Baseline study & analyzing the context of implementation of the DVR project in the Intervention zