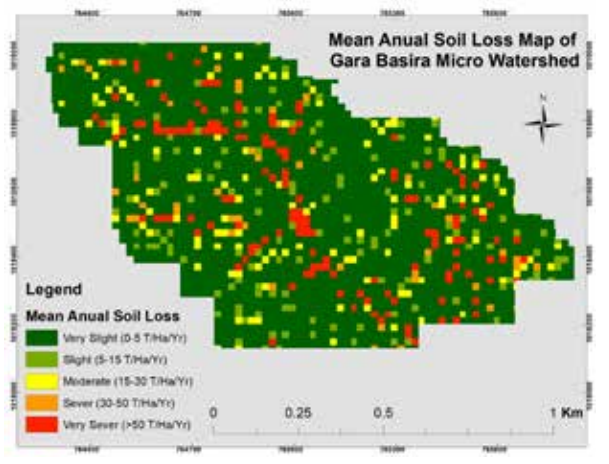
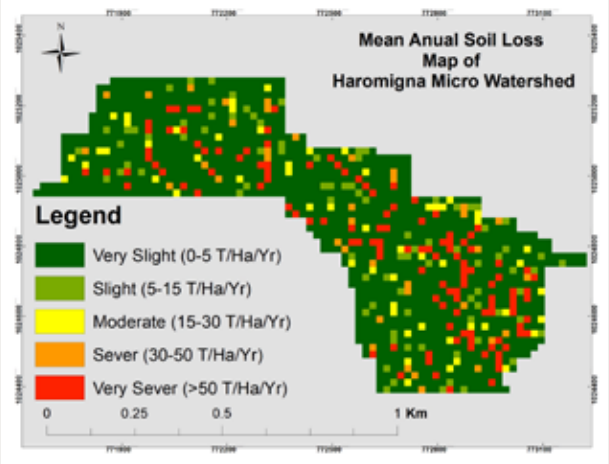


Figure 11. Mean annual soil loss maps of the sample watershed.

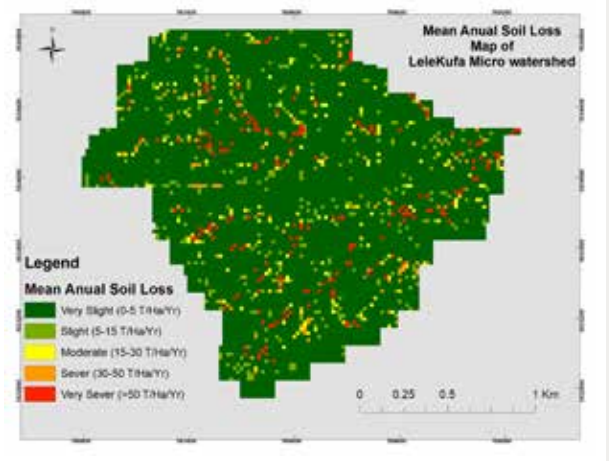
Gera Basira (Deder)



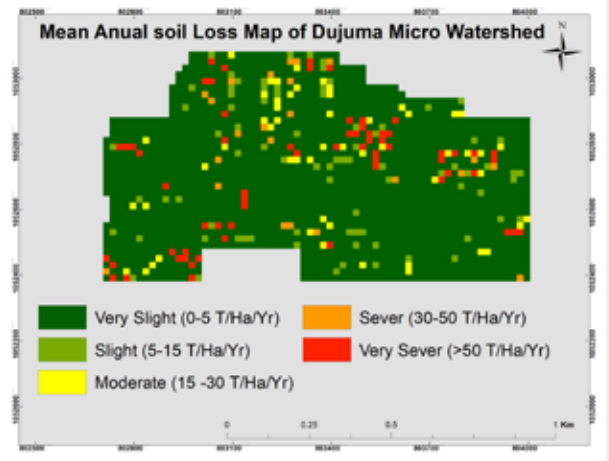
Haromigna (Deder)



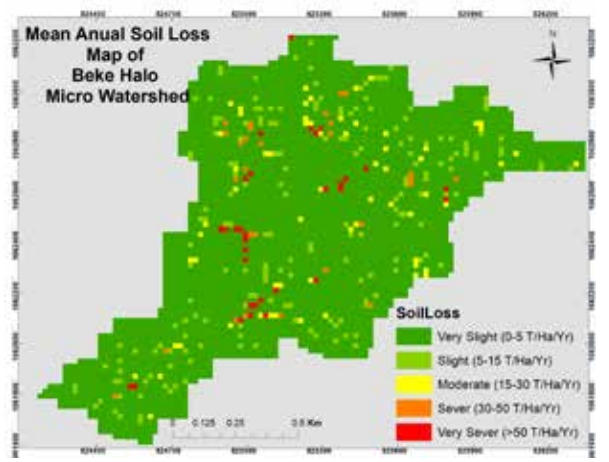
Lelekufa (Deder)



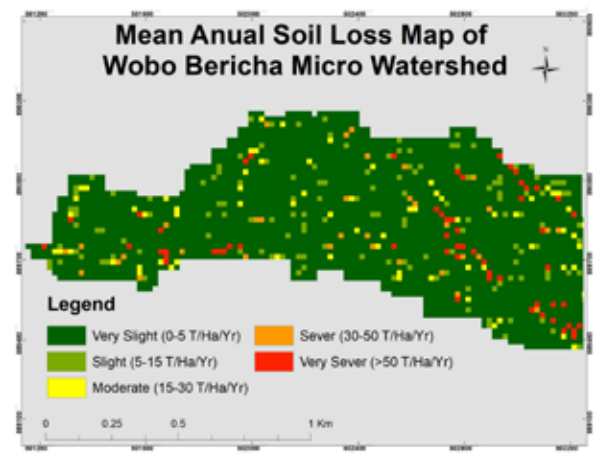
Dujuma (Dire Dawa)



Bekehalo (Dire Dawa)



Wobo Bericha (Zeway Dugda)



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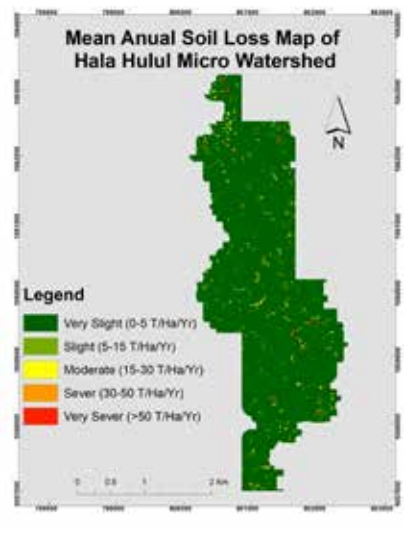
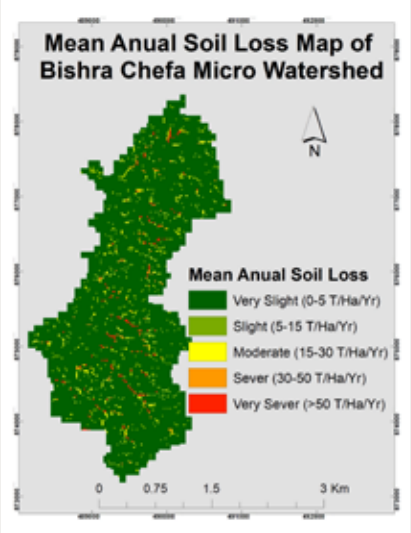
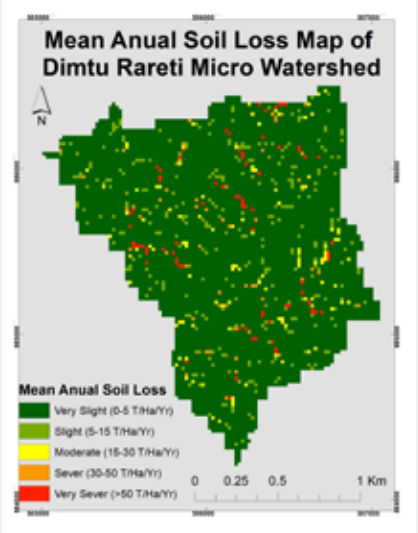
Halahulul (Dire Dawa)



Bishra Chefa (Zeway Dugda)



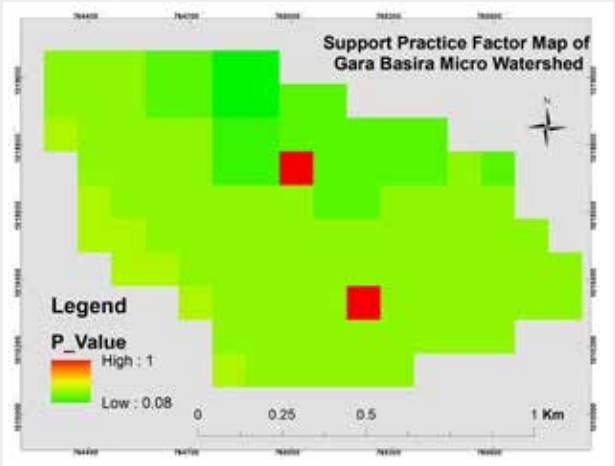
Dimtu Rareti (Zeway Dugda)



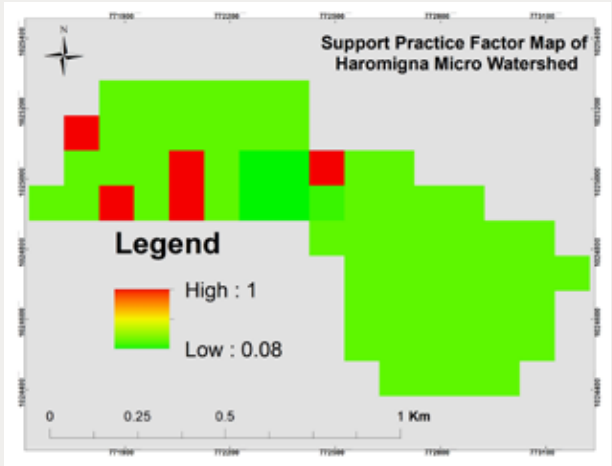
Based on the rapid ground assessment through transect walks and observations made on Google Earth, the support practice factor (P) for land units in the sample watersheds are determined and presented in a raster format in the maps in Figure 12.

Figure 12. Support practice factor maps for the watersheds.

Gera Basira (Deder) P = (0-1)



Haromigna (Deder)



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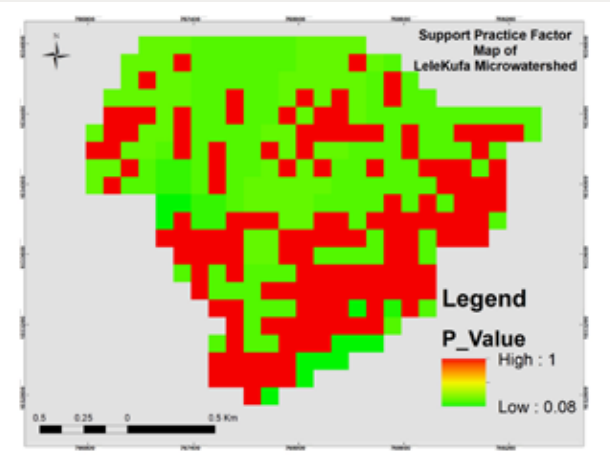
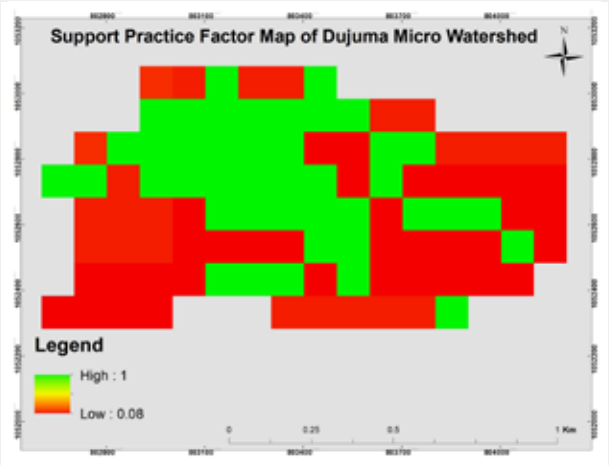
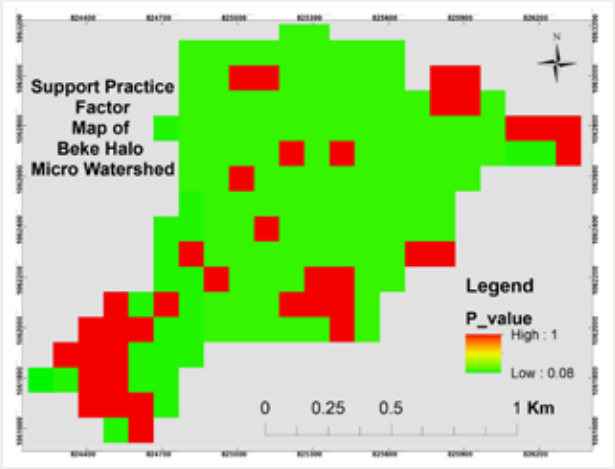
Lelekufa (Deder) P = (0-1)



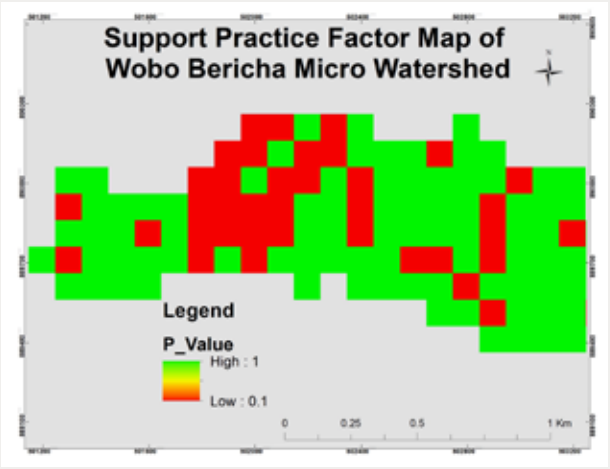
Dujuma (Dire Dawa) P = (0-1)



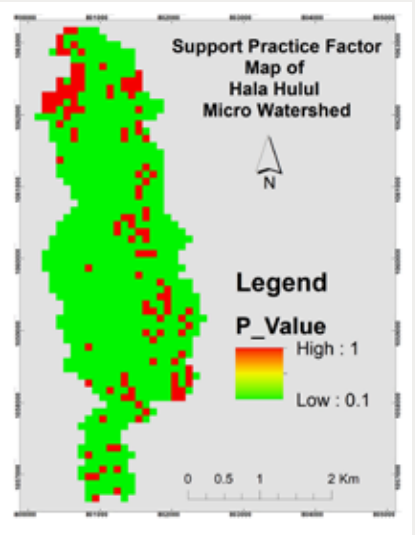
Bekehalo (Dire Dawa) P = (0-1)



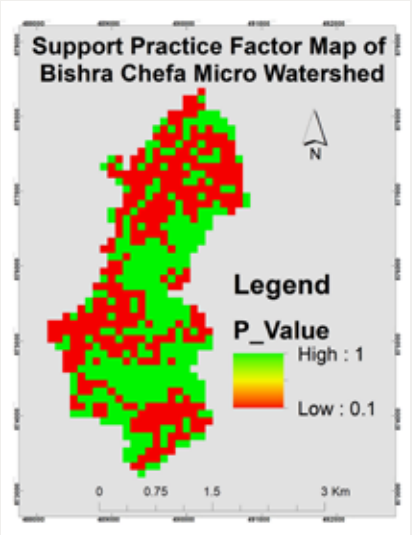
Wobo Bericha (Zeway Dugda) P = (0-1)



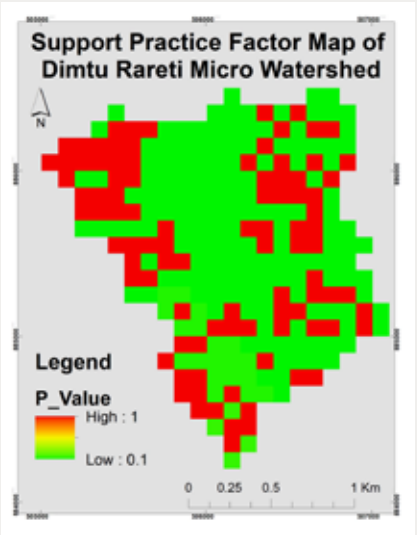
Halahulul (Dire Dawa) P = (0-1)



Bishra Chefa (Zeway Dugda) P = (0-1)



Dimtu Rareti (Zeway Dugda) P= (0-1)



The biophysical analysis shows the maximum and minimum annual soil erosion rates, the mean annual soil loss and the sediment yield of each watershed (Table 7). Figure 11 depicts the annual soil loss for each watershed. The estimated mean annual soil loss across the watersheds ranged from 5 to 65 tons per ha per year. The highest mean annual soil loss erosion rates were 65 and 40 tons per ha per year for Haromigna and Gera Basira watersheds respectively, both in Deder. These values are considerably higher than the maximum tolerable soil loss threshold of 16 tons per ha per year set for Ethiopia (Molla & Sisheber, 2016).[9] Four out of the nine watersheds (Bekehalo, Halahulul, Bishra Chefa and Dimtu Rareti) fell within the normal erosion rates of 5–7 tons per ha per year.

The highest erosion rates were 791 and 341 tons per ha per year, in Lelekufa and Gera Basira respectively, both in Deder. These rates are considerably higher than the commonly cited maximum annual soil loss of the country of 300 tons per ha per year (Hurni, 1993 and FAO, 1984). However, a recent study conducted in Beshillo Catchment of the Blue Nile Basin, Ethiopia revealed that the annual erosion rates ranged from 0 to above 935 tons per ha per year (Dagnew, et al., 2019). The same study mentioned a maximum tolerable soil loss value of 16 tons per ha per year. Another study conducted in Koga Watershed, Ethiopia reported that the highest soil loss is estimated from the steep slopes of upper watershed, which is 456.2 tons per ha per year (Molla & Sisheber, 2016).

4.2.2 NRM practices

4.2.2.1 NRM practices on private land

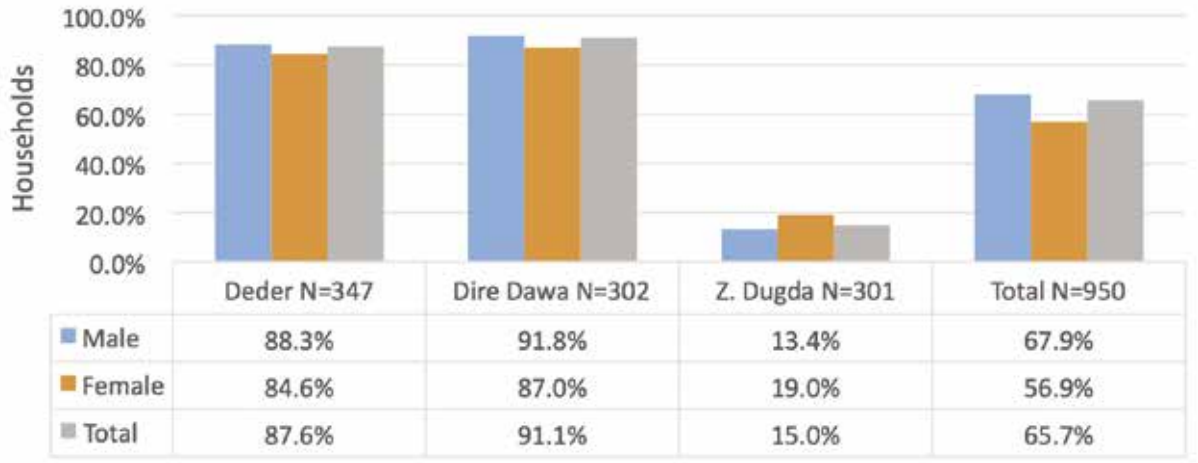
Overall, 66% of households had treated land under their use with one or more types of NRM. Of these households, 68% were MHHs and 57% were FHHs (Figure 13). NRM practices were high in Dire Dawa (91%) and Deder (88%), but very low in Zeway Dugda (15%). The dominance of flat land in Zeway Dugda might have reduced NRM practices, but further investigation is required.

Table 7. Erosion rates, mean annual soil loss and sediment yield of watersheds

Woreda/ watershed	Area (ha)	Rainfall erosivity factor	Soil erodibility factor	Slope length gradient factor (LS)	Land cover (C) factor	Support practice (P)	Erosion rate (t/ha/yr)	Average soil loss (t/ha/yr)	Sediment yield (t/yr)	% of land above tolerable soil loss
Deder										
Gera Basira	111	430–433	0.2	0–134536	0.02–0.17	0.08–1	0–341	40	14,770	13.4
Haromigna	67	432–436	0.2	0–94199	0.02–0.17	0.08–1	0–98	65	2,844	15.4
Lelekufa	352	410–415	0.2–0.15	0–269476	0.02–0.17	0.08–1	0–791	27	86,154	6.2
Dire Dawa										
Bekehalo	161	325–326	0.15	0–28358	0.02–0.17	0.08–1	0–49	5	2,826	3.3
Dujuma	103	325–326	0.15	0–38381	0.02–0.17	0.08–1	0–31	17	1,264	7.4
Halahulul	901	319–321	0.2	0–39591	0.02–0.17	0.1–1	0–0.7	4	167	1.1
Zeway Dugda										
Bishra Chefa	692	683–774	0.15–0.25	0–158261	0.02–0.17	0.1–1	0–145	7	27,203	3.3
Dimtu Rareti	269	408–439	0.2	0–56789	0.02–0.17	0.1–1	0–263	6	23,094	3.8
Wobo Bericha	124	380–383	0.2	0–30467	0.02–0.17	0.1–1	0–61	9	2,876	5.6

9 Tolerable soil loss is the maximum soil erosion loss that is offset by the theoretical maximum rate of soil development that will maintain an equilibrium between soil losses and gains (SSSA, 2001).

Figure 13. Percent of households having land plots treated with NRM.



	Deder N=347	Dire Dawa N=302	Z. Dugda N=301	Total N=950
Male	88.3%	91.8%	13.4%	67.9%
Female	84.6%	87.0%	19.0%	56.9%
Total	87.6%	91.1%	15.0%	65.7%

The main NRM practice used by households was SWC (56% of households) followed by manuring (44%), composting (42%), and plantations and hedges (37%) (Table 8). In Deder, a high proportion of households practiced SWC (84%), composting (63%) and manuring (65%) on lands under their use. In Zeway Dugda, a relatively low proportion of households used NRM practices, and these practices were mainly SWC (10%) and composting (7%).

While all watersheds were drought prone and farming systems were constrained by soil moisture stress, only 7% households practiced NRM related to water harvesting and irrigation (considering both HH-level water-harvesting and communal irrigation facilities).

The mean area of land covered by the different NRM practices ranged from 0.02 to 0.17 ha per household (Table 8); SWC was used on more land (0.17 ha per household), followed by composting (0.10 ha per household). Irrigation and water harvesting in these moisture-stressed watersheds was the least practiced measure (7.2% of households), with low average land coverage per household (0.02 ha).

Table 8. Proportion of households using NRM practices and area of land covered[10]

NRM method[11]	Deder (N = 304)		Dire Dawa (N = 275)		Zeway Dugda (N = 43)		Male (N = 510)		Female (N = 110)		Total (N = 620)	
	%	ha	%	ha	%	ha	%	Ha	%	ha	%	ha
SWC practiced on farmland	83.6	0.20	72.2	0.26	10	0.05	58.3	0.18	44.1	0.12	55.5	0.17
Composting	62.8	0.13	55.3	0.17	7	0.03	44.6	0.11	30.8	0.08	41.9	0.10
Plantation and hedges	57.3	0.12	50	0.11	4.3	0.03	39.7	0.09	28.2	0.06	37.4	0.09
Grassland	55.3	0.11	17.2	0.06	4	0.02	27.5	0.06	22.1	0.06	26.4	0.06
Manuring	64.8	0.12	22.2	0.05	4	0.02	32.9	0.07	25.1	0.06	31.3	0.07
Mulching	40.9	0.08	8.6	0.03	1.3	0.00	19	0.04	12.8	0.03	17.7	0.04
Gully treatment	36.6	0.07	10.3	0.03	3	0.02	18.2	0.04	13.3	0.03	17.2	0.04
Irrigation and water harvesting	11.5	0.02	9.3	0.04	0.7	0.01	7.2	0.02	7.2	0.03	7.2	0.02

With respect to the quality of NRM practices, SWC measures on farmlands, such as treated gullies, irrigation or water-harvesting facilities, and managed grasslands were reported to be very well managed by 60% to 70% of respondents, but moderately or poorly managed by 30% to 40% of households (Table 9). Plantation and hedges on lands privately used by households were the least maintained NRM measure (48%). This was specifically very high in Dire Dawa (18%). For soil fertility practices such as mulching, manuring and composting, these were reported to be well managed by between 51% and 68% of households, but moderately or poorly managed by 30% to 50% of households.

4.2.2.2 NRM practices on communal lands

As presented in Table 10, about 87% of the households acknowledged presence of biophysical SWC on communal lands in their watersheds. Area closures (82%), plantations and fodder hedges (80%), and pastureland management within the watersheds (75%) are also prominent interventions. Similarly, about 65% households indicated the presence of community-level water-harvesting or irrigation facilities. The NRM activities or measures were more common in Deder and Dire Dawa than in Zeway Dugda.

10 CRS promotes and continues to promote all the practices listed in tables 8, 9 and 10, apart from the following three: manuring, mulching and grassland management. These three are already being done by communities as a traditional, cultural practice. Non-PSNP communities are also practicing these promoted NRM practices on communal and private lands as they share resources with the PSNP community in the watershed. Development of small-scale irrigation, water supply schemes, closed areas / matured watershed are some of the NRM practices supported by DFSA and adapted by non-PSNP communities in Deder, Dire Dawa and Ziway Dugda woredas.

11 The N values are the number of households that reported to have NRM practice on their land. All percentages are calculated as the ratio of number of households reported to practice NRM and the sample size.

Table 9. Percentage of households maintaining/managing implemented NRM measures

Practices	Maintenance/ management status	Deder	Dire Dawa	Zeway Dugda	Total
SWC on farmlands	Very well	75.1	50.5	40	63.2
	Moderately	23.5	46.3	60	34.8
	Poorly or not at all	1.4	3.2	0	2
Plantation and fodder hedge	Very well	72.2	17.6	53.8	49.0
	Moderately	27.8	76.4	23.1	47.6
	Poorly or not at all	0	6.1	23.1	3.3
Grassland management	Very well	72.9	31.4	66.7	64.3
	Moderately	26.6	54.9	33.3	32.5
	Poorly or not at all	0.5	13.7	0	3.2
Composting	Very well	71.1	28.1	38.1	51.7
	Moderately	27.5	68.3	47.6	45.3
	Poorly or not at all	1.4	3.6	14.3	3
Manuring	Very well	68.1	43.3	8.3	60.3
	Moderately	30.1	32.8	75	32.5
	Poorly or not at all	1.8	22.4	16.7	6.8
Mulching	Very well	74.8	30.8	75	68.2
	Moderately	23.1	50.0	25.0	27.2
	Poorly or not at all	2.1	19.2	0	4.6
Gully treatment	Very well	78.1	51.6	45.5	71.2
	Moderately	21.1	22.6	45.5	22.9
	Poorly or not at all	0.8	25.8	9.1	5.8
Irrigation and water harvesting	Very well	71.1	39.3	100	60
	Moderately	24.4	25.0	0	24.0
	Poorly or not at all	2.2	35.7	0	14.6

Table 10. Percentage of households reporting NRM activities on communal lands

Type of NRM activity	Deder	Dire Dawa	Zeway Dugda	Total
SWC measures (physical, biological)	98.8	94.7	66.1	87.2
Plantations and fodder hedges	87.3	80.5	70.1	79.7
Area closures	98.3	71.2	73.4	81.8
Pastureland management	85.0	71.9	65.4	74.6
Community-level water-harvesting/ irrigation structures	78.7	81.1	33.6	65.2

SWC measures and area closures were reported to be very well managed by 52% of households (Table 11). In the case of pastureland management, and plantation and fodder hedges, only 27% and 32% of households categorized these practices as well managed. Of the three woredas, Deder was better in maintaining or managing NRM outputs under communally used lands.

Overall, the results show that although NRM practices can exist widely, NRM measures on lands under communal use are less well managed relative to those on private land. The reasons for this finding might be associated with the encroachment of animals for grazing or browsing and people for collecting firewood on communal land, as well the capacity of community structures to self-lead the maintenance and management practices on a regular basis.

Table 11. Percentage of households by current maintenance/management status of NRM measures implemented on communal lands

Maintenance/ management status	Deder	Dire Dawa	Zeway Dugda	Total	Deder	Dire Dawa	Zeway Dugda	Total
	SWC measures (biophysical)				Area closures			
Very well	75	35	36	52	76	31	39	52
Moderately	23	55	59	43	23	50	54	40
Poorly or not at all	2	10	6	5	1	19	8	8
	Pastureland management				Plantations and fodder hedges			
Very well	27	27	27	27	27	75	30	36
Moderately	54	54	54	54	54	24	60	59
Poorly or not at all	18	18	18	18	18	1	9	5
	Water-harvesting/irrigation structures							
Very well	77	27	31	50				
Moderately	22	54	60	42				
Poorly or not at all	1	18	8	8				

4.3 Access to watershed benefits and decision-making by socio-economic group

4.3.1 Sharing of watershed resources and services by socio-economic group

According to Article 40 of the Ethiopian Constitution, the State controls and owns land and natural resources.[12] Under this law farmers have the right to use rural land without payment, and they have protection against eviction. Although men and women have equal right to access rural land, our findings show a higher proportion of MHHs (82%) with access to crop land as a watershed resource relative to FHHs (67%) (Table 21).

As the redistribution of land is restricted by law, youths[13] do not have access to rural land. To address this issue and related ones, youths are given special privilege to use area closure sites for apiculture in a few watersheds, e.g., community FGD participants in the Dujuma watershed (Dire Dawa) noted that landless youths were benefiting from area closures. Nevertheless, this was not the case in all the sample watersheds. In Deder, for example, youths and women were not given priority in accessing area closure sites.

Under natural resources, access to water for domestic and livestock use is equal for all community members regardless of their socio-economic status. However, this is not the case for irrigation water. In Dire Dawa access to irrigation water from communal schemes depends on the location of the plot of land rather than the social-economic status of individual households. Households having plots in the command areas[14] have the right to access the irrigation water as per the scheme capacity. Hararghe Catholic Secretariat (HCS) staff estimated that in Dire Dawa, 20–30% of DFSA-developed irrigation scheme users are PSNP households. This proportion is relatively low because there are few PSNP clients with farmland in the irrigation command areas.

Based on KIIs with Dire Dawa Council Bureau of Agriculture and HCS, and kebele-level and community FGDs, the DFSA has a quota for women and youths in its livelihood interventions. For example, in Dire Dawa 50% of DFSA program livelihood group members are female and 20% are youths. Beekeeping and rural job creation schemes are focusing on youths whereas perma-gardens, improved stoves and functional adult literacy interventions are specifically targeting women.

In the household survey, women household heads and spouses in male-headed households were asked about the key benefits girls and women were receiving from local development interventions (Table 12). Sixty-eight percent and 52% of respondents indicated an increase in income and a reduction in workload respectively as the main benefits for women. Similarly, 63% and 50% of respondents indicated income increase and workload reduction respectively for girls.

An increase in women's decision-making roles at community level was reported by 47.5% of respondents, and 47.4% mentioned improvements in their health due to local development interventions. Sixty percent of respondents indicated a better chance for girl's education, and 25% of respondents acknowledged equal treatment of girls and boys as a benefit from development interventions. Only 11% of respondents reported an improved capacity of women to engage in IGAs.

12 Based on this provision, the federal and regional governments issue land administration and use proclamations, which are revised from time to time. Oromia Regional Government also issued its land law in 2002 (Dessalegn, 2020).

13 Ages 15-29 years, according to the National Youth Policy (FDRE, 2004).

14 Command area is the land surface that can access irrigation water.

Table 12. Percentage of women reporting specific benefits for women and girls from local development interventions

Specific benefits for women and girls		Deder	Dire Dawa	Zeway Dugda	Total
Women	Increased income	76.6	66.5	56.7	68.0
	Reduced workload	55.2	47.5	50.2	51.6
	Increased decision-making role at community level	56.9	29.0	51.1	47.5
	Improved health	57.8	25.8	52.4	47.4
	Increased capacity to engage in IGAs	15.9	1.4	14.2	11.4
Girls	Increased income	69.1	61.6	55.4	63.1
	Reduced workload	53.5	48.9	47.6	50.5
	Better chance for education	68.8	33.8	70.6	59.7
	Improved health	56.6	30.6	42.4	45.4
	Equal treatment as boys receive	31.5	6.4	38.1	26.5

4.3.2 Decision-making by socio-economic group in watershed resources and services development and use

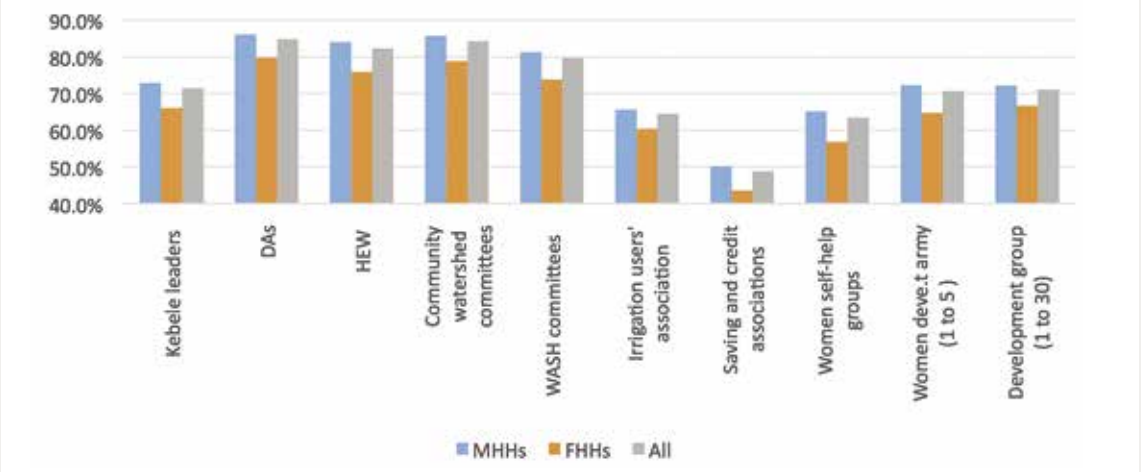
The participation of service users from different social groups in decision-making is crucial to ensure sustainable and equitable benefits from watershed development initiatives. In the study areas, women's membership in community watershed committees (CWCs) is mandatory, and women participate during planning and identification of actions. For example, in Dire Dawa water and fuel-saving stoves are prioritized because women were involved in the identification and prioritization of actions. Youth representatives are also included in CWCs, and they participate in the planning and implementation of development activities.

Table 13 shows the involvement of women in meetings organized by kebele leaders, development agents (DAs), health extension workers (HEWs) and watershed committees. The findings show that women's involvement in community meetings was higher in Deder than in Dire Dawa and Zeway Dugda. Moreover, the survey findings indicate women in MHHs are attending community meetings more than women in FHHs (Table 13). As shown in Figure 14, women in MHHs have more tendency to participate in community meetings. The reason for this and other women empowerment issues should be further investigated through a qualitative study.

Table 13. Community meetings attended by women, percentage of households

Meetings arranged by	Deder			Dire Dawa			Zeway Dugda		
	MHHs	FHHs	All	MHHs	FHHs	All	MHHs	FHHs	All
Kebele leaders	93.5	86.0	92.1	47.9	45.5	47.5	86.4	80.6	84.9
DAs	95.1	91.2	94.4	36.2	9.1	31.0	79.4	72.2	77.5
HEWs	95.9	91.2	95.0	42.2	36.4	41.1	80.4	72.2	78.3
Community watershed committees	95.1	93.0	94.7	35.6	18.2	32.1	58.8	58.3	58.7
WASH committees	76.3	78.9	76.8	37.8	27.3	35.7	43.1	36.1	41.3
Irrigation users' association	65.3	70.2	66.2	31.8	18.2	29.1	16.7	5.6	13.8
Saving and credit associations	86.9	78.9	85.4	27.3	45.5	30.9	21.6	22.2	21.7
Women self-help groups	83.3	77.2	82.1	70.5	45.5	65.5	40.2	47.2	42.0
Women deve.t army (5 group members with 1 leader)	81.7	78.9	81.2	81.8	54.5	76.4	39.2	47.2	41. 3
Development group (30 group members with 1 leased)	89.7	82.8	88.4	36.4	27.3	34.5	41.2	47.2	42.8

Figure 14. Percentage of households reporting women's attendance at community meetings.



4.4 Use of services and infrastructure

The baseline study considered two broad categories of services:

- Primary schools, health posts, FTCs, rural roads and veterinary facilities;
- Water and sanitation services.

4.4.1 Access to and availability of primary schools, health posts, FTCs, rural roads and veterinary facilities

Among the services listed in Table 14, availability and access to primary schools was highest, whereas health posts and veterinary services were less available and accessible. Availability refers to existence of facilities and associated services, while access is a households' use of the services from the available facilities. The results indicate that, generally, there are no major differences between availability of and access to the services (Table 14); i.e., if there are services, almost all households are using them. On average, all health posts were within a 40-minute walk.

Respondents' views on the performance of services are shown in Table 15, with wide variations between woredas. Further investigation is needed to understand the different reporting of performance by respondent and by area.

Table 14. Percentage of households reporting availability and access to services and infrastructure

Woredas		Primary school	Rural road	Health post	FTC	Veterinary facility
Deder	Available (%)	96.5	82.3	53.2	89.2	50.1
	Access (%)	95.3	81.4	52.0	87.5	48.7
	Average walking distance (minutes)	28	27	40	37	47
	No. of responding households	344	344	344	344	347
Dire Dawa	Available (%)	99.3	96.6	99.0	56.7	68.9
	Access (%)	97.3	95.6	96.0	55.7	67.2
	Average single walking distance from residence (minutes)	11	10	10	9	10
	No. of responding households	300	297	300	300	302
Zeway Dugda	Available (%)	98.7	71.2	38.5	92.6	43.1
	Access (%)	98.7	70.2	37.8	90.3	42.5
	Average walking distance (minutes)	31	24	28	30	34
	No. of responding households	299	299	299	299	299
Total	Available (%)	98.1	83.3	63.1	80.0	53.9
	Access (%)	97.0	82.3	61.5	78.3	52.6
	Average walking distance (minutes)	24	20	23	28	29
	No. of responding households	943	940	943	943	948

Table 15. Percentage of households reported functionality status of socio services

	Services	Functions very well	Functions moderately well	Functions poorly or not functioning
Deder	Veterinary facilities	57.8	36.7	5.6
	Health post	60.2	33.3	6.2
	School	74.3	24.0	1.8
	FTC	57.7	37.5	5.2
	Road	51.9	30.7	17.3
Dire Dawa	Veterinary facilities	43.1	45.5	11.7
	Health post	49.5	44.8	6.0
	School	58.5	40.1	1.0
	FTC	40.7	47.7	11.7
	Road	33.9	32.9	33.9
Zeway Dugda	Veterinary facilities	42.9	51.9	7.3
	Health post	35.3	54.6	13.1
	School	38.0	58.2	3.7
	FTC	35.4	54.9	10.4
	Road	36.6	55.1	8.8
Total	Veterinary facilities	48.1	44.1	8.4
	Health post	50.0	43.2	7.7
	School	57.6	40.1	2.1
	FTC	45.7	46.1	8.2
	Road	41.2	38.1	21.0

4.4.2 Water and sanitation

Overall, 84% of households in the sample watersheds used drinking water from safe or protected sources (Table 16). Deder has the highest percentage of households (30%) accessing drinking water from unprotected sources. On average, the domestic water consumption level was 9 l/day/person, from sources located within an average distance of 1.8 km (Tables 17 and 18).

Access to drinking water in the watersheds was high compared to the GTP II target of reaching 51% of the rural population by 2020 (FDRE, 2016). However, the consumption level of drinking water was substantially lower than the 2020 GTP II target for rural areas of 25 l/day/person within a 1 km radius distance. Only 4.5% of households in the watersheds reported consuming 25 l/day/person.

Table 16. Percentage distribution of households by sources of drinking water

	Sources	Deder	Dire Dawa	Zeway Dugda	Total
Protected sources	Public tap	0.9	91.9	85.0	48.7
	Protected spring	66.7		2.7	30.7
	Protected well in yard/plot	0.9		3.8	1.8
	Protected public well	0.3	3.7	2.0	1.6
	Rainwater, protected	0.9	0.7	0.3	0.6
	Total	**69.6**	**96.3**	**93.9**	**83.5**
Unprotected sources	Open well in yard/plot		2.9		0.5
	Open public well		0.7	1.0	0.5
	Unprotected spring	5.5		1.4	3.0
	River/stream	24.3		0.3	11.0
	Pond/lake	0.6		3.1	1.4
	Rainwater harvesting, unprotected			0.3	0.1
	Total	**30.4**	**3.7**	**6.1**	**16.5**

Table 17. Household water consumption

	Deder	Dire Dawa	Zeway Dugda	Total
Average domestic water consumption (l/day/person)	8.6	7.6	10.4	9.1
% households consuming 25 l/day/person (GTP II target)	3.2%	3.7%	6.5%	4.5%

Table 18. Distance to drinking water sources

Research site	Distance to water source (km)		
	Dry season	Wet season	Average
Deder	2.5	2.3	2.3
Dire Dawa	1.7	1.7	1.7
Zeway Dugda	1.5	1.3	1.3
Total	1.9	1.7	1.8

Only 10% of households were using improved toilet facilities (with slabs) for adults, and open defecation was practiced by 39% of households; 51% of households used open pits (Table 19). Only 2.2% of households reported using improved toilet facilities for their children. All other households were using unprotected facilities or openly throwing excreta from children into fields. About 10% households that have both improved and unimproved toilets are sharing toilet facilities with neighbors (Table 20).

Table 19. Percentage of households using different toilet facilities

	Deder	Dire Dawa	Zeway Dugda	Total	Deder	Dire Dawa	Zeway Dugda	Total	Deder	Dire Dawa	Zeway Dugda	Total
	Male adult				Women adult				Both			
No facility/ bush/ field	32.3	54.0	44.0	42.9	14.2	51.7	44.9	35.8	23.2	52.8	44.4	39.3
Pit latrines with no slab, open pit	53.1	33.0	55.7	47.4	71.6	33.7	54.4	54.1	62.4	33.3	55.0	50.8
Improved pit latrine with slab	14.7	13.0	.3	9.7	14.2	14.7	.7	10.1	14.4	13.8	.5	9.9
	Male child				Female child				Both			
No facility /bush/ field	7.5	56.4	43.0	30.5	7.8	54.9	42.9	30.2	7.7	55.7	42.9	30.3
Pit latrines with no slab, open pit	91.3	33.3	56.3	66.7	91.3	33.3	56.5	66.8	91.3	33.3	56.4	66.7
Improved pit latrine with slab	1.2	10.3	.7	2.9	.9	11.7	.7	3.0	1.0	11.0	.7	2.9

Table 20. Percentage households sharing toilet facilities with other households

Responses	Deder	Dire Dawa	Zeway Dugda	Total
No	95.1	90.4	83.1	89.7
Yes	4.9	9.6	16.9	10.3

4.5 Agricultural production and productivity

4.5.1 Crop production

4.5.1.1 Access to farmland

Table 21 shows that nearly 79% of households had access to land to cultivate crops during the 2011 Ethiopian Calendar (EC) *meher* and *belg* seasons, and 21% of households have no access to land in any form. Lack of access to land was higher for FHHs (33%) than MHHs (18%).

The average area of land was 0.54 ha, with MHHs and FHHs cultivating 0.55 ha and 0.50 ha respectively.

4.5.1.2 Land allocation and production by crop type

Sorghum, maize and wheat were the main cereal crops grown, covering about 27%, 26% and 10% of farmland respectively (Table 22). *Chat* was an important cash crop in Deder, with 25% of farmlands allocated to it.

Maize, sorghum and wheat contributed 47%, 34% and 15% of annual production respectively (Table 23). From the total annual crop production, 91% was produced during the *meher* season and 8.5% during the *belg* season; irrigated farming contributed 0.7% of crop production.

Table 21. Percentage distribution of households accessing land for cultivation and area of land cultivated (2011 EC *meher* and *belg* seasons)

Woreda	Sex of household head	Farmland accessed (%)		Area of land cultivated (ha)	N
		No	Yes		
Deder	Male	17.7	82.3	0.39	282
	Female	24.6	75.4	0.34	65
	Total	19.0	81.0	0.39	347
Dire Dawa	Male	2.0	98.0	0.49	256
	Female	8.7	91.3	0.35	46
	Total	3.0	97.0	0.47	302
Zeway Dugda	Male	36.9	63.1	0.91	217
	Female	53.6	46.4	0.82	84
	Total	41.5	58.5	0.89	301
Total	Male	17.9	82.1	0.55	755
	Female	33.3	66.7	0.50	195
	Total	21.1	78.9	0.54	950

Table 22. Percentage area of farmland allocated to different crops by woreda and season during 2011 EC

Crop type	Woredas*			Total				Total ha by sample HHs
	Deder	Dire Dawa	Zeway Dugda	Total*	*Meher*	*Belg*	Irrigated	
Maize	28.6 (249)	5.3 (25)	51.7 (154)	26.1 (428)	99.3	0.5	0.2	2,258.9
Sorghum	17.4 (151)	61.8 (293)		27.0 (444)	98.6	1.3	0.1	1,618.1
Wheat	7.6 (66)		30.5 (91)	9.6 (157)	99.0	0.9	0.1	690.5
Barley	3.6 (31)		6.0 (18)	3.0 (49)	98.2	1.6	0.2	119.1
Teff	0.2 (2)		9.4 (28)	1.8 (30)	99.2	0.0	0.8	31.4
Chat	24.7 (215)	3.8 (18)		14.2 (233)	93.4	2.8	3.8	417.4
Coffee	5.2 (45)	1.1 (5)		3.0 (50)	92.3	2.9	4.8	40.4
Papaya	0.1 (1)	10.1 (48)		3.0 (49)	59.22	86.5	1.5	59.2
Orange		2.7 (13)		0.8 (13)	33.88	97.4	0.0	33.9
Other	12.6 (110)	12.6 (99)	10.9 (89)	12.3 (126)	92.3	3.2	4.5	268.7
Total	100 (870)	100 (474)	100 (298)	100	98.1	1.1	0.8	5,537.0

*Note: The numbers in the brackets represent the number of households that reported planting listed crops during 2011 EC.

Table 23. Percentage of cereal crop production (qt) by crops and season during 2011 EC *meher* and *belg* seasons

Crop	Deder	Dire Dawa	Zeway Dugda	*Meher*	*Belg*	Irrigated	Total	Total (qt)
Maize	52.7%	4.8%	69.3%	48.0%	39.3%	67.6%	47.4%	2,439.5
Sorghum	31.3%	95.2%	0.0%	34.2%	34.4%	18.9%	34.1%	1,753.1
Wheat	11.0%	0.0%	26.6%	14.6%	22.2%	8.1%	15.2%	783.5
Barley	5.0%	0.0%	2.8%	2.5%	4.1%	2.7%	2.6%	136.0
Teff	0.0%	0.0%	1.4%	0.7%	0.0%	2.7%	0.6%	32.1
Total (qt)	1,386.5	1,384.6	2,373.1	4,670.4	436.8	37.0		5,144.2
Total (%)				90.8%	8.5%	0.7%	100.0%	

4.5.1.3 Crop productivity

The average yields of cereal crops in Deder, Dire Dawa and Zewa Dugda are shown in Table 24, and are far lower than national averages. For example, the average maize yield in the three woredas during 2018/19 was 16 qt/ha, while the national average for *meher* was 40 qt/ha (CSA, 2019).

Figure 15 shows the effects of NRM practices on cereal crop productivity. The analysis was done by classifying sample households into four groups depending on the percentage of cultivated farmland (0–25%, 25–50%, 50–75% and 75–100% of farmland), and considering two groups of NRM practices, i.e., SWC and soil fertility management (SFM).

Our descriptive analysis indicates that the use of SWC measures on farmlands contributes to increases in cereal crop productivity on average from 13.2 to 17.2 qt/ha. As illustrated in Figure 15, productivity for selected cereal crops improves when SWC is used on more than 50% of cultivated land. If a farmer is able to cover above 75% of land with SWC measures, annual production can increase by up to 4 qt/ha or 30%.

Table 24. Average annual crop productivity

	Deder		Dire Dawa		Zeway Dugda		Yield by season (qt/ha)			Total		National, qt/ha (*meher* only)*
Crop	Qt/ha	Qt/hh/yr	Qt/ha	Qt/hh/yr	Qt/ha	Qt/hh/yr	*Meher*	*Belg*	Both	Qt/ha	Qt/hh/yr	
Barley	12.65	2.83	-	-	11.17	5.15	12.32	9.60	11.87	11.87	3.65	21.77
Wheat	12.62	4.94	-	-	15.21	7.13	14.50	15.52	14.62	14.62	6.56	27.68
Maize	13.93	2.96	16.25	2.83	17.32	11.09	16.17	15.50	16.12	16.12	5.85	40.09
Sorghum	13.32	3.16	9.91	4.49	-	-	11.11	7.00	10.58	10.58	4.07	27.46
Teff	-	-	-	-	2.95	1.15	2.95		2.95	2.95	1.15	17.56
Total	13.51	4.87	10.10	4.72	15.51	13.39	13.37	10.74	13.09	13.09	6.81	

*Source: CSA (2019)

Figure 15. Cereal crop productivity trends by land coverage with SWC measures.

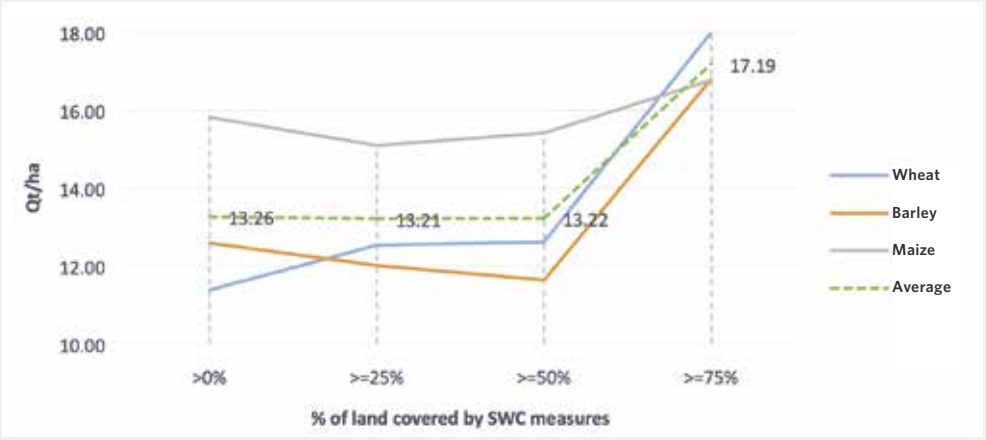
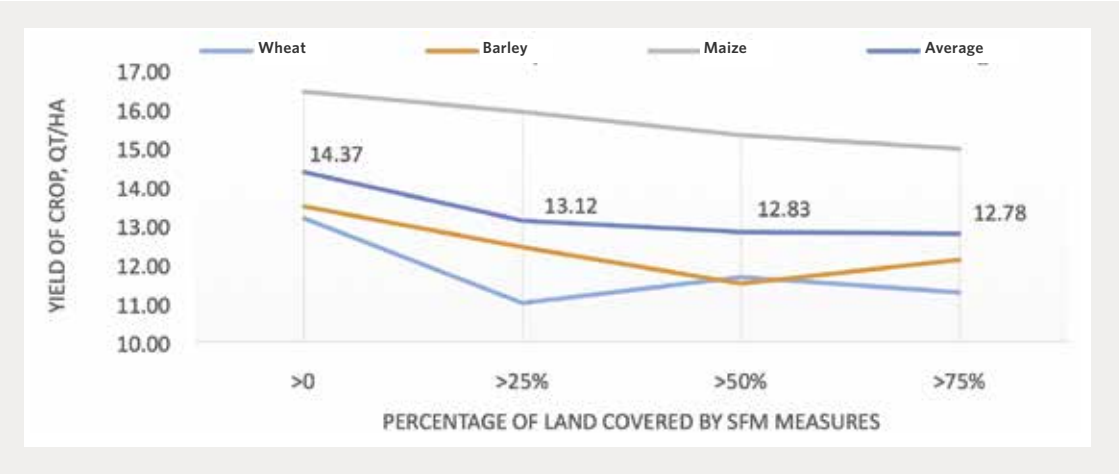


Figure 16. Cereal crop productivity by land coverage with soil fertility management practices.



As opposed to this trend, as the percentage of area of farmland covered by SFM practices increases from 0 to above 75%, crop productivity reduces from 14.7 to 12.3 qt/ha (Figure 16). This declining trend of crop productivity might have occurred because of reduction in application of SFM resources such as manure on a fixed land size owned by farmers. However, further investigation through qualitative research is needed to understand this finding.

4.5.2 Livestock production

4.5.2.1 Livestock ownership

Livestock production is an important source of livelihood for households and a strategy of reserving assets in the sample watersheds. About 62% of sample households owned one or more types of livestock, with more ownership among MHHs compared to FHHs (Table 25). Cattle, goats and poultry were the common types of animals owned.

Table 25. Percentage of HHs owning livestock

Livestock type	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
Cattle	38.3	81.5	35.2	54.0	39.0	51.1
Sheep	7.5	39.4	4.7	17.6	13.0	16.7
Goats	25.1	77.5	10.6	39.6	28.0	37.2
Equines	6.9	22.2	12.0	15.4	6.0	13.4
Poultry	28.5	51.0	16.6	33.5	26.0	31.9
Camels	0.0	5.3	0.0	1.7	1.0	1.7
Own at least one animal	49.6	96.0	42.5	65.2	50.3	62.1
No. of HHs that reported owning animals	179	291	133	500	103	603

Improved livestock breeds are also being introduced into the study areas to increase production and productivity of animals by the local farmers. The proportion of households having improved livestock breeds is very low and varies by woreda and livestock type. For instance, as shown by Table 26, a relatively sizable percentage (17%) of rural households own improved poultry breed compared to cattle (6%) and goats (4%), which are rarely available. One in three sample household (33%) in Dire Dawa has improved poultry breeds compared to Deder (12%) and Zeway Dugda (6%).

On average, a household owns 1.3 TLU, with more livestock owned by MHHs compared to FHHs (Table 27). As Dire Dawa is a more agro-pastoralist area, livestock ownership is relatively high at 2.5 TLU/household.

4.5.2.2 Livestock productivity

Local and improved breeds of poultry provided an average of 44 and 95 eggs per bird per year respectively (Figure 17). Both figures are relatively low compared to national averages, which are 48 eggs per year for local breeds and 152 eggs per year for improved hybrid types (CSA, 2018).

Cow milk production was 2.1 l/day and 11.9 l/day for local and improved breeds respectively (Figure 18). The national average is 1.4 l/day for local breeds, which normally have a six-month lactation period per year (CSA, 2018).

Local breeds of lambs and goats required 6.1 and 7.2 months respectively to mature and be ready for sale, whereas improved breeds required 4.5 months and 6.8 months respectively (Table 28).

Table 26. Percentage of households owning improved livestock

Livestock type	Woreda			Sex of HH head		
	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
Cattle	5.8%	7.6%	3.0%	6.2%	2.6%	5.5%
Goats	5.8%	7.0%	0.3%	4.9%	2.6%	4.4%
Poultry	11.8%	32.8%	6.0%	16.8%	15.9%	16.6%
Sheep	0.3%	4.6%	0.0%	1.9%	0.5%	1.6%
N	347	302	301	755	195	950

Table 27. Average livestock ownership, TLU per household

Livestock type	Deder	Dire Dawa	Zeway Dugda	MHHs	FHHs	Total
Cattle	0.5	1.40	0.65	0.91	0.56	0.84
Sheep	0.0	0.15	0.01	0.06	0.04	0.06
Goats	0.1	0.57	0.03	0.24	0.14	0.22
Equines	0.0	0.21	0.08	0.12	0.04	0.10
Poultry	0.0	0.02	0.01	0.02	0.01	0.02
Camels	-	0.17	0.00	0.06	0.03	0.05
Total	0.7	2.51	0.78	1.41	0.83	1.29

Figure 17. Annual egg production.

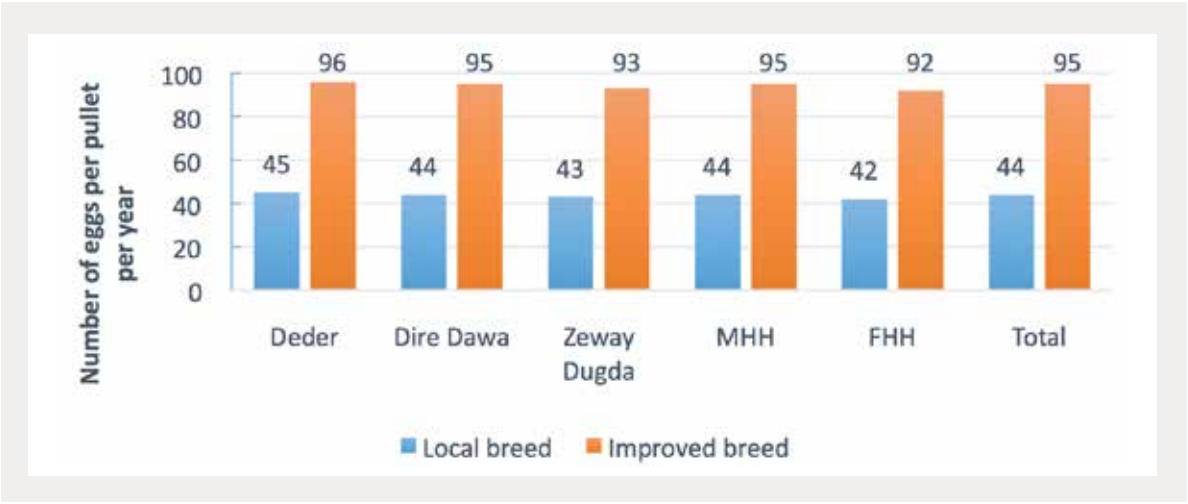


Figure 18. Annual cow milk production.

Likewise, on average a household kept an ox for about six months to fatten and bring to the market, but there was wide variation between woredas. It is also common to make use of the oxen for draft power during this time. However, keeping animals for longer has its own costs and risks. Farmers are aware of these factors and only fatten oxen when they are sure that the benefits outweigh the costs.

Table 28. Average number of months required to mature lambs and kids, and to fatten oxen

Woreda	Lambs for maturity		Goat kids for maturity		Oxen for fattening
	Improved breeds	Local breeds	Improved breeds	Local breeds	Local breeds
Deder	4.9	7.4	7.1	8.1	4.4
Dire Dawa	4.0	5.7	6.3	7.1	7.5
Zeway Dugda	3.5	3.3	6.5	5.3	3.6
Total	4.5	6.1	6.8	7.2	5.9

4.5.2.3 Livestock inputs

The availability of appropriate inputs and livestock management is critical to enhance productivity of livestock, alongside IWM practices. Forty-four percent, 50% and 57% of households had adequate access to feed for cattle, sheep and goats respectively (Table 29). Likewise, nearly 43%, 53% and 73% of households had adequate access to feed specifically for milking animals including cattle, goats and camels respectively. About 48% of households that engaged in poultry production had access to feed. By woreda, Zeway Dugda had the least access to animal feed, for all types of animals.

Veterinary services are also critical for enhanced production and productivity of livestock. For all the different types of animals, Dire Dawa had better access to veterinary services compared to Deder and Zewa Dugda. If cattle is considered in this case, about 64% of households in Dire Dawa reported access to veterinary services while it is 61% and 33% for Deder and Zeway Dugda (Table 30). For all types of animals, access to veterinary services in Zeway Dugda is alarmingly low: 33.3%, 14%, 31% and 8% of households for cattle, sheep, goats and poultry respectively.

4.5.2.4 Honey production

Beekeeping is becoming a common income source for households under many watershed initiatives in Ethiopia and is widely promoted in Tigray and Amhara Regions. However, only 2.5% of households practiced beekeeping in the study watersheds (Table 31). This might be because beekeeping is not acculturated and included in the agricultural extension system in these areas.

Among households with beehives, 42% used modern or transitional beehives, which produce honey at about 10 kg/hive compared to 6.9 kg/hive from traditional hives (Table 31 and Figure 19). Since the number of households that reported beekeeping practices is too low, the survey data do not allow undertaking further analysis such as access to inputs for honey production.

Table 29. Percentage of households reported adequate access to animal feed

Woreda	For fattening			For milk			Poultry for
	Cattle	Sheep	Goats	Cattle	Goats	Camels	eggs or meat
Deder	35.1	34.6	49.4	36.6	39.1		42.9
Dire Dawa	63.5	59.0	66.1	61.2	64.6	73.3	64.0
Zeway Dugda	8.6	7.1	9.4	7.6	12.5		8.0
Total	43.8	50.3	56.6	42.8	53.4	73.3	47.7

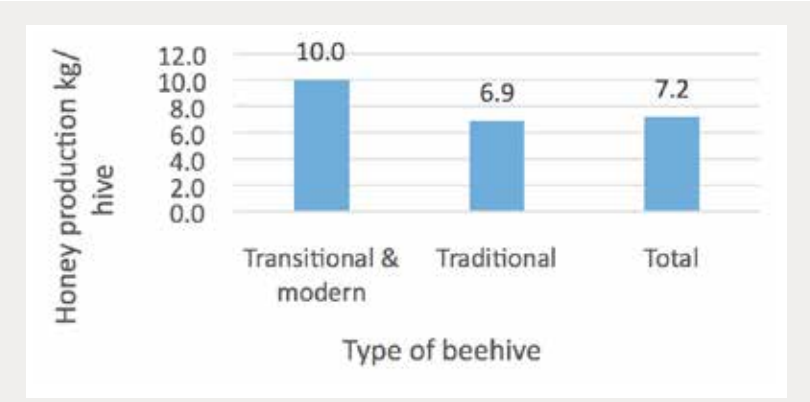
Table 30. Percentage of households that reported access to veterinary services by animal type

Woreda	Cattle	Sheep	Goats	Poultry	Camels
Deder	61.1	61.5	63.2	51.0	
Dire Dawa	63.9	65.0	63.4	56.0	80.0
Zeway Dugda	33.3	14.3	31.3	8.0	
Total	56.5	59.9	60.4	46.3	80.0

Table 31. Percentage of households practicing beekeeping

Woredas (no. of sample HHs)	% of HHs	% of modern or transitional hives
Deder (347)	2.3%	12.5%
Dire Dawa (302)	4.0%	50.0%
Zeway Dugda (301)	1.3%	75.0%
Total (950)	2.5%	41.7%

Figure 19. Honey productivity.



4.6 Climate change and weather variability

Climate change and weather variability are critical challenges for households in the sample watersheds. Given the existing level of understanding, about 48% of households reported that their livelihoods are being harmfully affected by climate change and weather variability (Table 32). Slightly more FHHs than MHHs are affected by climate change and variability. In terms of the distribution of respondents by woreda, households in Dire Dawa (43%) reported being the least affected.

About 60%, 44% and 42% sample households in the sample areas reported the effects of drought, seasonal irregularity of rain, and crop pests and diseases respectively on crop productivity. Similarly, drought, animal diseases and floods were reported to cause loss of livestock by 27%, 23% and 15% of households respectively (Table 33).

Table 32. Percentage of households that reported livelihood risks related to climate change and weather variability

Responses	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
No	53.3	56.8	46.3	52.1%	52.8%	52.2
Yes	46.7	43.2	53.7	47.9%	47.2%	47.8
No. of households that reported climate change and/or weather variability to be a risk for them	162	130	160	361	91	452

Table 33. Percentage of households reporting the effects of climate change and variability in agriculture

Effects on agriculture	Deder	Dire Dawa	Zeway Dugda	Total
Crop-related effects				
Loss/decline of crop harvest due to drought	52.4	66.6	63.1	60.3
Loss/decline of crop harvest due to seasonal irregularities of rain	57.1	23.8	49.8	44.2
Loss/decline of crop harvest due to pests and disease	46.1	39.4	38.9	41.7
Loss/decline of crop harvest due to flood	40.9	8.3	32.2	27.8
Livestock-related effects				
Loss/decline of animal stock due to drought	40.1	8.9	28.6	26.5
Loss/decline of animal stock due to animal disease	32.3	5.0	29.9	22.8
Loss/decline of animal stock due to flood	24.2	2.3	18.3	15.4
Loss/decline of livestock productivity due to flood	23.9	4.6	25.2	18.2
Loss/decline of livestock productivity due to drought	26.5	3.3	18.3	16.5
Loss/decline of livestock productivity due to animal disease	16.7	1.7	16.3	11.8

IWM can contribute to climate change adaptation and resilience building of agriculture- dependent households when weather information is available so that households can make informed decisions related to their livelihoods, and especially agriculture. Accordingly, about 46% of households in total, and 44% and 39% of MHHs and FHHs respectively, reported having received climate/weather forecast information during the 2018/19 agricultural seasons. As shown in Table 34, the major sources of this information were community discussions (57%), CRS-DFSA project (44%), DAs (40%), mass media (38%), kebele disaster risk reduction and early warning (DRR/EW) committees (17%), and woreda experts (12%).

Notably, over half of the sample watershed residents, including many FHHs, are not getting weather forecast information to make informed decisions on climate change and variability adaptation strategies. Second, local DRR/EW committees and DAs are supposed to provide advice and guidance on various agriculture-related issues including climate change and weather variability. However, as shown in Table 34, weather information provision by DAs is highly variable between the woredas, and information from DRR/EW committees is low or nonexistent. Among households that received climate/weather information, 69% had used risk reduction and resilience building actions during the 2018/19 agricultural seasons (Table 34).

Overall, about 30% of households are using weather information from different sources to make informed decisions on agricultural production. From this MHHs (32%) tend to be more users of such information compared to FHHs (26%).

Improved soil management practice was the most common practice, used by 84% of households (Table 35). Only a few households (8%) used drought-tolerant crop varieties. Efficient water management practices, switching to perennial crops, changing from livestock grazers to browsers and diversifying incomes sources as climate change adaptation strategies were being practiced by nearly 3% of households.

Table 34. Percentage of households receiving weather forecast information during the 2018/19 agricultural seasons

Sources of information		Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
Having access to weather information		62.5	30.4	36.9	44.3	38.9	45.7
Using the accessed weather information		83.4	87.9	25.5	69.7	66.7	69.1
Users of weather information from total sample		52.1	26.7	9.4	31.7	25.6	30.4
Sources of information	Community discussions	66.1	45.1	47.8	44.8	11.8	56.6
	CRS-DFSA project	75.2	56	11.5	42.7	11.4	45.0
	DAs	35.3	82.4	16.8	32.9	7.6	40.5
	Mass media	54.6	1.1	61.9	38.2	6.9	37.5
	Kebele DRR/EW committee	23.9	0	16.8	.2	0.0	16.8
	Woreda experts	16.5	1.1	13.3	14.0	2.8	12.3
	Others	0.5	0	0	0.2		0.2

Table 35. Percentage distribution of households by actions taken using climate/weather forecast information during 2018/19 agricultural seasons

Actions	Deder (N = 182)	Dire Dawa (N = 81)	Zeway Dugda (N = 30)	Total (N = 293)
Improved soil management (e.g., mulching)	89.0	90.1	33.3	83.9
Applied drought-tolerant crop varieties	8.2	7.4	10.0	8.2
Applied efficient water management practices (e.g., water harvesting or irrigation)	1.6	0.0	0.0	1.0
Switched from annual crops to perennial crops	0.5	0.0	26.7	3.1
Switched from livestock grazers to browsers	0.0	0.0	3.3	0.3
Diversified income sources (e.g., IGAs)	0.0	0.0	23.3	2.4
Others	0.5	2.5	3.3	1.0

4.7 Household food and nutritional security

The household survey used three indicators to measure household food and nutritional security, viz. the household food insecurity experience scale (FIES), number of months households have access to enough food per year and the household dietary diversity score (HDDS).[15]

4.7.1 Food insecurity experience scale (FIES)

FIES was used to measure the severity of food insecurity, and household interviews used eight questions with "yes or no" answers. The recall periods were 30 days and 12 months (Ballard, et al., 2013). The data analyzed and reported in the order of severity of food insecurity as shown in Figure 20.

When using 30-day recall, 57% of households have experienced moderate/severe food insecurity (Table 36). When using 12-month recall, 79% of households have experienced moderate/severe food insecurity (Table 37). Based on this, the 30-day food insecurity level is lower than the 12 months because the survey was conducted at the beginning of January, which was the time of harvest when there was relatively better availability of food at household level. MHHs and FHHs were almost equally (40%) moderately or severely food insecure over the 30-day recall period. However, FHHs (83%) were more food insecure than MHHs (77%) over the 12-month recall period.

The high prevalence of moderate or severe food insecurity for the 30-day recall in Deder might be

Figure 20. Continuum of food insecurity severity scale.

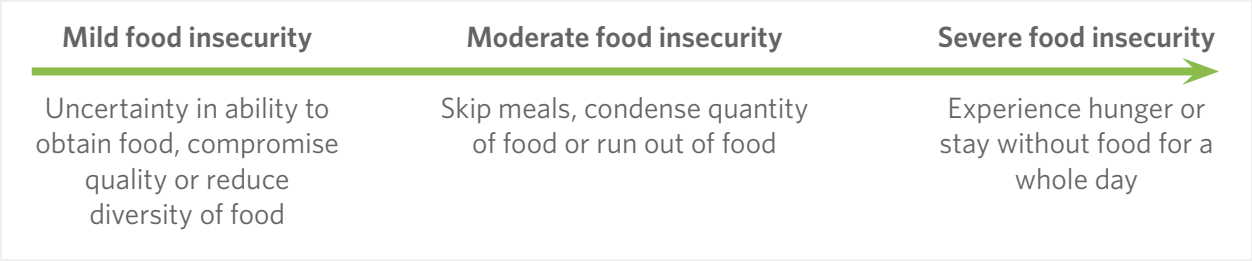


Table 36. Household food insecurity severity scale for 30-day recall

Food insecurity scale, 30-day recall	Deder	Dire Dawa	Zeway Dugda	Total		
				Male	Female	Both
Food secure	7.5	25.4	13.8	16.5	10.3	15.2
Mildly food insecure	23.8	15.0	41.4	25.9	33.5	27.5
Moderately food insecure	46.3	48.1	29.0	41.2	38.9	40.8
Severely food insecure	22.5	11.5	15.9	16.4	17.3	16.6
Moderately or severely food insecure	**68.8**	**59.6**	**44.8**	**57.6**	**56.2**	**57.3**
Food secure or mildly food insecure	31.3	40.4	55.2	42.4	43.8	42.7

15 All these indicators emphasize access to food by households. Moreover, HDDS provides a proxy indicator for household nutritional security: a more diversified diet is a better nutritional status, by itself leading to improved birth weight, child anthropometric status and improved hemoglobin concentrations.

Table 37. Household food insecurity severity scale for 12-month recall

Food insecurity scale, 12-month recall	Deder	Dire Dawa	Zeway Dugda	Total		
				Male	Female	Both
Food secure	6.7	1.0	7.6	5.5	3.8	5.1
Mildly food insecure	18.3	26.4	4.5	17.4	13.0	16.4
Moderately food insecure	42.7	57.5	54.5	51.6	50.8	51.5
Severely food insecure	32.3	15.1	33.4	25.5	32.4	27.0
Moderately or severely food insecure	**75.0**	**72.6**	**87.9**	**77.2**	**83.2**	**78.5**
Food secure or mildly food insecure	25.0	27.4	12.1	22.8	16.8	21.5

associated with the characteristics of the location. This area is relatively highland and cold one where the crop maturity and readiness for consumption take a prolonged period compared to the other two sites. The higher rate of moderate or severe food insecurity under 12-month recall in Zeway Dugda is mainly related to structural problems of households' access to food, which requires further investigation.

4.7.2 Number of months with adequate food access

Sample households were asked in which of the 12 months prior to the survey they had access to adequate food for family members. Overall, households had access to adequate food for 6.3 months. Zeway Dugda had the fewer months of food access (5 months), followed by Deder (6 months) and Dire Dawa (8 months) (Table 38). Adequate food access was higher among MHHs (6.6 months) compared to FHHs (5.3 months).

When these data are examined by quartiles, the 25% of households with the least food access had enough food only for four months per year. At the same time, a higher quartile had enough food for nine months per year.

Table 38. Average number of months per year with enough food

		Deder	Dire Dawa	Zeway Dugda	Total
Male		6.1	8.6	4.9	6.6
Female		5.6	5.8	4.7	5.3
Total		6.0	8.2	4.9	6.3
95% confidence intervals of mean differences		5.7–6.3	7.7–8.6	4.5–5.2	6.1–6.6
Quartiles	Q1: 25%	4.0	5.0	2.0	4.0
	Q2–Q3: 50%	6.0	9.0	4.0	6.0
	Q4: 25%	8.0	12.0	7.0	9.0

4.7.3 Household dietary diversity

Table 39 presents HDDS based on 24-hour recall.[16] On average, households consumed 3.9 out of 12 food groups. FHHs consumed a slightly lower number of food groups (3.6) compared to MHHs (4.0); the difference was not statistically significant. The lowest 25%, middle 50% and the upper 25% of households consumed 2.8, 4.0 and 5.0 out of the 12 food groups respectively. The lower quartile of households in Dire Dawa consumed the lowest number of food groups (2 out of 12).

The main food groups consumed were cereals (92%), sugar/honey (71%), vegetables (41%), tubers and root crops (40%), and miscellaneous (mainly coffee and tea) (51%). Consumption of oil and fat (31%), meat (1%), eggs (18%) and milk (39%) was low, as households either cannot afford to buy these foods or have no or insufficient assets, e.g., livestock, to produce them for home consumption. See Table 40.

Table 39. Average household dietary diversity score

Sex		Deder	Dire Dawa	Zeway Dugda	Total
Male		4.6	4.0	3.3	4.0
Female		4.4	3.6	2.9	3.6
Total		4.5	4.0	3.2	3.9
95% CI of mean difference		4.4–4.7	4.4–4.7	3.0–3.4	3.8–4.0
Quartiles	Q1: 25%	4.0	2.0	2.8	2.8
	Q2–Q3: 50%	5.0	4.0	4.0	4.0
	Q3: 25%	6.0	6.0	5.0	5.0

Table 40. Households' consumption of foods (% of HHs)

Food groups	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
Cereals	96.5	86.4	92.4	91.8	92.8	92.0
Eggs	26.5	18.6	7.0	19.8	10.3	17.8
Fish	0.0	0.0	6.6	2.3	1.5	2.1
Fruits	39.2	17.3	40.5	33.8	28.2	32.7
Legumes, nuts and seeds	29.7	37.9	9.6	25.7	26.7	25.9
Meat	0.0	0.0	3.7	1.3	0.5	1.2
Milk and milk products	54.2	37.9	21.9	40.7	31.3	38.8
Oil and fat	38.6	47.2	7.0	32.0	28.7	31.3
Sugar/honey	69.7	63.5	80.4	71.6	69.2	71.1
Vegetables	41.5	51.7	28.6	41.5	37.4	40.6
White tubers and roots	57.6	37.4	21.3	42.1	30.3	39.7
Miscellaneous (coffee or tea)	42.1	34.6	79.1	49.6	58.5	51.4

16 The exercise here is the simplest, taking only the frequency of food group consumed. The range of food groups used varies from one agency to another. For a more complicated procedure for calculating household dietary diversity, see **https://inddex.nutrition.tufts.edu/data4diets/indicator/food-consumption-score-fcs** and **https://www.indikit.net/indicator/1-food-security-and-nutrition/20-food-consumption-score-fcs** (accessed May 27, 2020).

4.8 Household expenditure, income and livelihood diversification

4.8.1 Household expenditure

In Ethiopia, it is common to consider household expenditure as a proxy for household income, as informants tend to be more comfortable discussing expenditure relative to income. Based on this, households were asked about expenditure in the 12 months prior to the survey. The average annual household expenditure was ETB 13,081 (US$ 380.9) (Table 41). The expenditure of MHHs (ETB 13,650) is 26% higher than FHHs (ETB 10,860). About 31% of household income was used to buy grain for food.

Table 41. Average household expenditure over 12 months in ETB

Expenditure category	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total	%
Food grain purchase	2,956	5,968	3,383	4,276	3,194	4,055	31.0%
Other food items	970	2,878	1,445	1,817	1,390	1,730	13.2%
Purchase of household clothes	2,047	1,969	2,835	2,309	2,100	2,266	17.3%
Health care expenses	383	697	1,955	988	905	971	7.4%
Education expenses	575	841	1,107	874	638	825	6.3%
Purchase of livestock	214	697	1,049	677	438	628	4.8%
Purchase of furniture/utensils	353	630	844	635	436	594	4.5%
Transport/communication costs	373	458	723	514	489	509	3.9%
Payment of social contributions (*iddir, mehaber,* etc.)	189	52	730	325	265	313	2.4%
Purchase of farm inputs/ technology	225	66	657	326	239	308	2.4%
Payment of loan and interest	244	108	364	256	167	238	1.8%
Purchase of farm tools/ equipment	236	86	276	205	182	200	1.5%
Maintenance/renovation costs	104	21	458	209	103	187	1.4%
Payment of taxes/other obligations	113	86	175	142	128	139	1.1%
Any other items	88	182	137	142	100	133	1.0%
Total HH expenditure for 12 months	9,070	14,662	16,211	13,650	10,860	13,081	100%

4.8.2 Household income and engagement in income-generation activities

4.8.2.1 Income sources

Sources of household income were organized into three groups following the PSNP IV pathway classification: on-farm, off-farm and wage labor employment.[17]

In total, about 65% of households were engaged in on-farm, off-farm and/or wage employment as income sources during the 12 months prior to the survey. About 61%, 29% and 11% of households were engaged in on-farm, off-farm and labor employment IGAs, respectively, as sources of income to cover their expenditures. A few households (3%), mainly FHHs (5%) were earning income only from off-farm IGAs. Likewise, 25% of households were involved in both on-farm and off-farm IGAs (Table 42).

Looking at the various components of on-farm IGAs, the production and sale of vegetables (42%), other high-value crops (46%) and fruits (39.0%) were the most frequent on-farm IGAs, followed by cow milk sales and poultry production. More MHHs than FHHs were engaged in on-farm IGAs, whereas the opposite pattern was evident for off-farm IGAs (Tables 43 and 44). This is because FHHs have lower access to farmland than MHHs (see Table 21). There were also more households in Deder woreda engaged in all on-farm IGAs than in Dire Dawa or Zeway Dugda (Table 43).

Table 42. Percentage of households by income sources during the last 12 months

Income sources	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
On-farm	84.1	50.3	45.5	62.5	55.9	61.2
Off-farm	41.5	13.6	28.9	26.9	35.4	28.6
Wage labor employment	16.7	7.3	9.3	12.7	6.2	11.4
On- and off-farm	37.5	12.3	24.3	24.1	29.7	25.3
On-farm, off-farm or wage labor employment	88.8	52.3	51.2	66.0	62.6	65.3
On-farm IGAs only	36.9	32.6	18.5	31.7	22.1	29.7
Off-farm IGAs only	4.0	1.3	2.6	2.1	5.1	2.7
Wage labor employment only	0.6	0.7	1.0	0.7	1.0	0.7

17 On-farm IGAs include income sources from crop and livestock production. Off-farm IGAs encompass business activities, and wage labor employment refers to income sources for households when their members are engaged in regular or temporary employment and earn income.

Table 43. Percentage of households engaged in on-farm IGAs during the previous 12 months

On-farm IGAs	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
Total	**84.1**	**50.3**	**45.5**	**62.5**	**55.9**	**61.2**
Vegetable production and sales	52.4	24.3	37.2	42.2	38.5	41.5
Fruit production and sales	42.8	32.2	36.5	39.6	33.9	38.6
Other high-value crop (pulses, spices, pepper, coffee, sugarcane, *chat*) production and sales	67.5	36.8	11.7	46.0	47.7	46.3
Dairy development	23.6	21.7	35.8	26.5	23.9	26.0
Poultry production	31.8	21.1	20.4	26.7	24.8	26.3
Shoat rearing/fattening	15.4	3.3	13.9	12.1	11.0	11.9
Cattle fattening	5.5	5.3	2.2	4.4	5.5	4.6
Beekeeping	1.4	.7	1.5	1.3	.9	1.2
Tree growing	.7	2.0	2.2	1.5	.9	1.4
Other	5.5	5.9	20.4	7.8	14.7	9.1

Table 44. Off-farm IGA households engaged in the last 12 months

Off-farm IGAs families engaged in	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
Total	**41.5**	**13.6**	**28.9**	**26.9**	**35.4**	**28.6**
Petty trading/mini-shop	61.1%	65.9%	56.3%	59.1%	63.8%	60.3%
Hand crafts, e.g., weaving, carpentry, metal work, pottery	63.9%	22.0%	32.2%	47.8%	46.4%	47.4%
Local drink sales	17.4%	2.4%	8.0%	11.8%	13.0%	12.1%
Other	7.6%	17.1%	25.3%	15.3%	13.0%	14.7%

4.8.2.2 Changes in income

Overall, 53% of respondents reported diversifying their income sources during the last three years (Figure 21), with income diversification more evident in MHHs compared to FHHs.

Overall, 50% of households reported an increase in their income over the last three years, but with wide variation between woredas (Figure 22: Deder (76%), Dire Dawa (29%) and Zeway Dugda (34%). Fifty-six percent of FHHs experienced no change in their income, relative to 42% of MHHs.

The most frequently mentioned reasons for changing incomes were the use of NRM practices on farms and communal lands (76%), as well as agricultural support and agro-enterprise development (62%) (Table 45). Multiple uses of water (29%), access to saving and credit services (24%), and engagement in IGAs (14%) were also mentioned.

Climate-related and other shocks were the main reasons for households not acquiring more income or acquiring less income across the three woredas, for both MHHs and FHHs. Drought was the most commonly cited reason (66%) for static or declining income (Table 46). Other reasons were variable between woredas.

Figure 21. Percentage of households reporting diversified income sources over the past three years.

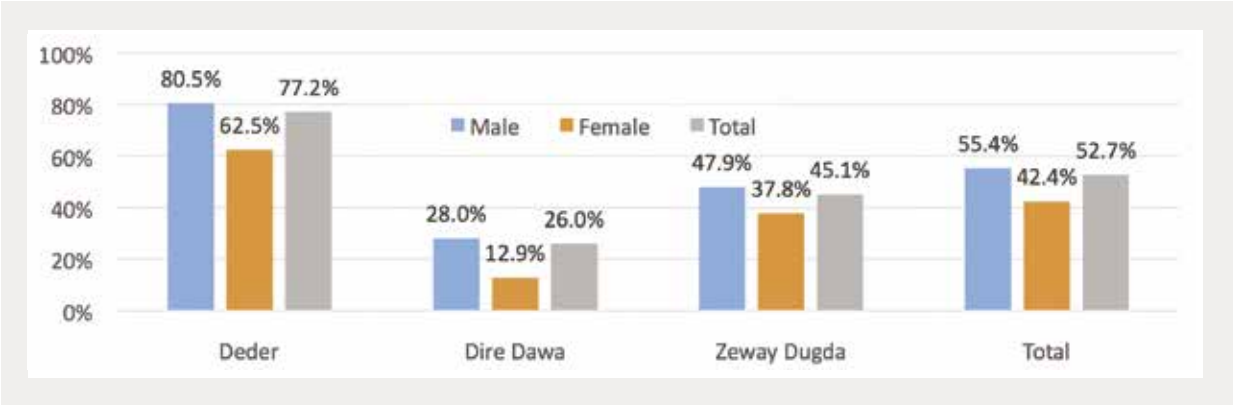


Figure 22. Changes in household income in the last three years by percentage of households.

	Deder			Dire Dawa			Zeway Dugda			Total		
	Increase	No change	Decrease	Increase	No change	Decrease	Increase	No change	Decrease	Increase	No change	Decrease
Male	79	19	1	32	58	10	34	58	8	52	42	6
Female	61	39		13	71	17	34	65	1	41	56	3
Total	76	23	1	29	60	11	34	60	6	50	45	5

Table 45. Percentage of households by reasons for increase in income

Reason for changing income	Deder	Dire Dawa	Zeway Dugda	Total		
				Male	Female	Both
Natural resources management practices	92.7	78.3	29.5	78.9	66.7	76.1
Agricultural support and agro-enterprise development	66.5	23.3	74.7	22.8	33.3	62.2
Multiple uses of water (irrigation and livestock)	38.1	11.7	13.7	12.3	0.0	28.7
Access to saving and credit services	30.8	3.3	17.9	3.5	0.0	23.9
Income-generation activities	16.9	11.7	6.3	10.5	33.3	13.7
Other	.8	1.7	1.1	1.8	0.0	1.0

Table 46. Percentage of households by reasons for decrease or no change in income

Reasons	Deder	Dire Dawa	Zeway Dugda	Male	Female	Total
Climate and other related shocks						
Drought	79.5	66.2	59.6	65.4	67.7	65.9
Flood hazard	18.1	16.5	27.3	22.2	20.2	21.7
Crop pests or diseases	14.5	12.9	16.4	16.0	11.1	14.8
Livestock disease	6.0	10.8	18.6	14.4	10.1	13.3
Shortages of services and agricultural input supplies						
Shortage of access to financial services	2.4	31.7	32.8	26.5	25.3	26.2
Shortage of agricultural inputs	2.4	36.0	19.1	23.2	16.2	21.5
Poor extension services	3.6	27.3	6.6	14.7	8.1	13.1
Market failures						
Livestock market failure	3.6	8.6	7.7	6.9	8.1	7.2
Crop market failure	8.4	2.2	7.7	5.2	8.1	5.9
Other, including land degradation and increase in family size	4.8	2.1	8.2	5.9	4	5.4

4.9 Approach to IWM in the watersheds

Before describing the approach to IWM that was being used in the baseline study woredas and some of the perceived gaps, background information is provided on the history of IWM in Ethiopia (section 4.9.1), and relevant policies, programs and government guidelines (section 4.9.2).

4.9.1 The genesis of IWM in Ethiopia

Watershed development planning started in Ethiopia in the 1980s. Initially, the purpose was mostly to implement natural resources conservation and development programs. However, the results were not satisfactory mainly due to: lack of effective community participation; limited sense of responsibility for the assets created; and the planning units being too large (up to 40,000 ha) and unmanageable. Learning from these experiences, the "minimum planning" approach and bottom-up community-based planning approach were piloted from 1988 to 1991, and afterwards, the Ministry of Agriculture (MoA), with the support of the World Food Programme, developed the Local Level Participatory Planning Approach (LLPPA). LLPPA focused on NRM, productivity intensification measures, and small-scale community infrastructure such as water ponds and feeder roads.

Around the same time, a Participatory Land Use-Planning (PLUP) approach was introduced that aimed to mainstream a participatory element into land use planning and NRM. Under the PLUP were biological and physical SWC measures, crops and farming practices, and area closure sharing arrangements and user rights. These activities were piloted in different parts of the country by different NGOs and bilateral agencies in the 1990s. In addition, a project named "AMAREW" was piloted in two woredas of Amhara Region and promoted micro-enterprise development, agricultural research and extension, and group formation and organization for watershed development and management. The lesson was that the watershed-focused approach could ensure site-specific application of suitable interventions and active participation of the community.

Based on the lessons and experiences from these different approaches and others, the MoA with the support of its partners developed the **Community-Based Participatory Watershed Development** Guideline (CBPWDG) in 2005, almost 15 years after the LLPPA. The CBPWDG provided a common and standardized approach to be used country-wide (Desta, et al., 2005).

The Guideline recommends the establishment of watershed teams at woreda, kebele and community levels with specifications on membership and detailed steps on how to plan (including conception of ideas), design, implement and monitor community watershed development activities. These steps and guiding principles are summarized in Boxes 5 and 6.

Box 5: Steps in CBPWDG (source: Lakew, et al., 2005)

Step 1. Getting started at woreda level: prioritization and selection of watersheds, which among others involves:

- Forming and organizing woreda-level watershed team;
- Identification of major watershed and critical watershed units;
- Identification of community watersheds within broader units;
- Selection and priority setting of community watersheds with respect to resources;
- Identification and organization of DAs' tasks (including equipment, materials, training needs and the like);
- First visit at community level.

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Step 2. Getting started at community level, which involves forming and organizing community-level watershed planning teams (through the general assembly) and agreeing on timing for planning work and main tasks.

Step 3. Biophysical and socio-economic survey.

Step 4. Identification and prioritization of interventions that bring change.

Step 5. Getting the options and interventions discussed and approved by the General Assembly.

Step 6. Development map, inputs and action plan.

Step 7. Implementation strategies.

Step 8. Participatory monitoring and evaluation.

Box 6: Major principles of CBPWD (source: Lakew, et al., 2005)

1. Watershed logic and potential respected—adoption of ridge to valley approach.
2. Participatory—watershed communities need to be involved in all stages.
3. Gender sensitive—Women's involvement in all stages is the key to ensure that they equally benefit from the various measures.
4. Building upon local experience, strength and what works—local knowledge is essential.
5. Realistic, integrated, productive and manageable.
6. Integrated conservation and development of the natural resources base with the optimum use of social resources—watershed development activities should provide tangible and quick benefits to households.
7. Flexibility—in selection of community watersheds, watershed size, steps of the procedures, the choice and design of measures and the like.
8. Cost-sharing and empowerment/ownership building.
9. Complementary to food security and rural development mainstream (including HIV/AIDs, health and education, and others)—to the extent possible, watershed development planning will incorporate additional elements related to basic services and social infrastructure.

4.9.2 Policy/program framework for IWM in Ethiopia

According to FAO, IWM is a holistic area-based planning process that extends the government's policy on sustainable NRM and development activities (Achouri, et al., 2005). This means that in Ethiopia, some policies that are related to sustainable NRM and development are relevant to IWM.

The most relevant policies/programs to IWM are summarized below.

Growth and Transformation Plan II (GTP II): The plan emphasizes the importance of improving natural resources conservation and utilization (rural land administration, watershed management and

expansion of small-scale irrigation), and of undertaking crop and horticulture development with adequate moisture. Accordingly, with respect to watershed management GTP II aimed to (i) increase the number of community watersheds with a development plan; (ii) increase the area of land rehabilitated through area closure; (iii) increase the area of watersheds supported with physical soil and water conservation structures; (iv) create jobs for citizens through development works in watershed management; (v) enhance climate-resilient agricultural development on watersheds that have been previously covered by physical and biological soil and water conservation structures, and rehabilitated through area closure; and (vi) measure the amount of carbon accumulated annually to determine the change brought about as a result of improving reforestation programs.

Ethiopia's Climate-Resilient Green Economy (CRGE): CRGE considers the introduction of lower-emitting techniques, such as conservation agriculture (including applying zero or minimum tillage), watershed management, and soil nutrient and crop management, to contribute to reduced emissions. CRGE also aims to enhance the introduction of low-emission techniques in agriculture and sustainable land management practices to reduce emissions while maintaining production levels. These techniques include agronomic soil practices to increase carbon storage, optimal nutrient management to improve nitrogen use efficiency, effective tillage and residue management practices, terracing and other water-harvesting techniques, and agro-forestry practices to prevent soil erosion and degradation. CRGE planned massive community-based soil conservation activities on watershed development and natural resources management through different interventions. Watershed-based integrated farming systems that combine the production of livestock and food crops on land that also grows trees for timber, firewood or other tree products are planned in the CRGE to increase the standing stock of carbon above ground relative to equivalent land use without trees. Examples of practices of this type include shelterbelts, introduction of high-value tree crops such as fruit trees, agri-silvopasture practices like growing fodder trees within crop fields as a source of livestock feed, live fences and multi-story crop production (FDRE, 2011).

Productive Safety Net Programme (PSNP): The public works component of the program focuses on integrated community-based watershed development, covering activities such as SWC measures, and the development of community assets such as roads, water infrastructure, schools and clinics. These works are viewed as contributing to improved livelihoods (through increased availability of natural resources, including water and cultivatable land, soil fertility, increased agricultural production and improved market access), strengthened disaster risk management and climate resilience, and nutrition (MoA, 2014).

Moreover, the PSNP IV Program Implementation Manual (PIM) (MoA, 2014) states that public works plans are prepared based on sub-projects selected through the watershed-based community development planning process specified in CBPWDG. It also states that prior to the community planning process, work will have to take place at woreda level to define the major watersheds and the critical watershed units. These watershed units may still encompass several kebeles or communities and will therefore need to be further defined into community-based sub-watersheds. It is these community-based sub-watersheds (or community watersheds) that form the basis for planning, in order to have integrated management of watersheds (rather than a piecemeal selection of sub-projects). In this regard, CBPWDG plans are multi-year plans while public works plans are annual plans that are prepared based on the CBPWDG.

4.9.3 Existing IWM approach and practices in the study watersheds

4.9.3.1 Woreda and kebele watershed teams

Woreda and kebele key informants confirmed a woreda watershed team (WWT)[18] is formed from the different government sectors including agriculture, health, education, water, rural roads, and women's and youths' affairs. Kebele watershed technical teams (KWTs) were also established and were operational in all kebeles covered by the qualitative research. The KWT members are the

18 The CBPWDG refers to this as "watershed teams" not "technical teams." The key informants use the latter term.

HEWs, DAs, kebele chairpersons, school principal (if available), and women and youth representatives from different villages in the kebeles.[19] The composition of the KWTs is almost the same as kebele food security task force (KFSTF); the name of the group changes depending on the purpose for which it is assembled.

The WWT is led by the natural resources management team leader in the Woreda Office of Agriculture while the kebele chairperson leads the KWT. In Dire Dawa, KWT members from the community side join the KWT following the selection of kebele leaders, not through community elections. As a result, when the kebele chairperson changes so do the community members of the KWT.

The WWTs and KWTs jointly prioritize and identify community watersheds for intervention. The two entities also facilitate the formation of community watershed committees (CWCs) at community watershed level, from community members elected by the residents. At a minimum, the members of the CWC are influential men, women and youths from the different villages in the watershed.

4.9.3.2 IWM planning

Each year KWT members together with CWCs hold public meetings and prepare participatory watershed plans as public works plans to be implemented by PSNP and free community labor contribution. The KWT brings the different watershed plans or public works plans together and incorporates them into the kebele annual development plan. The WWT provides technical support to KWTs and CWCs in this process.

The kebele annual plans include prioritized community needs as presented by the community/village representatives. The planning is guided by indicative plans provided to the kebele by the woreda. Once the kebele annual development plan is reviewed and approved by the kebele council, it is sent to the woreda. The plans from different kebeles are again reviewed and compiled by the WWT for further review and approval by woreda cabinet and finally, the woreda council.

Often, the kebele-level annual development plans are confused with the IWM plan. The kebele plans are annual plans prepared by adjusting and summing up the community/village plans based on indicative plans from the woreda. In contrast, IWM plans are multi-year, integrated development plans that should have a base map, development map, list of activities to be performed, resource and budget table, and a clear action plan. However, such full-fledged IWM plans were rarely available. The main reasons mentioned for this were lack of manpower to prepare detailed plans, high staff turnover and lack of capacity of new staff, loss of plan documents due to staff turnover and lack of attention given to planning following watershed principles.

Approved kebele plans are implemented in prioritized watersheds. Normally, plans of different programs (like PSNP, mass mobilization and others) are implemented in distinct sites/watersheds. Watershed selection for PSNP public works interventions considers the maximum distance (5 km) specified for public works clients to travel to reach work sites. This may require having more than one PSNP watershed per kebele. For example, in 38 PSNP kebeles of Dire Dawa, there are 45 watersheds being treated by CRS/HCS as part of PSNP.

4.9.3.3 IWM implementation

In the implementation of IWM, the approach is to complete the treatment of prioritized watersheds before moving on to other watersheds. However, programs often move to other watersheds before completing activities in the prioritized watersheds. This happened when there were complaints from communities in non-priority watersheds and when unexpected natural hazards like floods occurred in non-priority watersheds. Changes in kebele leadership and associated re-prioritization of watersheds were also mentioned in Dire Dawa and Deder as reasons for shifting to non-priority watersheds.

With regards to implementing organizations, key informants from government and CRS implementing partners indicated that kebele administrations,

19 For administrative and developmental purposes, the kebeles are further divided into sub-kebeles or villages known as *ganda* in Oromia and *gott* or *kushet* in other regions.

watershed committees, irrigation user associations/ irrigation committees, water, sanitation and hygiene committees (WASHCOs), village sanitation and hygiene groups (VSHGs), and saving groups are relevant community institutions that might assist in the planning and implementation of IWM. However, findings from KIIs indicated that these actors are not vibrant enough and lack the capacity to effectively engage in IWM. For instance, according to Deder Woreda Office of Agriculture (WOoA), CWCs are active only when there are frequent follow-ups from WWTs and KWTs. Given the large number of watersheds in the woreda, and capacity gaps and member turnover in the WWT and KWTs, strong technical support and follow-up were not available to make the CWCs fully operational. According to key informants from the CRS implementing partner in Dire Dawa, despite enormous past efforts to build the capacity of government and communities in IWM, much still has to be done with regard to adherence to the CBPWDG approach as there is continuous turnover of staff and community representatives.

4.9.3.4 CRS-DFSA support to IWM

Key informant interviews with offices of agriculture and CRS implementing partners in the three woredas indicated that CRS-DFSA is supporting the planning and implementation of government "watershed development plans" using the CBPWDG. This support is in the form of training, supervision, technical assistance and finance to local government institutions, and facilitating regular joint monitoring missions. The support contributes to a relatively better quality of work in CRS-DFSA project-assisted sites compared to other sites.

In addition, woreda officials also reported that in CRS operational areas NRM measures are balanced by biological and physical works. In other cases, such as public labor mobilization, the NRM interventions are dominated by physical works; this is less effective and unsustainable in serving their purposes. For instance, physical treatment of gullies without grass or tree plantation does not stabilize the gullies and can even lead to aggravated erosion.

The KIIs also indicated that there are gaps in the implementation of the CBPWDG. The major gaps identified were:

- Proper watershed delineation based on hydrological boundaries and unique outlet points is missing, and often, a watershed is misunderstood as a NRM implementation site. Watershed management is broadly seen as NRM;
- Lack of proper planning as per the steps listed in the CBPWDG (see Box 5), which resulted in a lack of documented and detailed multi-year watershed plans that are prepared by a multidisciplinary team together with the community;
- Lack of integration among actors and measures at the watershed, farm plot and household levels, leading to limited complementarity of efforts and measures;
- Despite the continuous capacity-building support from different projects, capacity limitations remain, mainly due to high staff turnover and loss of trained and experienced staff in the WOoA and woreda administration;
- Low capacity and functionality of community institutions like KWTs, irrigation users' associations/irrigation committees, WASHCOs, VSHGs and saving groups;
- Frequent change of KWT members and loss of trained, experienced persons from woredas. This happens when the kebele leadership changes and they re-craft the lower community-level structure;
- Specifically in Dire Dawa, KWT members from the community demanded incentives for their work with the team and the travel involved. Neither the DFSA or the GoE system allows incentives to be paid.

Chapter 5: Discussion and Recommendations

5.1 The food security context and implications for IWM and NRM

The most important finding of the baseline study was the high level of food insecurity in the three woredas:

- When a 12-month recall period was used, moderate or severe food insecurity was reported by 87.9% of households in Zeway Dugda, 75% of households in Deder and 72.6% of households in Dire Dawa; across the three woredas, moderate or severe food insecurity affected 83.2% of FHHs and 77.2% of MHHs (Table 37).

- The data collection took place during harvest time when food security is typically better. When a 30-day recall period was used, moderate or severe food insecurity was reported by 44.8% of households in Zeway Dugda, 68.8% of households in Deder and 59.6% of households in Dire Dawa; across the three woredas, moderate or severe food insecurity affected 56.2% of FHHs and 57.6% of MHHs (Table 36).

- When food security was measured in terms of the number of months per year when households had adequate food, the findings were 8.2 months in Dire Dawa, 6 months in Deder and 4.9 months in Zeway Dugda (Table 38). FHHs had consistently fewer months with adequate food: 5.8 months in Dire Dawa, 5.6 months in Deder and 4.7 months in Zeway Dugda compared to 8.6 months, 6.1 months and 4.9 months in MHHs respectively.

Livelihoods in the three woredas are typically characterized as rural and agricultural. However, areas of cultivated land per household were low and ranged from only 0.39 ha in Deder to 0.89 ha in Zeway Dugda (Table 21). Notably, although 84.1% of households in Deder reported income from on-farm activities, only 50.3% of households in Dire Dawa and 45.5% of households in Zeway Dugda reported on-farm income (Table 43). In other words, about 50% of households reported no on-farm income in Dire Dawa and Zeway Dugda, compared to 98% and 63.1% of households that accessed land for cultivation (Table 21).

These findings indicate that in a substantial number of households, all own-produced crops are consumed, not sold. However, as the food security findings show, own production is not sufficient to meet needs. Limited on-farm income and insufficient own production means that households must try to fill income and food gaps from off-farm sources and that any off-farm income will be first used to buy food. This is verified in Table 41 in which food purchases are the main expense over 12 months in all three woredas. Given this situation, households have minimal cash to invest in farm development; only 2.4% of expenditure was used to buy farm inputs/technology (Table 41).

Recognizing that GoE and PSNP have a major influence on IWM and NRM investments, the findings have at least two direct implications for IWM and related strategies for NRM. First, many households are unlikely to invest in or maintain inputs, structures or facilities that require them to spend cash because they have insufficient income. Second, even though public works are conducted in off-season months, households will assess whether other activities produce better or quicker returns and will manage their time and effort accordingly. The baseline results indicate the access to land is lower for FHHs and youths. It is also likely that in a context of high levels of food insecurity (Tables 36–38) and insufficient diet (Table 39), the capacity of households to conduct physical work will be hindered, and labor will be directed towards prioritized tasks.

In part, these findings help to explain the findings on NRM practices in the three woredas. Although people widely recognized and used NRM activities, the maintenance and management of physical structures was highly variable, e.g., Table 9, and in general, structures and practices on communal land

were less well maintained and managed, e.g., Table 11. At the same time, the detailed biophysical analysis in section 4.2.1 clearly shows the need to protect and develop land for cultivation and for livestock grazing and browsing, with some watersheds showing alarming levels of soil loss erosion.

5.2 Strengthening the IWM approach

The study was a baseline study and not an evaluation of IWM. However, section 4.9.3 provides information on the reported challenges facing IWM implementation such as the capacity of government and community-level actors, weak planning processes, and issues around the delineation of watersheds.

IWM enables development interventions to be planned, implemented, monitored and evaluated in an integrated way within the natural boundary of a drainage area, and to support the sustainable development of land, water and vegetation resources to meet people's needs.[20] However, the baseline study and previous reports (CRS, 2017; Hebert, et al., 2010) noted that although the GoE IWM guideline is used, the planning and implementation of IWM did not follow draining areas (watershed boundaries) as a basic principle. This general issue has to be addressed if IWM is to be used effectively, along with the correct use of the GoE CBPWDG.

On the basis of biophysical analysis, watershed management plans have to incorporate measures that deal with the three soil loss factors (slope length gradient factor (LS), land cover (C) factor and support practice factor (P)) out of the five in the soil loss equation that are issues of land management. The other two factors, i.e., erosivity and erodibility, are largely determined by natural factors and not influenced by human interventions through IWM.

The following recommendations draw on these findings:

- Assessing the impact of IWM should include objective biophysical measures and monitoring of land use. The use of remote sensing technology and maps such as those presented in section 4.2.1 should be normalized to ensure relevant watershed delineation, assist planning and measure IWM impacts. For impact evaluation, biophysical and land use changes need to be combined with changes in livelihoods and food security at household level, with appropriate analysis of the attribution of IWM.

- CRS-DFSA should continue supporting woredas and kebeles in the implementation of the GoE CBPWDG in its operational areas. In doing so, it has to address gaps in the implementation of the CBPWDG.

- As indicated in the CBPWDG, the IWM process should start with identification and prioritization of hydrologically defined major and critical watersheds. Then, community watersheds—the smallest planning and implementation units—need to be identified and prioritized for IWM planning and implementation.

- Using participatory processes and steps (Box 5) and adhering to the basic IWM principles (Box 6), prepare and archive comprehensive multi-year community watershed development plans, and align with other community plans. The plans should contain a base map, development map, activity and budget plan, and a clear action plan with implementation modalities.

- Given the high human resource requirement, it may not be practically possible to prepare full-fledged watershed plans for every watershed in the operational areas. Therefore it is suggested that jointly with WOoA, two to three model watersheds per year are selected in a few kebeles per woreda to strictly apply the CBPWDG. In all these processes, WWT, KWT and kebele watershed committees are supposed to be the drivers of this initiative at their levels.

- Propagate the lessons from model watersheds to other non-model watersheds and the woreda and kebele officials, WWTs, KWTs and community leaders through providing cross-visits and audio-visual displays. In this way, expand the

20 **https://wle.cgiar.org/glossary/integrated-watershed-management** (accessed August 9, 2020).

number of model watersheds annually both in CRS and other programs' operational areas. WWT can play a great role in this regard.

- The model watershed approach has to be implemented while continuing to work in every PSNP kebele with the current modality. Woreda capacity development is needed in applying the IWM processes and principles as stated in CBPWDG, and to use technologies such as GIS. Advanced technical analysis such as use of remote sensing can be done by CRS Ethiopia and implementing partner (IP) staff, but with capacitating woreda staff at the same time.

- Work together with WWTs to ensure community representatives in KWTs are elected by and accountable to the community, not the kebele or woreda officials; this should include representatives who are women, youths and persons with disabilities (PWD). This will help to have more stable and capable community institutions, and sustainable IWM outcomes.

- Promote and strengthen diverse community institutions that can support and handle IWM. This includes watershed committees, irrigation user associations/irrigation committees, WASHCOs, self-help groups (SHGs), saving groups and others. This will expand the opportunities for watershed users to participate in IWM in one or another community institution.

5.3 Issues for further investigation

The baseline study findings indicated various issues that require further investigation and that are relevant to CRS-DFSA programming. These issues are suitable for rapid qualitative inquiries and should be designed with the general food security context (section 5.1) in mind.

- **PSNP impacts on food security**

The high levels of food insecurity described in the report coincided with the long-term presence of the PSNP in the three woredas. As the PSNP has been operational since 2005, CRS should review impact evaluations of the PSNP and studies on PSNP graduation, and continue its dialogue with GoE on the higher-level PSNP strategies and expected impacts.

- **NRM practices and cereal productivity**

The baseline study indicated a direct link between the use of SWC measures and cereal crop productivity, but only when SWC was used on more than 50% of the land cultivated (Figure 15). There is a need to better understand farmers' decision-making on the use of SWC and the barriers to ensuring that SWC is applied with sufficient coverage. In contrast, SFM was not associated with improved productivity (Figure 16). There is a need to examine how SFM is used by farmers and determine the reasons for the limited impact on productivity. This further research should take account of the very low productivity for all cereals in the three woredas relative to national averages (Table 24).

Related to NRM practices was the issue of the mixed long-term maintenance and management of NRM-related structures (e.g., Table 9 and 11). Further research is needed to understand the reasons behind limited or no maintenance of structures in some communities.

- **Income generation for women and youths**

While achieving food security through farming alone was difficult in the three woredas, it was especially difficult for FHHs. Compared to 18% of MHHs, 33% of FHHs were landless and so did not directly benefit from the numerous on-farm IGAs listed in Table 43 and were restricted to off-farm IGAs (Table 44). There is a need to better understand women's preferences for IGAs, including wage employment, and how IGAs can be balanced with women's other roles, e.g., childcare.

The study noted the opportunity for landless households, women and youths to benefit from area closures for activities such as forage production and apiculture. The feasibility of using these approaches more widely should be assessed, along with options for savings and micro-credit schemes. The assessment should involve consultation with women and youths.

- **Climate information**

Timely and accurate information on weather for farmers, especially rainfall, is an important aspect of IWM and assists farm management in normal years as well as in the frequent drought years (Table 34). However, as few as 30% of households reported

having access to weather information (in Dire Dawa), and there was wide variation in the use of DAs and kebele DRR/EW committees as sources of weather information (Table 34). There is a need to understand how farmers use weather information, their preferences for sources and types of weather information, and how these preferences can be best addressed. This work should also assess the reliability and timeliness of climate information, and whether climate information is linked to agricultural extension and recommendations.

- **Livestock**

Livestock has multiple uses in the three woredas. They are a key financial asset and form of saving, which grows as livestock reproduce, and which can be converted to cash to meet predicted domestic needs or during shocks such as drought; they provide products such as milk and eggs with high market and nutritional value, as well as manure; oxen can be used for ploughing and donkeys for transport; livestock form the basis for many social transactions and are often integral to traditional social support systems. Although the study reported the better production of improved breeds of livestock, improved breeds require more inputs such as feed and veterinary care, which in turn require cash. These breeds are also more expensive, and more easily lost due to disease or drought. In contrast, research in Ethiopia shows that local breeds are hardy and adaptable, and production in these breeds can be dramatically improved through relatively minor improvements in feed. This points to the need to review feeding practices against production levels, and review the affordability, quality and availability of livestock feed, and farmers' preferences.

- **Sanitation**

Despite many years of WASH programs, as few as 0.3% of households (in Zeway Dugda) used improved pit latrines with a slab, and between 23% and 53% of households practiced open defecation, depending on woreda (Table 19). Research or reviews are needed to understand the limited toilet facilities in these rural areas and the feasibility of producing and supplying latrine covers, e.g., through organized youth groups as an IGA. Community-level barriers to adopting covered toilets also need to be understood, including the costs at community or household levels.

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Annexes

Annex 1: Terms of Reference for the research

Research Title: Quantitative Research on Integrated Watershed Management (IWM)

Background

The Feinstein International Center (FIC) at Tufts University is providing research support to Catholic Relief Services (CRS) Ethiopia Development Food Security Activity (DFSA). The research support will contribute to CRS/DFSA's aim of:

- Reaching 240,625 Productive Safety Net Program (PSNP) IV beneficiaries of which 60,000 are expected to graduate.

- Improving the quality and timeliness of data for better decision-making and sharing with communities, local government, donors and other PSNP IV stakeholders.

It is widely acknowledged that IWM and NRM interventions in Ethiopia are almost unparalleled globally. Presently, these modalities are promoted within the GoE PSNP program and the CRS Ethiopia has a long history with local partners of implementing these activities.

CRS began its IWM Program in 2001 to address the problem of pervasive food insecurity and degraded livelihoods in rural communities in Ethiopia. CRS and its partners adopted a watershed approach as the primary focus for project interventions and worked directly with communities and the government as partners in protecting and managing the natural resources, and they provide a range of interventions to improve food security and livelihoods of target communities.

The objectives of the IWM program in the CRS Ethiopia are to:

1. Improve cash and food crop production, leading to food security;

2. Improve soil and water conservation, soil fertility and land management with the use of appropriate biological and physical measures and agricultural inputs;

3. Improve water supply for domestic, livestock and irrigation purposes (multiple use of water – MUS);

4. Increase household income through diversification of agricultural and non-agricultural activities;

5. Empower communities to develop their resources in a sustainable manner through education, training and strategic linkages to government and non-government agencies; and

6. Address other priority needs of the community through integrating relevant sectors such as community-based health education, hygiene and sanitation, savings, and also to increase the status of women and girls within target communities.

The major component of the program are (i) Natural Resource Management (ii) Agricultural Support and Agro-enterprise Development (iii) Multiple Uses of Water (irrigation, domestic water supply – human and livestock use) (iv) Sanitation, Hygiene and Health Education and disease prevention (v) SILC (Savings and Internal Lending Communities) and income generation activities and (vi) Cross-cutting: Gender and

Partnership Arrangements. The planned research builds on these and similar works.

Objectives of the research:

The overall purpose is to establish baseline values for indicators on climate change adaptation, resilience and livelihood gains from the future IWM program implementation.

Specific objectives of the study are to:

1. Establish socio-economic and biophysical baseline values on IWM indicators

2. Suggest strategies, approaches and metrics to improve and strengthen interventions (suggest IWM implementation model)

The study areas

CRS/DFSA is implemented in 9 woredas of Oromia Regional State.

- The survey will be carried out in 3 woredas (purposely selected using specific criteria).
- Questionnaire survey for 300 HHs/woreda; total 900 HHs (randomly selected).
- FGDs 10/woreda total 30 FGDs (disaggregated by male/female/wealth group).

The research is expected to establish a baseline value for indicators exhibiting the link between watershed management interventions and improvements in household livelihoods in CRS operational areas.

Research questions and methods of data collection: From existing body of knowledge:

1. What is the most appropriate conceptual framework for CRS in the implementation IWM interventions?

2. What is the status and management practices of natural resources (soil, water and vegetation) and their contributions to household livelihoods improvement?

3. What is the status of household food and nutritional security?

4. What is household income size and source diversification (of agricultural and non-agricultural activities)?

5. What are the levels of agricultural production and productivity?

6. How are watershed resources and services shared among different socio-economic groups (gender, wealth & age groups)?

7. How are the decision making roles of different socio-economic groups (gender, wealth & age groups) in watershed resources and services development and utilization?

8. How is the coverage and access to social services (health, education, WASH, road, FTC)?

9. What are the existing local institutions and their capacity to sustainably support of IWM interventions?

Proposed methods

The data collection methods are:

- Critical local and global literature review and analysis
- Household questionnaire
- Focus group discussions
- Key informant interviews to generate perceptions and insights (e.g. on targeting issues) from opinion leaders in government, non-government and communities.
- Observation (e.g. government & non-government interventions)
- Validation workshop

Deliverables:

1. Inception report: charting how the research team plans to operationalize the research. It is particularly expected that inception report elaborates on (i) the conceptual framework making clear distinction between evaluation and research (ii) data collection tool – a well-structured household survey questionnaire and checklist for conducting FGDs; (iii) data analysis tool/software and (iv) capacity within the team for data collection and analysis including operating the tool/ software.
2. Draft findings/report
3. Presentation at validation workshop
4. Revised findings/report incorporating the input from the workshop

5 Final report

Annex 2: Household survey questionnaire

Consent Form

Good morning/afternoon! My name is_____, and I am working for Dadimos Development Consultants Plc. to study the CRS-DFSA project. We are conducting a survey to understand the current situation of the area in relation to the DFSA/IWM project. You are being asked to participate in this survey because of your important role as a participant/beneficiary of the project or resident of the project area. I will ask you a series of questions that would take about 45 minutes. Your name and responses will remain confidential and be analyzed together with the responses of others, solely for the purpose of this study. We expect you to answer all questions truthfully. It is your choice whether or not to take part in this interview and if you choose to participate, you have the right not to answer any question or to stop the interview at any time. If you don't choose to participate, it will in no way impact your relationship with the project. Before we begin, do you want to ask me any questions about the survey? Shall I continue in asking you each question?

Please note that all the calendars are in Ethiopia.

Note: in this survey both the husband and wife of the HH are respondents and questions related to benefits towards empowering women and girls (Module J) have to be answered by women or girls:

Thank you

Sample verification

Do you live in or depend on this watershed for your livelihood?

1) Yes 0) No

-If **yes**, proceed to Module A

-If **No**, thank the person, and terminate the interview here

Module A- Identification

S/N	Variables	Name	Code
A1	Name and code of the woreda		
A2	Name and code of the Kebele/s		
A3	Name and code of watershed		
A4	Name and code of the Supervisor		
A5	Name and code for the Enumerator		
A6	Code of Household		
A7	Geographical coordinates of the household residence	Longitude (X)	
		Latitude (Y)	
		Altitude (Z)	

Module B: Household roster

LINE #	PERSON'S NAME	RELATIONSHIP TO HEAD	SEX	AGE		What is the marital status for age≥15	EDUCATION For age≥5	
		Relationship of <NAME> to head of household	Sex of <NAME> 1=Male 2=Female	Age of <NAME> in **years** if ≥ 5 years	Age of <NAME> in **months** if < 5 years (59.99 months)		Literate 0=No; 1=Yes	Highest grade level completed
(B1)	(B2)	(B3)	(B4)	(B5)	(B6)	(B8)	(B9)	(B10)
01		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
02		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
03		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
04		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
05		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
06		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
07		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
08		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
09		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
10		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
11		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
12		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
13		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
14		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
15		☐☐	☐	☐☐	☐☐	☐	☐	☐☐
16		☐☐	☐	☐☐	☐☐	☐	☐	☐☐

Relationship to Head

01. Head of household
02. 1st wife
03. 2nd, or 3rd .... wife
04. son or daughter
05. son/daughter in law
06. grandson/daughter
07. mother or father of 01/02/03
08. father/mother in law of 01/02/03
09. brother or sister of 01/02/03
10. other relatives
11. adopted child, custody
12. no relationship
13. stays here

98= don't know

Marital Status

1. Married
2. Single
3. Divorced or separated
4. Widowed
6. No answer/not
7. Other (specify) applicable

Education

Enter # for highest grade completed

or

20 if only traditional, religious schooling completed or adult education

or

00 if no schooling completed (neither formal nor traditional/ religious schooling)

Module C- Household's PSNP status

S/N	Variables	Reponses
C1	Is your HH currently a PSNP client? *1) Yes 0) No.* ***If no go to C7***	
C2	Since when (write the year in Eth.Cal) are you targeted?	|_|_|_|_|
C3	How many members of the HH are currently targeted for PSNP 4 transfer (write number)?	
C4	What type of PSNP client is the HH ? *1) Temporary direct support 2) Public work*	
C5	Is your HH currently livelihood client? *1) Yes 0) No*	
C6	If yes, to C5, in which livelihood pathway are you participating? *1. Crop and livestock 2. Off-farm 3. Employment linkage* ***(Multiple responses are allowed!)***	
C7	If the HH is not currently targeted by PSNP, was it targeted in the previous years of PSNP *1)Yes 0) No,* ***(if the answer is yes go to D1)***	
C8	If yes to C7, why the HH is not currently targeted by PSNP? *1) Forced graduation 2) self graduation 3) other (specify).....*	

Module D- Natural resource management and infrastructures

1. Natural resource management (NRM)

1.1 NRM on communal lands

1.1.1 NRM activities implemented/ constructed on communal lands

D1	Which of the following natural resources conservation activities are implemented/ constructed on communal lands in your village or watershed? (These works can be done through PSNP, community free labour or by other agency)	
Type of activity	Constructed/implemented	
D1.1. SWC measures (physical & biological)	1= Yes	0=No
D1.2. Gullies and hillsides treated	1= Yes	0=No
D1.3. Plantations and fodder hedges	1= Yes	0=No
D1.4. Area closures	1= Yes	0=No
D1.5. Grass land management	1= Yes	0=No
D1.6. Community level water-harvesting /irrigation structures	1= Yes	0=No
D 1.7. Others (specify).....	1= Yes	0=No

1.1.2 Maintenance of NMRM activities implemented or constructed on communal lands

D2	Are these NRM activities on communal lands well maintained? This should be restricted to those chosen in D1				
Type of activity	Maintained very well	Maintained moderately	Maintained poorly	Not maintained at all	No need for maintenance
D2.1. SWC measures (physical, biological)					
D2.2. Gullies and hillsides treated					
D2.3. Plantations and fodder hedges					
D2.4. Area closures					
D2.5. Grass land management					
D2.6. Community level water-harvesting structures					
D 2.7. Others (specify).....					

1.1.3 Benefits from NRM activities on communal lands

D3	What benefits /harms is **your household getting** due to these NRM activities on communal lands?		Responses
D3.1	**SWC measures** (physical, biological): *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 4) prolonged/increased stream flow and spring discharge 5) increased wood & fodder production 6) increased crop productivity of own land 7) increased HH income 8) nothing; 9) other specify*	***What harms are caused?*** *10) reduced size of farm plot 11) reduced grazing plot 12) flood hazards 13) aggravated soil erosion 14) nothing 15) other specify*	
D3.2	**Gullies treated:** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased crop productivity of own land 6) increased HH income 7) convert waste land to productive land 8)nothing; 9) other specify*	***What harms are caused?*** *10) flood hazards 11) aggravated soil erosion 12) nothing 13) other specify*	
D3.3	**Plantations and fodder hedges:** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased crop productivity of own land 6) increased HH income 7) convert waste land to productive land 8) improved plant and wild animal diversity 9) nothing; 10) other specify*	***What harms are caused?*** *11) depleted water resource 12) introduced invasive plants 13) reduced grazing land 14) nothing 15) other specify*	
D3.4	**Area closures;** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased crop productivity of own land 6) increased HH income 7) obtained apiary sites & bee forages 8) convert waste land to productive land 9) improved plant and wild animal diversity 10) nothing 11) other specify*	***What harms are caused?*** *12) depleted water resource 13) introduced invasive plants 14) nothing 15) other specify*	
D3.5	**Grazing land management** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 6) increased HH income 7) improved plant and wild animal diversity 8) nothing 9) other specify*	***What harms are caused?*** *10) introduced invasive plants 11) nothing 12) Others specify*	
D3.6	**Other specify,....** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased crop productivity of own land 6) increased HH income 7) obtained apiary sites & bee forages 8) convert waste land to productive land 9) improved plant and wild animal diversity 10) nothing 11) other specify*	***What harms are caused?*** *12) depleted water resource 13) introduced invasive plants 14) nothing 15) Others specify*	

1.2 NRM on own lands

1.2.1 NRM activities implemented/ constructed on own lands& maintenance conditions

D4	Do you have (own or rented) **household** plot of land covered by soil & water conservation measures? 1) yes 0) no *(If no skip to question **D7**)* *(Note: The treatment can be through PSNP PWs, community free labor, other programs or by the household)*	
Type of soil and water conservation activity on the household plot of land		Area covered by the measure (timad/kindi)
D4.1 Farm land treated by SWC measures: (physical, biological)		|_|_|.|_|
D4.2 Plantations and fodder hedges		|_|_|.|_|
D4.3 Grass land management		|_|_|.|_|
D4.4 Soil fertility improvement technologies and practices:		
D4.4.1 Compost		|_|_|.|_|
D4.4.2 Manure		|_|_|.|_|
D4.4.3 Mulching		|_|_|.|_|
D4.4.4 Others (specify) _____		|_|_|.|_|
D4.4.5 Others (specify) _____		|_|_|.|_|
D4.4.6 Others (specify) _____		|_|_|.|_|
D4.5 Irrigation facilities or irrigable land owned by the HH (HH level water harvesting or communal irrigation facilities)		|_|_|.|_|
D4.6 Gully treatment		|_|_|.|_|
D4.7 other measures (specify) _____		|_|_|.|_|
D4.8 other measures (specify) _____		|_|_|.|_|
D4.9 other measures (specify) _____		|_|_|.|_|
D5	Are these NRM activities on own (or rented) lands well maintained/managed? This should be restricted to those chosen in D4. Chose from the following: 1)maintained very well 2) moderately maintained 3) poorly maintained 4)not maintained at all 5)no need of maintenance	
Type of soil and water conservation activity on the household plot of land		Response
D5.1 Farm land treated by SWC measures: (physical, biological)		
D5.2 Plantations and fodder hedges		
D5.3 Grass land management		
D5.4 Soil fertility improvement technologies and practices:		
D5.4.1 Compost		
D5.4.2 Manure		
D5.4.3 Mulching		
D5.4.4 Others (specify) _____		
D5.4.5 Others (specify) _____		
D5.4.6 Others (specify) _____		
D5.5 Irrigation facilities or Irrigable land owned by the HH (HH level water harvesting or communal irrigation facilities)		
D5.6 Gully treatment		
D5.7 other measures (specify) _____		
D5.8 other measures (specify) _____		
D5.9 other measures (specify) _____		

1.2.3 Benefits and harms from NRM activities on own lands

D6	What benefits/harms **is your household getting** due to these NRM activities on own (or rented) lands?		Responses
D6.1	**SWC measures** *(physical, biological) (multiple responses are allowed);*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) prolonged/increased stream flow and spring discharge 4) increased wood & fodder production 5) increased crop productivity of own land 6) increased HH income; 7) nothing; 8) other specify*	***What harms are caused?*** *9) reduced size of farm plot 10) reduced grazing plot 11) flood hazards 12) aggravated soil erosion 13) nothing 14) other specify*	
D6.2	**Gullies treated** *(multiple responses are allowed);*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased crop productivity of own land 6) increased HH income 7) convert waste land to productive land; 8) nothing; 9) other specify*	***What harms are caused?*** *10) flood hazards 11) aggravated soil erosion 12) nothing 13) other specify*	
D6.3	**Plantations and fodder hedges;** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased crop productivity of own land 6) increased HH income 7) convert waste land to productive land 8) improved plant and wild animal diversity; 9) nothing; 10) other specify*	***What harms are caused?*** *11) depleted water resource 12) introduced invasive plants 13) reduced grazing land 14) nothing 15) other specify*	
D6.4	**Area closures;** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased crop productivity of own land 6) increased HH income 7) obtained apiary sites & bee forages 8) convert waste land to productive land 9) improved plant and wild animal diversity; 10) nothing; 11) other specify*	***What harms are caused?*** *12) depleted water resource 13) introduced invasive plants 14) nothing 15) other specify*	
D6.5	**Grazing land management;** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased HH income 6) improved plant and wild animal diversity; 7) nothing; 8) other specify*	***What harms are caused?*** *9) introduced invasive plants 10) nothing 11) other specify*	
D6.6	**Other specify;** *(multiple responses are allowed)*		
	What are the benefits? *1) erosion protection 2) water infiltration 3) increased wood & fodder production 4) prolonged/increased stream flow and spring discharge 5) increased crop productivity of own land 6) increased HH income 7) obtained apiary sites & bee forages 8) convert waste land to productive land 9) improved plant and wild animal diversity; 10) nothing; 11) other specify*	***What harms are caused?*** *12) depleted water resource 13) introduced invasive plants 14) nothing 15) other specify*	

2. Access to Social Infrastructures & Services

2.1. Social infrastructures constructed and maintained, and services accessed

D7	Which of the following infrastructures are constructed/rehabilitated in your village or watershed? Do you have access to their services? *(Note: These works can be done through PSNP, community free labour or by other agency)*

1. Type of activity	2. Constructed/ implemented		3. If yes to 2 do you have access to the services?		4. Single trip walking distance in minuets
D7.1. Veterinary facilities	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D7.2 Clinic/health post	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D7.3 School	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D7.4 FTC	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D7.5 Road	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D7.6 Irrigation facilities	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D7.7 Area closure	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D.7.7 Others (specify).....	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D.7.8 Others (specify).....	1= Yes	0=No	1= Yes	0=No	|_|_|_|
D.7.9 Others (specify).....	1= Yes	0=No	1= Yes	0=No	|_|_|_|

2.2. Functionality of constructed/Rehabilitated infrastructures/facilities

D8	How is the current functionality status of these infrastructures? *Note: This should be restricted to the infrastructures chosen in D7*

Functionality of the infrastructure	Functioning very well	Functioning moderately well	Functioning poorly	Not functioning at all	Damaged
D8.1. Veterinary facilities					
D8.2 Clinic/health post					
D8.3 School					
D8.4 FTC					
D8.5 Road					
D8.6 Irrigation structures					
D8.7 Area closure					
D8.8 Others (specify).....					
D8.8 Others (specify).....					
D8.10 Others (specify).....					

2.3 Benefits from infrastructures/facilities constructed/rehabilitated

D9	What benefits /harms **is your household getting** due to these infrastructures constructed/maintained (This will be restricted to those chosen in D7)		Responses
D9.1	**Veterinary facilities** *(multiple responses are allowed)*		
	What are the benefits? *1) increased access to animal health services 2) increased uptake/ utilization of animal health services 3) improved animal health 4) other specify*	***What harms are caused?*** *5) reduced size of farm plot 6) reduced grazing plot 7) other specify*	
D9.2	**Clinic/health post** *(multiple responses are allowed)*		
	What are the benefits? *1) increased access to health services 2) increased uptake/utilization of health services 3) improved health 4) other specify*	***What harms are caused?*** *5) reduced size of farm plot 6) reduced grazing plot 7) other specify*	
D9.3	**School** *(multiple responses are allowed)*		
	What are the benefits? *1) increased access to education by children 2) other specify*	***What harms are caused?*** *3) reduced size of farm plot 4) reduced grazing plot 5) other specify*	
D9.4	**FTC/PTC;** *(multiple responses are allowed)*		
	What are the benefits? *1) increased access to extension services 2) increased uptake/ utilization of agricultural technologies 3) improved production and productivity 4) other specify*	***What harms are caused?*** *5) reduced size of farm plot 6) reduced grazing plot 7) other specify*	
D9.5	**Road;** *(multiple responses are allowed)*		
	What are the benefits? *1) increased access to the governance body 2) increased access to basic services 3) increased access to market 4) improved access to transport service 5) other specify*	***What harms are caused?*** *6) reduced size of farm plot 7) reduced grazing plot 8) soil erosion and deforestation 9) other specify*	
D9.6	**Irrigation structures** *(multiple responses are allowed)*		
	What are the benefits? *1. Increased agricultural production & productivity 2. Reduced risk of droughts 3. Enabled to produce high value crops 4. Other specify*	***What harms are caused?*** *5) reduced grazing plot 6) soil erosion and deforestation 7) caused conflict with neighbors 8) other specify*	
D9.7	**Area closure** *(multiple responses are allowed)*		
	What are the benefits? *1. Increased production productivity of cattle 2. Increased production productivity of shoats 3. Increased honey production*	***What harms are caused?*** *4. Reduced open grazing land 5. Other specify...*	

Module E: Agricultural production and productivity

Crop Production and Productivity

E1. Have you grown crop/crops on your own land (using owned or rented land) or through share cropping arrangement in the 12 months? 1) Yes 0) No; If no skip to E3

E2) What are the major crops you have grown in the last 12 months? *(Note: Ask the question and fill the responses as indicated in the following table).*

E2.1 Crop type	Meher (2012)		Belg (2011)		Irrigation cycle 1 (2011)	Irrigation cycle2 (2012)
	F2.2. Area (kindi / timad)	F2.3. Prodn (qt)	F2.4. Area (kindi / timad)	F2.5. Prodn (qt)	F2.6. Area (kindi / timad)	F2.7. Prodn (qt)
1 *Teff*	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
2 Wheat	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
3 Barley	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
4 Maize	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
5 Sorghum	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
6 Millet	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
7 Fababeans	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
8 Potato	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
9 Tomato	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
10 Pepper	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
11 Carrot	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
12 Chatt	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
13 Other, specify...	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
14 Other, specify..	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
15 Other, specify.....	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|
16 Other, specify.....	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|	__|__|.|__|

E3. Are you accessing inputs for the main crops in the following seasons? If not what is the reason?		E3.1 ***Meher input*** Access	E3.2 Reasons for poor/no input access in Meher*	E3.3 ***Belg input*** Access	E3.4 Reasons for poor/ no input access in Belg*	E3.5 ***Irrigation input*** Access	E3.6 Reasons for poor/no input access in Irrigation*
1	Teff	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
2	Wheat	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
3	Barley	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
4	Maize	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
5	Sorghum	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
6	Fababean	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
7	Potato	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
8	Tomato	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
9	Millet	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
10	Carrot	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
11	Chatt	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
12	Other	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
13	Other, specify.....	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
14	Other, specify.....	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	
15	Other, specify.....	1=Yes 0=No		1=Yes 0=No		1=Yes 0=No	

* E3.2, E3.4 and E3.6. Reasons for poor/no input access: 1) poor availability 2) high cost 3) lack of finance 4) inappropriate packaging 5) untimely supply 6) other

E4	Have you ever had livestock in the last 12 months? 1) Yes 0) No. *If no, go to E6.*
E5	If yes to E4 would please tell me the type and number of number of livestock of the household owned? *(Note: Ask the question and fill the responses as indicated in the following table)*

E5.1. Type of livestock	Currently		Just before the recent bad season		Just after the recent bad season	
	E5.2.Local breed	E5.3.Improved breed	E5.4.Local breed	E5.5.Improved breed	E5.6.Local breed	E5.7.Improved breed
1. Cattle	__|	__|	__|	__|	__|	__|
2. Sheep	__|	__|	__|	__|	__|	__|
3. Goat	__|	__|	__|	__|	__|	__|
4. Equines	__|	__|	__|	__|	__|	__|
5. Poultry	__|	__|	__|	__|	__|	__|
6. Other	__|	__|	__|	__|	__|	__|

E6 Have you ever had beehives in the last 12 months? 1) Yes 0) No. *If no, go to E7*
If yes to E6 would please tell me the type and number of number of beehives the household own? *(Note: Ask the question and fill the responses as indicated in the following table)*

E6.1. Types of bee hives	E6.2. 2012 (currently)	E6.3 Just before the recent bad season	E.6.4 Just after the recent bad season
1. Modern	__|	__|	__|
2. Transitional	__|	__|	__|
3. Traditional	__|	__|	__|

Livestock productivity

E7) If yes to E4, what was the average productivity (production per animal) from the livestock you own?

E7.1. Description	Current (last 12 months)		Good year		Bad year		Average year	
	E7.2. Local breed	E7.3. Improved breed	E7.4. Local breed	E7.5 Improved breed	E7.4. Loca breed	E7.5 Improved breed	E7.4. Local breed	E7.5 Improved breed
1. Milk yield lt/cow/day								
2. Egg production: number of eggs/pullet/ year								
3. Number of lambs born at a time/ ewe								
4. Number of kids born at a time/ Ram								
4. Number months for maturity of lambs for slaughter								
4. Number months for maturity of kids for slaughter								
5. Number of months for fattening of cattle								

E8) If Yes to E6, what was the average annual productivity of the hive (production per year per hive)?

E8.1. Honey production	E8.2.Current year (the last 12 months)	E8.3 Good year	E8.4 Bad year	E8.5 Average year
1. Traditional hive, kg/year	___	___	___	___
2. Transitional hive, kg/year	___	___	___	___
3. Modern hive, kg/year	___	___	___	___

F8.6 Are you accessing inputs for your livestock production? If not what are the reasons?		F8.6.1 ***input*** Access		F8.6.2 Reasons for poor /no input access*
1	Beekeeping equipment	1=Yes	0=No	
2	Bee forage	1=Yes	0=No	
3	Poultry feed	1=Yes	0=No	
4	Dairy feed	1=Yes	0=No	
5	Fattening feed	1=Yes	0=No	
6	Veterinary medicines for cattle	1=Yes	0=No	
7	Veterinary medicines for poultry	1=Yes	0=No	
8	Veterinary medicines for shoats	1=Yes	0=No	

* F8.6.2. Reasons for poor/no input access for livestock production: 1) poor availability 2) high cost 3) lack of finance 4) inappropriate packaging 5) untimely supply 6) other

Climate Adaptation and Resilience Building

E9	Is climate change related climate variability or risk problem to your household?	1= Yes	0=No
E10	Is anyone in your household has received climate/weather forecast information such as seasonal forecasts in 2011 E.C? if no skip to E14	1= Yes	0=No
E11	From which sources did you receive this forecast information? ***(Multiple responses possible!)***	1=CRS/DFSA project 2=Community discussions 3=DAs 4=woreda experts 5=kebele DRR/EW committee 6=mass media 7=others, specify,	
E12	Did your household utilize the climate/weather information for risk reduction or resilience building in 2011 EC?	1= Yes	0=No
E12	What actions did you take in 2011E.C to reduce risk or improve resilience to climate change?		
E.13.1	Improved soil management (e.g. mulching)	1= Yes	0=No
E.13.2	Applied crop varieties that are less susceptible to climate change risks such as drought tolerant;	1= Yes	0=No
E.13.3	Applied efficient water management practices such as water harvesting or irrigation;	1= Yes	0=No
E.13.4	Switched from annual crops to perennial crops;	1= Yes	0=No
E.13.5	Changed livestock grazing practices (cut & carry , zero grazing)	1= Yes	0=No
E.13.6	Reduced herd size	1= Yes	0=No
E.13.7	Switched from grazers to browsers;	1= Yes	0=No
E.13.8	Diversified income sources (e.g. IGAs),	1= Yes	0=No
E.13.9	Others specify.....	1= Yes	0=No
E.13.10	Others specify.....		

E14. What are the most frequent types of shocks you have experienced in your agriculture production?		Responses	
E14.1	Loss/decline of crop harvest due to drought	1= Yes	0=No
E14.2	Loss/decline of crop harvest due to seasonal irregularities	1= Yes	0=No
E14.3	Loss/decline of crop harvest due to pest and disease	1= Yes	0=No
E14.4	Loss/decline of crop harvest due to flood	1= Yes	0=No
E14.5	Loss/decline of animal stock due to drought	1= Yes	0=No
E14.6	Loss/decline of animal stock due to flood	1= Yes	0=No
E14.7	Loss/decline of livestock productivity due to drought	1= Yes	0=No
E14.8	Loss/decline of livestock productivity due to flood	1= Yes	0=No
E14.9	Loss/decline of animal stock due to animal disease	1= Yes	0=No
E14.10	Loss/decline of livestock productivity due to animal disease	1= Yes	0=No
E14.11	Other (please specify)	1= Yes	0=No

E15. How do you cope up with the shocks you mentioned in E14		Responses: 1= by myself 2= Assisted by family 3= Assisted by community 4= Assisted by Go/NGO 5= Didn't cope/lost my asset
E15.1	Loss/decline of crop harvest due to drought	
E15.2	Loss/decline of crop harvest due to seasonal irregularities	
E15.3	Loss/decline of crop harvest due to pest and disease	
E15.4	Loss/decline of crop harvest due to flood	
E15.5	Loss/decline of animal stock due to drought	
E15.6	Loss/decline of animal stock due to flood	
E15.7	Loss/decline of livestock productivity due to drought	
E15.8	Loss/decline of livestock productivity due to flood	
E15.10	Loss/decline of animal stock due to animal disease	
E15.11	Loss/decline of livestock productivity due to animal disease	
E15.12	Other (please specify)	

E16. What are the most likely risks you expect in your agriculture?	Responses	
E16.1 Loss/decline of crop harvest due to drought	1= Yes	0=No
E16.2 Loss/decline of crop harvest due to seasonal irregularities	1= Yes	0=No
E16.3 Loss/decline of crop harvest due to pest and disease	1= Yes	0=No
E16.4 Loss/decline of crop harvest due to flood	1= Yes	0=No
E16.5 Loss/decline of animal stock due to drought	1= Yes	0=No
E16.6 Loss/decline of animal stock due to flood	1= Yes	0=No
E16.7 Loss/decline of livestock productivity due to drought	1= Yes	0=No
E16.8 Loss/decline of livestock productivity due to flood	1= Yes	0=No
E16.9 Loss/decline of animal stock due to animal disease	1= Yes	0=No
E16.10 Loss/decline of livestock productivity due to animal disease	1= Yes	0=No
E16.11 Other (please specify)	1= Yes	0=No

E17. Will you be able to cope up with the resulting shocks if the risks you mentioned in E 16 happen?	**Responses:** 1= Yes, I will cope up by myself 2= Yes, I will cope up with some assistance of my relatives 3= Yes ,I will cope up with some assistance of my community 4= I will cope up only if assisted by Go/NGO
E17.1 Loss/decline of crop harvest due to drought	
E17.2 Loss/decline of crop harvest due to seasonal irregularities	
E17.3 Loss/decline of crop harvest due to pest and disease	
E17.4 Loss/decline of crop harvest due to flood	
E17.5 Loss/decline of animal stock due to drought	
E17.6 Loss/decline of animal stock due to flood	
E17.7 Loss/decline of livestock productivity due to drought	
E17.8 Loss/decline of livestock productivity due to flood	
E17.9 Loss/decline of animal stock due to animal disease	
E17.10 Loss/decline of livestock productivity due to animal disease	
E17.11 Other (please specify)	

Module F- Water resource:

Domestic Water, Hygiene and Sanitation

S/N	Question	Response
F1	What kind of toilet facility do members of your household usually use? *1 = Male adults* *2 = Female adults* *3 = Male children* *4 = Female children* 0 = No facility/bush/field ***Flush or pour/flush toilet flushed to:*** *1 = Piped sewer system* *2 = Septic tank* *3 = Pit latrines* *4 = Somewhere else* ***None Flushed:*** *5 = Ventilated improved pit latrine* *6 = Pit latrine with slab* *7 = Pit latrine with no slab/open pit* *8 = Composting toilet* *9 = Bucket toilet* *10 = Hanging toilet/latrine* *11= Other (specify)_____*	
F2	Do you share this facility with other households? *1 = No, my household use it independently* *2 = Yes*	
F3	What is the main source of drinking water for members of your household during the **dry season**? *1 = Piped into dwelling* *2 = Piped into yard/plot* *3 = Public tap* *4 = Protected well in dwelling* *5 = Protected well in yard/plot* *6 = Protected public well* *7 = Protected spring* *8 = Rainwater protected* *9 = Open well in dwelling* *10 = Open well in yard/plot* *11 = Open public well* *12 = Un protected Spring* *13 = River/stream* *14 = Pond/lake* *15 = Dam* *16 = Rainwater harvesting unprotected* *17 = Other (specify) _____*	
F4	How long does it take to fetch domestic water (including queue and a round trip in minutes) during **dry season** minutes? (Note: Select Don't know if the respondent doesn't remember or know the distance)	
F5	What is the main source of drinking water for members of your household during the **wet season**? *1 = Piped into dwelling* *2 = Piped into yard/plot* *3 = Public tap* *4 = Protected well in dwelling* *5 = Protected well in yard/plot* *6 = Protected public well* *7 = Protected spring* *8=Rainwater protected* *9 = Open well in dwelling* *10 = Open well in yard/plot* *11 = Open public well* *12 = Un protected Spring* *13 = River/stream* *14 = Pond/lake* *15 = Dam* *16 = Rainwater harvesting unprotected* *17 = Other (specify) _____*	
F6	How long does it take to fetch domestic water (including queue and a round trip in minutes) during **wet season** minutes?	
F7	Most of the time who is fetching water for domestic use in the family? *1)Women2) Girls 3) Boys4) Men*	
F8	How often do you get domestic water from the source for your household? *1) 24 hours in a day 2) certain hours in a day 3) every other day 4) every three or more days 5) irregular*	
F9	How many liters of water do you bring to home per day for domestic use? (1 *jerican* =20 lt) (including drinking, cooking, bathing, cloth washing and utensil washing in Lt/day)	
F10	Did the quantity of your domestic water supply improve from what it was before the project? *1)Yes 0) No*	
F11	Did the quality of your domestic water supply improve from what it was before the project? *1)Yes 0) No*	
F12	How do you see the contribution of PW/watershed management activities in terms of improving the supply of domestic water? **(Multiple responses possible)** *0) No watershed management activities in the area 1) prolonged the duration water supply from the source 2) increased quantity of water available 3) constructed water points 4) depleted the water resource of the watershed 5) no positive or negative contribution*	

Irrigation

S/N	Variables			Responses
F13	Do you have access to household and /or community level water-harvesting structures? *1)Yes 0) No (If no skip to question* ***F21)***			
F14	If yes, which structure? **(Multiple responses possible)** *1) river diversion 2) community pond 3) household pond 4) household water wale 5) communal water wale 6) individual motorized irrigation 7) communal motorized irrigation 8)traditional spring 9)protected water 10)Other, specify*			
F15	What type of crops do you grow using this irrigation? **(Multiple responses)** *1) vegetables 2) root crops 3) fruits 4) cereals 5) pulses6) other (specify)*			
F16	How do you use your harvest from your irrigated farm? **(Multiple responses)** *1) for own consumption 2) sell in the market 3) for other purpose (specify)*			
F17	What are the benefits you get from your irrigated farm? **(Multiple responses)** *1) Improved food security 2) Increased income 3) Improved dietary diversity 4) Better knowledge and skill 5) Others (specify)*			
F18	For how many seasons and hectares of irrigation land do you use the water per year? What was your income during each season?	Cycle (Choose)	Area (timad /kert/kinde)	Sales income (ETB)
		1st	|_|_|.|_|	|_|_|_|_|
		2nd	|_|_|.|_|	|_|_|_|_|
		3rd	|_|_|.|_|	|_|_|_|_|
F19	How do you see the contribution of the NRM activities in your watershed in terms of improving the supply of irrigation water? **(Multiple responses)** *1) it developed the water resource of the watershed 2) it constructed water points3) it depleted the water resource of the watershed 4) no positive or negative contribution 5) Others (specify)*			

Water sources for livestock

S/N	Variables	Responses
F20	Where do you access water drinking livestock during dry season? *1) river diversion 2) protected community pond 3) unprotected community pond 3) household pond 4) household water wale 5) communal water wale 6) piped water 7) traditional spring 8) protected spring*	
F21	Does the dry season livestock watering point have a cattle trough? *0) Not important to have it 1) Yes) 0) No*	
F22	Where do you access water for drinking livestock during wet season? *1) river diversion 2) protected community pond 3) unprotected community pond 3) household pond 4) household water wale 5) communal water wale 6) piped water 7) traditional spring 8) protected spring*	
F23	Does the wet season livestock watering point has a cattle trough? *0) Not important to have it 1) Yes) 0) No*	
F24	How do you see the contribution of NRM activities in terms of improving the supply of water for animals? *1) it developed the water resource of the watershed 2) it constructed water points 3) it depleted the water resource of the watershed 4) no positive or negative contribution*	

Module G- Access to financial services (saving and credit) and income generating activities (IGAs)

S/N	Questions			Responses
G1	Have you started or operated any income generating activity (IGA)?*If no go to H1*	*1) Yes* *0) No*		
G1.1	When did you start the IGA?			
G1.2	Are you still operating the IGA?	*1) Yes* *0) No*		
G2	Did you receive any technical assistance or support to start or operate this income generating activity?	*1) Yes* *0) No*		
G3	Who provided this support for starting or operating this income generating activity? **(Multiple responses are possible)**	*1) CRS-DFSA project* *2) Other NGO projects* *3) Government* *4) Other (specify).....*		
G 4	How do you finance this income generating activity? **(Multiple responses are possible)**	*1) Own source* *2) donation/grant* *3) loan*		
G5	If you finance this income generating activity through loan, from who did you borrow money from? **(Multiple responses are possible)**.	*1) Money lender* *2) Relative* *3) Friend/Neighbor* *4) From Equb* *5) Cooperative, Including RUSACCO* *6) Savings & Internal Lending Communities (SILC)* *7) Local Organization other than SILC*	*8) Development Agent* *9) Microcredit Institution Or Program* *10) Ngo* *11) Bank* *12) Other (specify).....*	
G6	Who assisted you in obtaining this credit for IGA? **(Multiple responses are possible)**	*1) Development Agent* *2) other kebele official/FSTF* *3) DFSA project staff* *4) Other (specify).....*		
G7	Was the credit beneficial to you?	*1) yes it was* *2) partly yes*	*3) no it wasn't*	
G8	Was the credit easily accessible to you?	*1) yes it was* *2) partly yes*	*3) no it wasn't*	
G9	How do you rate your success in this income generating activity?	*1) Poor* *2) Good*	*3) Very good*	
G10	What are the major constraints to maintain and/or expand this IGA? **Multiple responses are possible**	*1) Finance* *2) Skill*	*3) Market* *4) Other (specify).....*	
G11	Do you have saving? If no skip to module H	*1) Yes*	*0) No*	
G12	If you have saving, how do you save it?	*1) At microfinance* *2) Community institutions like SILC* *3) Traditional saving like "Ekub"* *4) At formal banks* *5) At home as cash* *6) Saving in kind (asset)*		
G13	For what purpose do you save?	*1) For investment* *2) For schooling* *3) For medical expense*	*4) To buy asset* *5) Other (specify)*	

Module H- Livelihood and household income diversification

1. Livelihood diversification

S/N	Questions	Response
H1	What are the major livelihood options of the household for the last 12 months? (Give 0 if you don't practice and 1-5 for those which you practice based on the ranking order)	Choose a rank
	1) Crop production	0, 1, 2, 3, 4,5
	2) Livestock Production	0, 1, 2, 3, 4,5
	3) Off-farm activities (None-wage based income sources, e.g. petty trading, hand crafting, carpentry, masonry, etc.)	0, 1, 2, 3, 4,5
	4) Wage employment (other than PSNP)	0, 1, 2, 3, 4,5
	5) Productive safety net	0, 1, 2, 3, 4,5
H2	Is your livelihood being more diversified than it was before three years? *1) Yes 0) No*	
H3	What are the major on-farm IGAs your family was engaged in ***(Multiple responses up to 5)*** 1) Vegetable Production 2) Fruit production 3) Other high value crops (pulse, spices, pepper, coffee, sugarcane, chat) production 4) Dairy development 5) Shoat rearing/fattening 6) Poultry production 7) Cattle fattening 8) Beekeeping 9) Tree growing 10)others (specify).....11) None	
H4	What are the major off-farm IGAs your family was engaged in in the last 12 months?***(Multiple response)*** *1) Petty trade 2) Hand craft (weaving, carpentry, metal work, pottery, etc.) 3) Mini shops 4) Local drinks 5) Wage/casual labor 6) Other (specify) .....7) None*	
H5	How was your income level in last three years? *1) Increased 2) No change 3) Decreased (If 2 or 3, skip to H7)*	
H6	If **your income has increased in the last three years**, which interventions helped you most to do so? ***(Multiple response)*** *1) Natural Resource Management (e.g. soil and water conservation, soil fertility and land management, tree planting, area closure) 2) Agricultural Support and Agro-enterprise Development 3) Multiple Uses of Water (irrigation, domestic water supply – human and livestock use) 4) SILC (Savings and Internal Lending Communities) 5) income generation activities 6) Other (specify).....*	
H7	If your income has no change or decreased in the last three years what was the reason? *1) Drought 2) Flood hazard 3) Crop failure due pests and disease 4) Livestock disease 5) Crop market failure 6) Livestock market failure 7) Shortage of land 8) Land degradation 9) Shortage of agricultural inputs 10) Shortage of access to financial services 11) Poor extension service 8) Other specify*	

H8	In the last 12 months, what were the main expenses of your household?	1)Yes 0) No	Amount (Birr) , if yes
H8.1	Purchase of food grain		|_|_|_|_|
H8.2	Purchase of other food items		|_|_|_|_|
H8.3	Purchase of livestock		|_|_|_|_|
H8.4	Purchase of farm inputs/technology		|_|_|_|_|
H8.5	Purchase of household clothes		|_|_|_|_|
H8.6	Purchase of farm tools/equipment		|_|_|_|_|
H8.7	Purchase of furniture/utensils		|_|_|_|_|
H8.8	Maintenance/renovation costs		|_|_|_|_|
H8.9	Payment of taxes/other obligations		|_|_|_|_|
H8.10	Health care expenses		|_|_|_|_|
H8.11	Education expenses		|_|_|_|_|
H8.12	Labor costs		|_|_|_|_|
H8.13	Material rental expenses		|_|_|_|_|
H8.14	Payment of social contributions (iddir, mehaber, etc.)		|_|_|_|_|
H8.15	Transport/communication costs		|_|_|_|_|
H8.16	Payment of loan & interest		|_|_|_|_|
H8.17	Other (Specify)_____		|_|_|_|_|
	Total expenditure		|_|_|_|_|

Module I: Household Food & Nutrition Security

FOOD INSECURITY EXPERIENCE SCALE (FIES)-current

S/N	Question ()	Reponses	Skip
I1	During the **past 30 days**, was there a time when you or others in your household were worried you would not have enough food to eat because of a lack of money or other resources?	0=No 1=Yes	If yes skip to **I2**
I1A	During the past **12 months**, was there a time when you or others in your household were worried you would not have enough food to eat because of a lack of money or other resources?	0=No 1=Yes	
I2	During the **past 30 days**, was there a time when you or others In your household were unable to eat healthy and nutritious food because of a lack of money or other resources?	0=No 1=Yes	If yes skip to **I3**
I2A	During the **past 12 month**, was there a time when you or others In your household were unable to eat healthy and nutritious food because of a lack of money or other resources?	0=No 1=Yes	
I3	During the **past 30 days**, was there a time when you or others In your household ate only a few kinds of foods because of a lack of money or other resources?	0=No 1=Yes	If yes skip to **I4**
I3A	During the **past 12 months**, was there a time when you or others In your household ate only a few kinds of foods because of a lack of money or other resources?	0=No 1=Yes	
I4	During the **past 30 days**, was there a time when you or others In your household had to skip a meal because there was not enough money or other resources to get food?	0=No 1=Yes	If yes skip to **I5**
I4A	During the **past 12 months**, was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?	0=No 1=Yes	
I5	During the **past 30 days**, was there a time when you or others in your household ate less than you thought you should because of a lack of money or other resources?	0=No 1=Yes	If yes skip to **I6**
I5A	During the **past 12 months** was there a time when you or others In your household ate less than you thought you should because of a lack of money or other resources?	0=No 1=Yes	
I6	During the **past 30 days** was there a time when your household did not have food because of a lack of money or other resources?	0=No 1=Yes	If yes skip to **I7**
I6A	During the **past 12 months**, was there a time when your household did not have food because of a lack of money or other resources?	0=No 1=Yes	
I7	During the **past 30 days**, was there a time when you or others In your household were hungry but did not eat because there was not enough money or other resources for food?	0=No 1=Yes	If yes skip to **I8**
I7A	During the **past 12 months**, was there a lime when you or others In your household were hungry but did not eat because there was not enough money or other resources for food?	0=No 1=Yes	
I8	During the **past 30 days**, was there a time when you or others in your household went without eating for a whole day because of a lack of money or other resources?	0=No 1=Yes	If yes skip I19
I8A	During the **past 12 months** was there a time when you or others In your household went without eating for a whole day because of lack of money or other resources?	0=No 1=Yes	

AVERAGE HOUSEHOLD DIETARY DIVERSITY SCORE

Note: Ask to the person responsible for household food preparation

No.	Question	Response	Skips
I9	**RESPONDENT'S LINE NUMBER FROM THE HOUSEHOLD ROSTER** **HDDS QUESTIONS** Now I would like to ask you about the types of foods that you or anyone else in your household ate yesterday during the day and at night. ***READ THE LIST OF FOODS. CHOOSE "YES" IF ANYONE IN THE HOUSEHOLD ATE THE FOOD IN QUESTION.*** ***CHOOSE "NO" IF NO ONE IN THE HOUSEHOLD ATE THE FOOD.*** ***THE FOODS LISTED SHOULD BE THOSE PREPARED IN THE HOUSEHOLD AND EATEN IN THE HOUSEHOLD OR TAKEN ELSEWHERE TO EAT. DO NOT INCLUDE FOODS CONSUMED OUTSIDE THE HOME THAT WERE PREPARED ELSEWHERE.*** VERIFY THAT YESTERDAY WAS NOT UNUSUAL OR SPECIAL (FESTIVAL, FUNERAL, OR IF MOST HOUSEHOLD MEMBERS WERE ABSENT). IF IT WAS AN UNUSUAL/SPECIAL DAY, SKIP TO QUESTION I21.		If yesterday was special or unusual day, skip to I21
I10	Any *enjera*, bread, rice, biscuits, or other foods made from *teff*, millet, sorghum, maize, rice, pasta, macaroni, wheat or barley or other cereal.	0 = No 1 = Yes	
I11	Any potatoes, yams, cassava, or any other foods made from roots or tubers?	0 = No 1 = Yes	
I12	Any vegetables?	0 = No 1 = Yes	
I13	Any fruits?	0 = No 1 = Yes	
I14	Any meet, beef, lamb, goat, wild game, chicken, liver, kidney, heart, or other organ meats?	0 = No 1 = Yes	
I15	Any eggs?	0 = No 1 = Yes	
I16	Any fresh or dried fish?	0 = No 1 = Yes	
I16	Any foods made from beans, peas, lentils, haricot beans, or nuts?	0 = No 1 = Yes	
I17	Any cheese, yogurt, milk, or other milk products?	0 = No 1 = Yes	
I18	Any foods made with oil, fat, or butter?	0 = No 1 = Yes	
I19	Any sugar or honey?	0 = No 1 = Yes	
I20	Any other foods, such as condiments, coffee or tea?	0 = No 1 = Yes	

Number of Months with Adequate Food Provisioning

Ask these questions to household heads

<table>
<tr>
<td>I21</td>
<td>Did you have enough food to cover all your needs in the last 12 months of 20011/12 EC from all different sources?</td>
<td>This question refers to the amount of food the household had available during the last twelve months. Choose one of the options shown below:
0. No
1. Yes
9. NA/DK</td>
<td>If NA/ DK, skip J1</td>
</tr>
<tr>
<td>I22</td>
<td>During which months did you have enough food during 2011/12 E.C from all different sources?</td>
<td>This question identifies during which months during 2011/12 E.C. the household had enough food available. You should read each month of the year one by one, and, for each month, check (√) box to represent the household either had “Enough” food or “Not Enough” food for that month. Start asking the questions from the latest month and finish by the earliest month.
<table>
<tr><th>Month</th><th>1. Enough</th><th>2. Not Enough</th><th>3. Not Applicable</th><th>Remark</th></tr>
<tr><td>a) DECEMBER 2012</td><td></td><td></td><td></td><td>1 months ago</td></tr>
<tr><td>b) NOVEMBER 2012</td><td></td><td></td><td></td><td>2 months ago</td></tr>
<tr><td>b) OCTOBER 2012</td><td></td><td></td><td></td><td>3 months ago</td></tr>
<tr><td>d) SEPTEMBER 2012</td><td></td><td></td><td></td><td>4 months ago</td></tr>
<tr><td>e) AUGUST 2011</td><td></td><td></td><td></td><td>5 months ago</td></tr>
<tr><td>f) JULY 2011</td><td></td><td></td><td></td><td>6 months ago</td></tr>
<tr><td>g) JUNE 2011</td><td></td><td></td><td></td><td>7 months ago</td></tr>
<tr><td>h) MAY 2011</td><td></td><td></td><td></td><td>8 months ago</td></tr>
<tr><td>i) APRIL 2011</td><td></td><td></td><td></td><td>9 months ago</td></tr>
<tr><td>j) MARCH 2011</td><td></td><td></td><td></td><td>10 months ago</td></tr>
<tr><td>k) FEBRUARY 2011</td><td></td><td></td><td></td><td>11 months ago</td></tr>
<tr><td>l) JANUARY 2011</td><td></td><td></td><td></td><td>12 months ago</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

Module J: Benefits to and empowerment of girls and women

Note: All the questions under module J are asked to an adult woman (the spouse in male headed households or female household head)

QID	Question					Response
J1	Please insert the woman's ID from the Household Roster:	|_|_|			
J2	Have you received any training or community message on women participation and decision making at household & community levels roles in the **last 12 months**?	1) Yes	0) No			
J3	Which community meetings did you attend in the **last 12 months**?					
J3.1	Meetings arranged by kebele leaders	1) Yes		0) No		
J3.2	Meetings arranged by DAs	1) Yes		0) No		
J3.3	Meetings arranged by HEW	1) Yes		0) No		
J3.4	Meetings arranged by watershed committee	1) Yes	2) N/A, if no committee exists	0) No		
J3.5	Meetings arranged by water committee	1) Yes	2) N/A, if no committee exists	0) No		
J3.6	Meetings arranged by irrigation user's association	1) Yes	2) N/A, if no communal irrigation facility exists	0) No		
J3. 7	Meetings arranged by saving & credit associations	1) Yes	2) N/A, if no saving & credit association exists	0) No		
J3.8	Meetings arranged by women self-help group	1) Yes	2) N/A, if no women self-help group exists	0) No		
J3.9	Meeting arrange by women development army (1 to 5)	1) Yes	2) N/A, if no women development army exists	0) No		
J3.10	Meetings arranged by development group (1 to 30)	1) Yes	2) N/A, if no development groups exists	0) No		
J4	Who decides on the following?					
J4.1	Productive assets (e.g. land, animals ...)	1)husband	2)wife	3)both		
J4.2	Farm management (technology selection, management choice, crop selection....)	1)husband	2)wife	3)both		
J4.3	House hold income allocation	1)husband	2)wife	3)both		
J4.4	Children schooling	1)husband	2)wife	3)both		
J4.5	Children health	1)husband	2)wife	3)both		
J4.6	Saving and credit	1)husband	2)wife	3)both		
J4 .7	Investment (purchase of cattle or any other asset)	1)husband	2)wife	3)both		
J4.8	Membership to a group	1)husband	2)wife	3)both		
J5. With which of the two statements do you agree most?						
J5.1	*1) A woman can be a leader, just like a man can.* *2) Men are better leaders than women.*					

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J5.2	*1) It is a waste of time to train a woman to keep financial records when you could train a man and he will do the job better.* *2) It is good to train a woman to keep financial records because she can do the job as well as a man.*			
J5.3	*1) A good marriage is more important for a girl than a good education.* *2) A good education is more important for a girl than a good marriage.*			
J6. Access to economic opportunities and decision making				
J6.1	Have you done any paid work in the last few years? 1) Yes 0)No			
J6.2	During the period, were you usually paid in cash or kind for the work or were you not paid at all?	*1) Cash only 2) Cash and kind* *3) In kind only → if in-kind go to J6.4* *4) Not paid*		
J6.3	When you were paid in cash for this work, was the payment usually made directly to you, to your spouse/ partner or to Someone else in your household?	*1) Respondent* *2) Spouse/partner* *3) Someone else in the household* *4) Other (specify)*		
J6.4	Do you usually discuss with someone about how the cash you earn will be used?	*1) Yes* *0) No → if No skip to J6.6*		
J6.5	With whom do you usually talk about how the cash you earn will be used?	*1) Spouse/partner* *2) Someone else in HH* *3) Other (specify)*		
J6.6	Who usually decides how the cash you earn will be used?	*1) Yourself* *2) Spouse/partner* *3) Yourself and spouse/ partner jointly*	*4) Yourself and other jointly(specify)* *5) Other (specify)*	
J6.7	Have you started or operated any income generating activity (IGA)? If no go to J6.12	*1) Yes 0) No*		
J6.8	How do you finance this income generating activity? **(Multiple responses are possible)**	*1) Own source* *2) donation/grant* *3) loan*		
J6.9	If you finance this income generating activity through loan, from who did you borrow money from? **(Multiple responses are possible)**.	*1) Money lender* *2) Relative* *3) Friend/Neighbor* *4) From Equb* *5) Cooperative, Including RUSACCO* *6) Savings & Internal Lending Communities (SILC)*	*7) Local Organization other than SILC* *8) Development Agent* *9) Microcredit Institution Or Program* *10) Ngo* *11) Bank* *12) Other (specify).....*	
J6.10	Who usually collects the income from the IGA?	*1) Respondent* *2) Spouse/partner*	*3) Someone else in the household* *4) Other (specify)*	
	Do you usually discuss with someone about how the income from the IGA will be used?		*1) Yes* *0) No → if No skip to J6.11*	

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J6.11	With whom do you usually talk about how the income from the IGA will be used?	*1) Spouse/partner* *2) Someone else in HH* *3) Other (specify)*	
J6.12	Who usually decides how the income you earn from the IGA will be used?	*1) Yourself* *2) Spouse/partner* *3) Yourself and spouse/partner jointly* *4) Yourself and other jointly(specify)* *5) Other (specify)*	
J6.13	If you are not currently operating any income generating activity what is/are the reason/s?	*1) Not interested* *2) Lack of finance* *3) Lack of skill* *4) Not agreed with spouse* *5) Have other work burden* *6) Others specify _____*	
J7	What specific benefits in particular you are getting from the development interventions? **Multiple responses are possible**	*1) Increased income* *2) Reduced workload* *3) Increased decision making role* *4) Improved health* *5) Increased capacity to engage in IGAs* *6) Others (specify)*	
J8	What are the specific benefits in particular girls in your HH are getting from the development interventions? **Multiple responses are possible**	*1) Increased income* *2) Reduced workload* *3) Better chance to education* *4) Improved health* *5) Equally treated with boys* *6) Others (specify)*	

Annex 3: Qualitative data collection instruments

IWM site observation checklist and transact walk format

Name of Observer: _____: Name of the Critical /Major watershed:_____

Name of the Community /Micro-watershed: _____

Date of Observation: _____

Time of Observation: _____

Note: The following check list will be applied to ask community members familiar with the study watershed. The answers to these questions can be obtained through interviews and observations by the researchers.

Site (listed as example)	What was visited? (For NRM: Enclosure or farmland? If enclosure, how much land was under enclosure)	GPS Reading	What interventions were observed?	What was done well?	What was not done well?	What biophysical impacts are observed?	Additional comment
NRM/Watershed work – Enclosures and SWC measures on Hillsides							
SWC on farmland							
Gully plugging							
Agriculture Technologies (seed producer groups, Keyhole gardens)							
Technology- Water/irrigation							
Forestry /Agroforestry							
Technology- livelihoods (beehives/ FES)							
Others							

Give an overall expert judgment related to the quality, quantity /coverage (spatial coverage) of the intervention i.e. interval, spacing of the various SWC and forestry agro forestry measures observed above:

_____
_____
_____
_____
_____

Transact walk format

Issue	Observation
Woreda	
Kebele	
Community watershed	
Geographic location	
Transect Number	
Type of crops grown in the MWS	
Type of trees grown in the MWS	
Density and distribution of trees	
Dominant species of grass	
Slope of the micro watershed	
Soil texture	
Soil depth	
Soil erosion situation	
Water Logging	
Soil infiltration	
Stoniness	
Soil Color	
Traditional Agro climatic zone of the micro watershed	
The existing function of the land (Land cover)	
Surface water bodies that exist in the micro watershed	
The distance of micro watershed from the residence area	
The distance of micro watershed from the main road GPS Reading Seasonality	
Infra structures around the project	
Year Constructed	
Current Status	

Annex 4: Key informant interviews

Note: At this initial stage of the research, qualitative data will be collected selectively. That is, only for research questions requiring such data. After analysis of quantitative data is completed, it may be necessary to "dive in" to investigate some of the research questions and generate real life cases. The FGD and KII questions presented below are more extensive than required for this phase of the research. They are included as part of this IR for documentation purposes.

Note-taker's name			
Facilitator's name			
Regional State	Woreda	Watershed/Kebele	implementers
Location of interview			
MP3 folder		MP3 file name	
Date	Start time	Finish time	

Participant names	Sex	Age group	HH head/member?	Type of livelihood activity/IGA engaged in

Were there any interruptions to the discussion?	
Was anyone present who might have inhibited the participants from speaking freely?	
Were there any other problems or comments?	

Consent Form

Good morning/afternoon! My name is_____, and I am working for Dadimos Development Consultants Plc. to study the CRS/IPS-DFSA project. We are conducting a study to understand the current situation of the area in relation to the DFSA/IWM project. You are being asked to participate in this survey because of your important role as a participant/beneficiary of the project or resident of the project area. I will ask you a series of questions that would take about 1 hr. Your name and responses will remain confidential and be analyzed together with the responses of others, solely for the purpose of this study. We expect you to answer all questions truthfully. It is your choice whether or not to take part in this interview and if you choose to participate, you have the right not to answer any question or to stop the interview at any time. If you don't choose to participate, it will in no way impact your relationship with the project. Before we begin; do you want to ask me any questions about the survey? Shall I continue in asking you each question?

Please note that all the calendars are in Ethiopia.

Thank you.

1.2.1 A. Community Watershed Committee (if available) KIIs

1. Does your community implement IWM program? If yes, what are the strategies, process and standards followed?

2. What are the programs (PW, Mass mobilization, SLM, MERET, NGO's.....) participating in the watershed development and how do you compare them?

3. What are the major components (NRM & non-NRM) of the IWM program in your area? And how do you see the relevance of each of these components? Does it differ from program to program? How do you comment on the one carried out by CRS-DFSA?

4. Do you think there is a missing component/s from the watershed development program in your area? If yes, what is it? Please comment on the components of CRS-DFSA integrated watershed development program specifically.

5. How do you see the involvement of different social groups and their benefit from the watershed development activities and resources? (Probe: by PSNP status, age group, gender group, wealth group...)

6. What benefits/harms are observed 1) **at household level** and 2) **at community level** due to these NRM activities?

7. What are the major positive and negative impacts of the IWM interventions in your watershed? (probe by social, economic and environmental impacts)

8. What is IWM interventions contribution to food and nutritional security improvements of target households? What are the challenges of the program implementation? What are your recommendations?

9. If there are benefits at household and at community level, how are these benefits distributed among and accessed by different ***age***, ***gender*** and ***wealth*** groups?

10. What planning procedures followed for NRM /IWM by the government and CRS? How is the participation of the men, women and youth groups with the IWM planning? What are the limitations and strengths? What recommendations do you have for improvement of IWM planning? (separately probe for government, CRS and other NGO programs.)

11. What implementation procedures and resource mobilizations (labor, local materials, etc.) strategies are being applied in the implementation of IWM under the government, CRS and other NGOs led program? How is the participation of the men, women and youth groups within the watershed? What are the limitations and strengths? What recommendations do you have for improvement of IWM implementation? (separately probe for government, CRS and other NGO programs.)

12. What post implementation procedures and resource mobilizations (labor, local materials, etc.) strategies are being applied to sustainably mange IWM outputs and impacts under the government, CRS and other NGOs led program? How is the participation of the men, women and youth groups within the watershed? What are the limitations and strengths? What recommendations do you have for improvement of IWM implementation? (separately probe for government, CRS and other NGO programs.)

13. What benefits/harms are observed 1) **at household level** and 2) **at community level** due to these social infrastructures that are constructed or maintained? If there are benefits at household and at community level, how are these benefits distributed to and accessed by different ***age***, ***gender*** and ***wealth*** groups?

14. How is climate change (drought, flood, season unpredictability…) impacting crop production and what adaptation measures (crop & variety selection, water harvesting, crop diversification….) being practiced? What was the contribution of NRM activities with this regard?

15. What are the major challenges and opportunities for crop productivity in the area? What are your recommendations?

16. How is climate change (drought, flood, higher temperature…..) impacting livestock production and what adaptation measures (Livestock type & breed selection, water harvesting, livestock diversification, stock reduction, change in fodder development strategy ….) do you practice? What was the contribution of IWM activities with this regard? What are the roles of CRS (PSNP DFAP) in this regard?

17. What are the major challenges and opportunities for livestock productivity in the area? What are your recommendations?

18. How many household within the watershed have access to irrigation? What is the estimated percentage of these HHs as compared to the total? Out of these: a) what proportion is using only HH level facilities? b) What proportion is using only communal facilities? And c) what proportion is using both communal and HH level facilities? (Please use proportional pilling method for this.)

19. What is the irrigation potential of the watershed? What proportion of this potential is developed so far? If there is unused potential what is the reason and what do you recommend?

20. What are the key factors affecting water supply for different uses (domestic, irrigation and livestock watering? [Probe: Natural resources degradation, farm land expansion, population pressure, climate change (drought, flood, higher temperature….)]

21. What climate change adaptation (water harvesting, regulating water utilization….) and other measures being practiced for appropriate use of water? What was the contribution of NRM activities with regard to climate change adaptation?

22. What are the major challenges and opportunities for water resources development in the watershed? What are your recommendations?

23. How is the income level of HHs in your watershed over time? If the income level has increased or decreased over time what was the reason? What were the contributions of PSNP and other similar programs (government, CRS, MFI, etc.) with this regard? Please discuss the issues of agricultural non-agricultural income levels differently and also the implications of these for different age, gender and wealth groups.

24. How is the situation in food and nutrition security (in terms of access, availability and utilization) in your watershed over time? If the food and nutrition security situation has improved or deteriorated over time, what was the reason? What were the contributions of IWM interventions (government, CRS, MFI, etc.) with this regard? Please discuss the situation of different age, gender and wealth groups' separately. Focus on infants and pregnant and lactating woman.

25. What are the specific interventions of IWM that are intended to benefit and empower girls and women? How do you describe the impacts of each of these interventions on women and girls benefit and empowerment and the changes overtime? What are the roles of the government and CRS (PSNP/DFAP) in this regard?

26. What are specific local (community-based) institutions supporting the planning, implementation and sustaining IWM intervention? How is the capacity of this institutions to sustainably support IWM interventions?

27. Are watershed committees formed? How do you describe its functionality? How is their capacities to sustainably support development and utilization IWM inventions?

28. What are other local IWM related structures and biological outputs (soil conservation, water harvesting, vegetation cover)? How is their functionality and effectiveness? If they are not functional and effective, what is the problem and what do you recommend?

29. What are the trainings given to communities as part of the IWM interventions so far? And how do these trainings help communities to develop their resources in a sustainable manner?

30. What strategic linkages to government and non-government services (education, health, WASH…) created for communities as part of the IWM?

31. Did the training and the strategic linkages to government and non-government services empowered communities? Please explain how the capacity building impacted the communities' capacity to take similar initiatives and how this changed overtime?

1.2.2 B. Woreda Public Work Technical Committee Members and Woreda Livelihood Technical Committee Members

1. Does the Woreda implement IWM program? If yes, what are the strategies, process and standards followed? (Probe by planning, implementation and post-implementation of IWM intervention)

2. What are the programs (PW, Mass mobilization, SLM, MERET, NGO's…..) participating in the IWM implementation and how do you compare them?

3. What are the components of the IWM program by different implementers?? And how do you see the relevance of each of the component? Does it differ from program to program?

4. How do you comment on the IWM components, and planning, implementation and sustaining the IWM interventions carried out by CRS/IPS-DFSA? (Probe the strengths and limitations of the component by planning, implementation and sustainability mechanisms)

5. Do you think there is a missing component/s from the watershed development program in your area? If yes, what is it? Please comment on the components of CRS/IPS-DFSA integrated watershed development program specifically.

6. How do you see the participation of different social groups within a micro-watershed In the planning, implementation and sustaining IWM outputs? (Probe: age group, gender group, wealth group…). In addition probe by government, CRS and other NGOs.

7. What are the major positive and negative impacts of the IWM in your Woreda? What is its contribution to food and nutritional security improvements of target households? What are the challenges of the program implementation? What are your recommendations?

8. How do you see the distribution of IWM benefits among the different social groups within a micro-watershed and their benefit from the watershed development activities and watershed resources? (Probe: age group, gender group, wealth group…). In addition probe by government, CRS and other NGOs.

9. What planning procedures followed for NRM?IWM by the government and CRS/IPS? *[Ask and report separately for CRS and government.]*

10. What are the specific interventions of IWM that are intended to benefit and empower girls and women? How do you describe the impacts of each of these interventions on women and girls benefit and empowerment and the changes overtime (before and after 2008)? What are the roles of the government and CRS/IPs (PSNP/DFAP) in this regard?

11. How is the formation of watershed committees formation in different watershed sides? How do you describe their functionality? What capacity building supports given to watershed committees? Who gave them the capacity building supports? What gaps do they have in terms of capacity and system for them to operate well? (probe by Government, CRS and other NGOs implementation areas)

12. What are other local IWM related structures? How is their functionality and effectiveness? If they are not functional and effective, what is the problem and what do you recommend?

13. What are the trainings given to communities as part of the IWM interventions so far? And how do these trainings help communities to develop their resources in a sustainable manner?

14. What strategic linkages to government and non-government services (education, health, WASH…) created for communities as part of the IWM?

15. Did the training and the strategic linkages to government and non-government services empowered communities? Please explain how the capacity building impacted the communities' capacity to take similar initiatives and how this changed overtime (before and after 2008)?

16. Who is participating in building the capacity of the community with regard to IWM? What are the strengths and weaknesses of each capacity building supports and what are your recommendations for future improvements?

17. ON the basis of the watershed development guideline of the MoA, what are the strengths and gaps of IWM interventions in CRS operation micro-watersheds? (probe from the perspective of watershed development planning, implementation and post implementation phases of IWM interventions)

1.2.3 C. Project staff/including CRS-HQ

1. Is CRS/IPs implementing IWM program? What are the components of IWM program of CRS/IPs in your area?

2. What are its planning implementation strategies and processes? Is it different from the one followed by the Office of Agriculture?

3. Do the IWM planning adequately address the concerns, priorities as well as gaps of each gender, age and wealth group?

4. Is integration and complementarities of activities taken in to consideration during planning and implementation?

5. What are the challenges in implementing IWM in CRS/IPS project areas? What do you recommend for future improvements?

6. How does CRS/IPS monitor the implementation of IWM activity? Who participate in the process? How often the woreda offices involve in this IWM activity monitoring? How effective is the activity monitoring system?

7. How does CRS/IPS track the environmental, social and livelihood impacts of its IWM intervention? Who participate in the process? How often the woreda offices involve in this impact tracking events? How effective is the impact tracking system?

8. What are the positive and negative impacts/outcomes (environmental, economic and social) of CRS/IPS IWM interventions? What are its contributions for food and nutritional security improvements of target households in particular?

9. What are the specific interventions of IWM that are intended to benefit and empower girls and women? How do you describe the impacts of each of these interventions on women and girls benefit and empowerment and the changes overtime (before and after 2008)? What are the roles of the government and CRS/IPS (PSNP/DFAP) in this regard?

10. Are watershed committees formed? How do you describe their functionality? What capacity building supports given to watershed committees? Who gave them the capacity building supports? What gaps do they have in terms of capacity and system for them to operate well?

11. What are other local IWM related structures? How is their functionality and effectiveness? If they are not functional and effective, what is the problem and what do you recommend?

12. What are the trainings given to communities as part of the IWM interventions so far? And how do these trainings help communities to develop their resources in a sustainable manner?

13. What strategic linkages to government and non-government services (education, health, WASH…) created for communities as part of the IWM?

14. Did the training and the strategic linkages to government and non-government services empowered communities? Please explain how the capacity building impacted the communities' capacity to take similar initiatives and how this changed overtime (before and after 2008)?

15. Who is participating in building the capacity of the community with regard to IWM? What are the strengths and weaknesses of each capacity building supports and what are your recommendations for future improvements?

1.2.4 D. Development Agent/ Kebele Agricultural Office

1. Does the kebele implement IWM program? If yes, what are the strategies, process and standards followed?

2. What are the programs (PW, Mass mobilization, SLM, MERET, NGO's.....) participating in the watershed development and how do you compare them?

3. What are the major components of the watershed development program in your kebele? And how do you see the relevance of each of these components? Does it differ from program to program? How do you comment on the one carried out by CRS-DFSA?

4. Do you think there is a missing component/s from the watershed development program in your kebele? If yes, what is it? Please comment on the components of CRS-DFSA integrated watershed development program specifically.

5. How do you see the involvement of different social groups and their benefit from the watershed development activities? (Probe: PSNP status, age group, gender group, wealth group...)

6. What are the major positive and negative impacts of the IWM in your kebele? What is its contribution to food and nutritional security improvements of target households? What are the challenges of the program implementation? What are your recommendations?

7. How is the income level and diversification of HHs in your kebele over time? Ifthe income level has increased or decreased over time what was the reason? Ifthe income source diversity has increased or decreased over time what was the reason? What were the contributions of PSNP and other similar programs (government, CRS, MFI, etc.) with this regard? Please discuss the issues of agricultural non agricultural income differently and also the implications of these for different age, gender and wealth groups.

8. How is the situation in food and nutrition security (in terms of access, availability and utilization) in your kebele over time? If the food and nutrition security situation has improved or deteriorated over time what was the reason? What were the contributions of PSNP and other similar programs (government, CRS, MFI, etc.) with this regard? Please discuss the situation of different age, gender and wealth groups' separately. Focus on infants and pregnant and lactating woman.

9. What are the specific interventions of IWM that are intended to benefit and empower girls and women? How do you describe the impacts of each of these interventions on women and girls benefit and empowerment and the changes overtime (before and after 2008)? What are the roles of the government and CRS (PSNP/DFAP) in this regard?

10. Are watershed committees formed? How do you describe their functionality? What capacity building supports given to watershed committees? Who gave them the capacity building supports? What gaps do they have in terms of capacity and system for them to operate well?

11. What are other local IWM related structures? How is their functionality and effectiveness? If they are not functional and effective, what is the problem and what do you recommend?

12. What are the trainings given to communities as part of the IWM interventions so far? And how do these trainings help communities to develop their resources in a sustainable manner?

13. What strategic linkages to government and non-government services (education, health, WASH...) created for communities as part of the IWM?

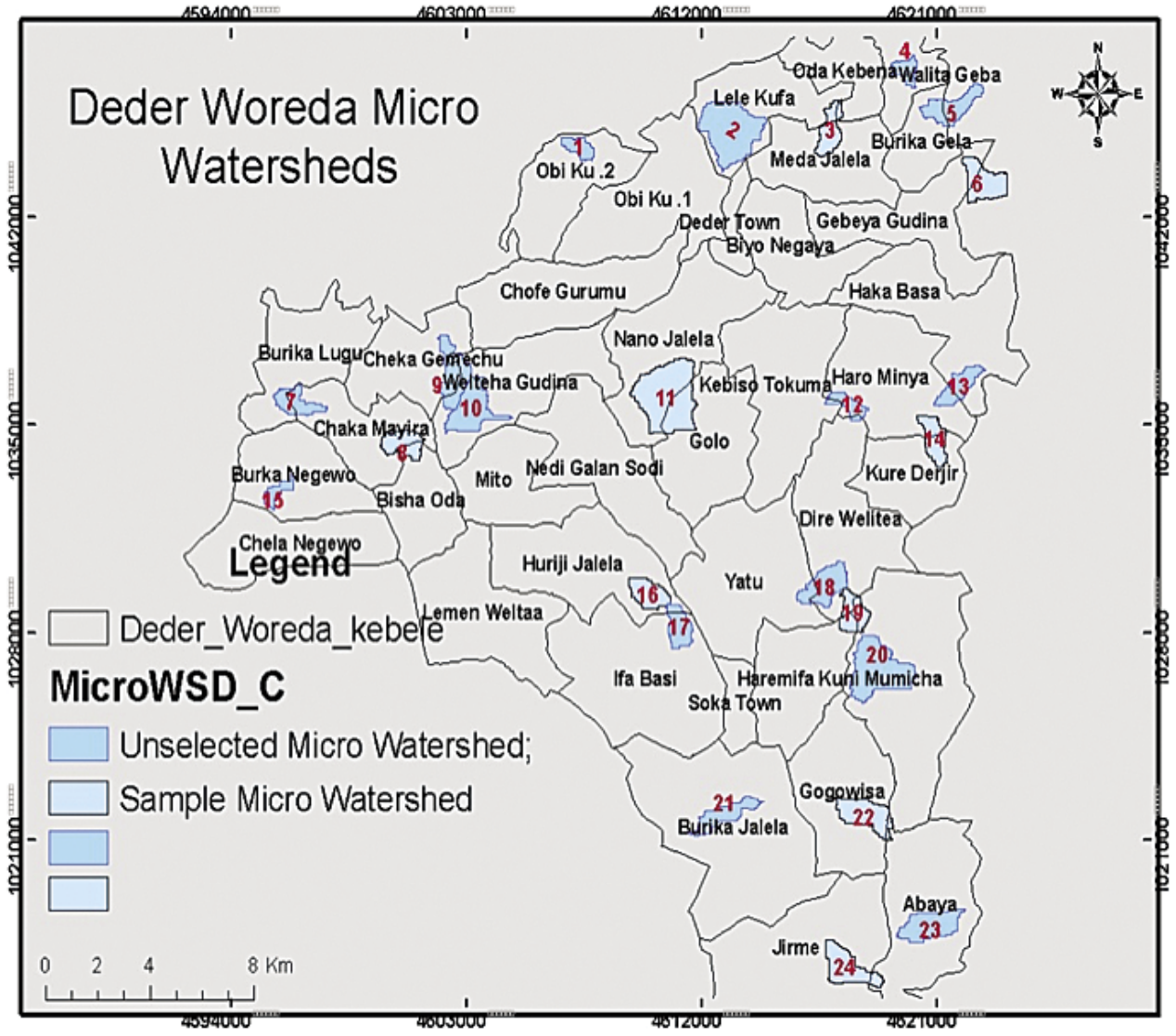
14. Did the training and the strategic linkages to government and non-government services empowered communities? Please explain how the capacity building impacted the communities' capacity to take similar initiatives and how this changed overtime (before and after 2008)?

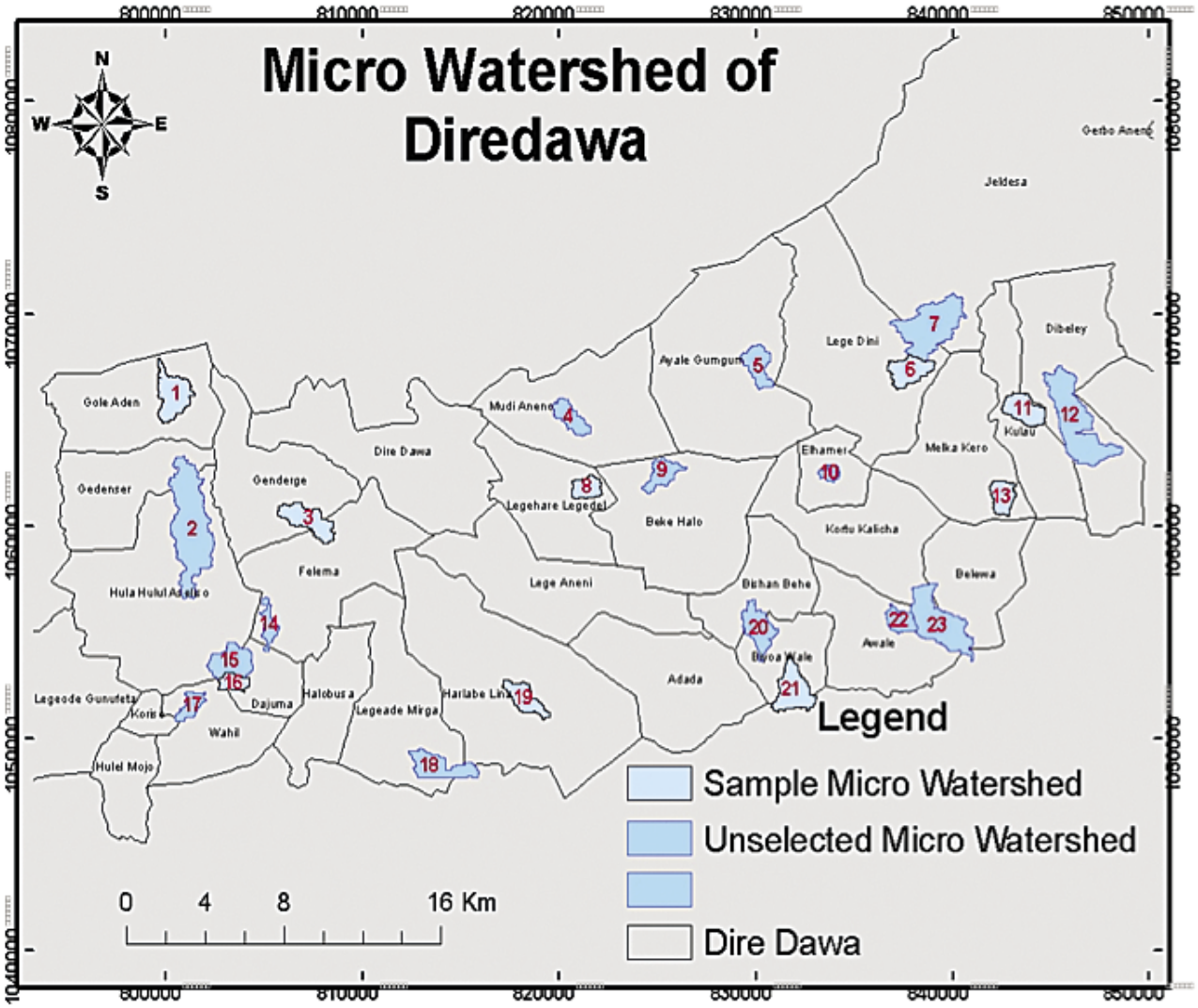
15. Who is participating in building the capacity of the community with regard to IWM? What are the strengths and weaknesses of each capacity building supports and what are your recommendations for future improvements?

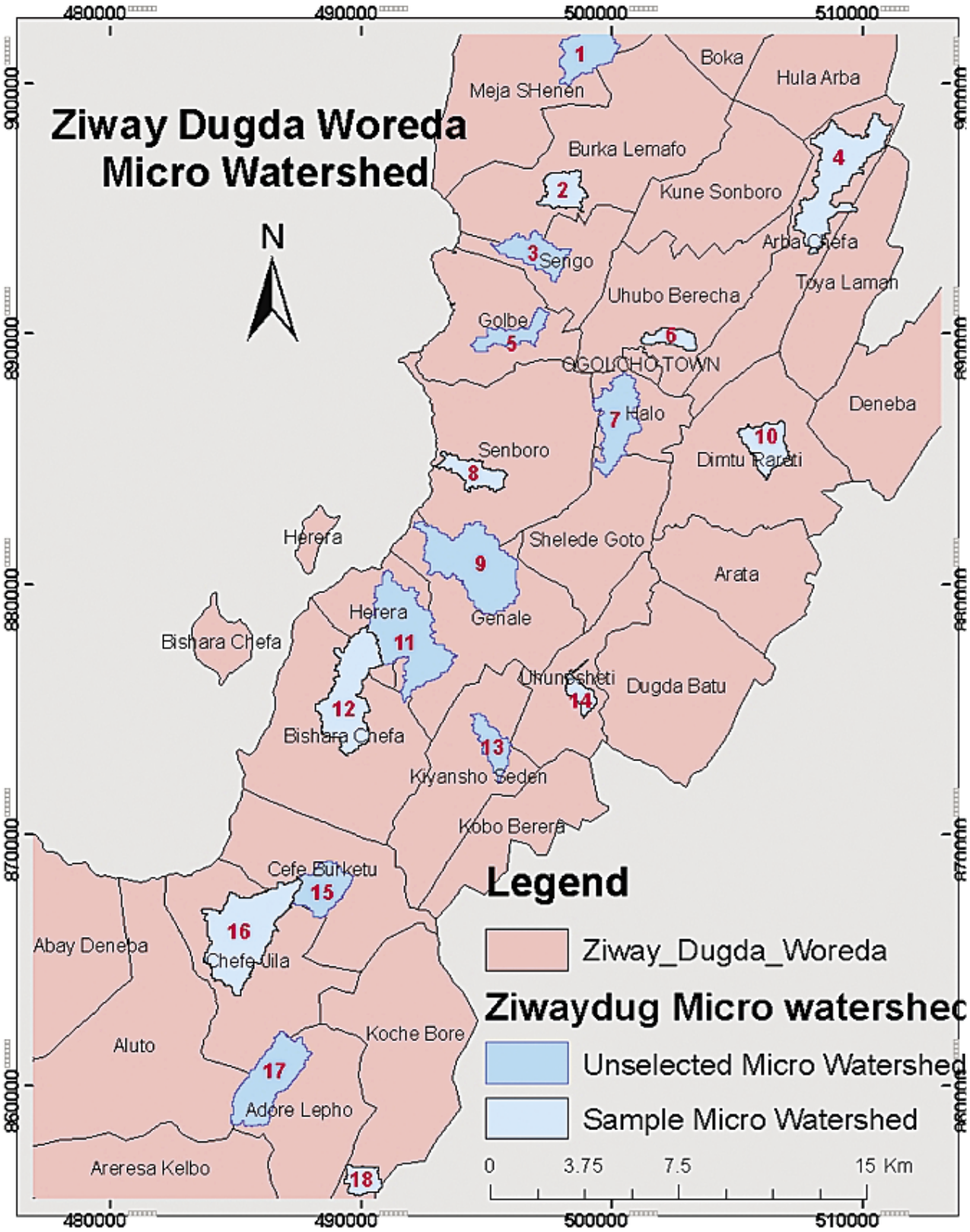
Annex 5: List and maps of sample watersheds

S/N	*Woreda* name	*Kebele* name	Sample watershed code[18]
1.	Deder	Meda Jalela & Lele Kufa	3
2.	Deder	Gebeya Gudina	6
3.	Deder	Chaka Mayira & Bishan Oda	8
4.	Deder	Naono Jalala & Golo	11
5.	Deder	Kure Darjiri & Haro Minya	14
6.	Deder	Huriju Jalalaa	16
7.	Deder	Municha	20
8.	Dire Dawa	Gole Aden	1
9.	Dire Dawa	Genderge	3
10.	Dire Dawa	Lege Dini	6
11.	Dire Dawa	Legehare Legdale	8
12.	Dire Dawa	Kulau	11
13.	Dire Dawa	Melaka Kero	13
14.	Dire Dawa	Dajuma	16
15.	Zeway Dugda	Burka Lemafa	2
16.	Zeway Dugda	Arba Chefa	4
17.	Zeway Dugda	Uhubo Berecha	6
18.	Zeway Dugda	Senboro	8
19.	Zeway Dugda	Dimtu Rarati	10
20.	Zeway Dugda	Bishara Chefa	12
21.	Zeway Dugda	Uhunesheti	14

18 Location of the watersheds can be found in the maps on the following pages.


Deder Woreda Micro Watersheds
4594000
4603000
4612000
4621000
1042000
1035000
1028000
1021000
N
W
E
S
Oda Kebena
Walita Geba
Lele Kufa
Burika Gela
Meda Jalela
Obi Ku .2
Obi Ku .1
Deder Town
Gebeya Gudina
Biyo Negaya
Chofe Gurumu
Haka Basa
Nano Jalela
Burika Lugu
Cheka Gemechu
Welteha Gudina
Kebiso Tokuma
Haro Minya
Chaka Mayira
Golo
Burka Negewo
Mito
Nedi Galan Sodi
Kure Derjir
Bisha Oda
Dire Welitea
Chela Negewo
Huriji Jalela
Yatu
Lemen Weltaa
Ifa Basi
Haremifa Kuni Mumicha
Soka Town
Gogowisa
Burika Jalela
Abaya
Jirme
Legend
Deder_Woreda_kebele
MicroWSD_C
Unselected Micro Watershed;
Sample Micro Watershed
0 2 4 8 Km


Micro Watershed of Diredawa
N
W
E
S
800000
810000
820000
830000
840000
850000
1080000
1070000
1060000
1050000
1040000
Gole Aden
Gedenser
Genderge
Dire Dawa
Mudi Anene
Ayale Gumgum
Jeldesa
Gerbo Anene
Lege Dini
Dibeley
Kulalu
Melka Kero
Elhamer
Legehare Legedel
Beke Halo
Korbu Kalicha
Belewa
Felema
Lege Aneni
Bishan Behe
Awale
Hula Hulul Adaka
Legeode Gunufeta
Korie
Wahil
Dajuma
Halobusa
Legeade Mirga
Harlabe Lina
Adada
Hulel Mojo
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
0
4
8
16 Km
Legend
Sample Micro Watershed
Unselected Micro Watershed
Dire Dawa


Ziway Dugda Woreda
Micro Watershed
N
480000
490000
500000
510000
900000
890000
880000
870000
860000
Meja SHenen
Boka
Hula Arba
Burka Lemafo
Kune Sonboro
Arba Chefa
Toya Laman
Sengo
Uhubo Berecha
Golbe
OGOLCHO TOWN
Deneba
Halo
Senboro
Dimtu Rareti
Herera
Shelede Goto
Arata
Genale
Bishara Chefa
Dugda Batu
Kiyansho Seden
Kobo Berera
Cefe Burketu
Abay Deneba
Chefe Uila
Aluto
Koche Bore
Adore Lepho
Areresa Kelbo
Legend
Ziway_Dugda_Woreda
Ziwaydug Micro watershec
Unselected Micro Watershed
Sample Micro Watershed
0
3.75
7.5
15 Km

Annex 6: Definitions for factors of soil loss

1. Average annual soil loss (A) is soil loss from rill and interrill erosion caused by rainfall and its associated overland flow per annum (tons ac-1 yr-1) (USDA RUSLE Development Team, 2001),
2. Soil erodibility (K) factor is the intrinsic susceptibility of a soil to erosion by runoff and raindrop impact (VERMONT, n.d.).
3. The slope-steepness (S) factor is the ratio of soil loss from the field slope gradient to that from a 9-percent slope under otherwise identical conditions (USDA, 1978).
4. Slope length is the distance from the origin of overland flow along its flow path to the location of either concentrated flow or deposition (Michigan State University, 2002).
5. The land cover and management (C) factor is the ratio of soil loss from an area with specified cover and management to that from an identical area in tilled continuous fallow (USDA, 1978).
6. The support practice (P) factor is the ratio of soil loss with a support practice like contouring, strip-cropping or terracing to that with straight-row farming up and down the slope (USDA, 1978).

Annex 7: Rainfall and altitude classes for Ethiopia

Rainfall amount (mm)	Rainfall class
≤ 600	Dry
600–1,400	Moist
1,400–2,200	Wet

Altitude (m)	Altitude class
500–1,500	Kolla
1,500–2,300	Woina Dega
2,300–3,200	Dega
3,200–3,700	Wurch

Source: Ministry of Agriculture, 2020

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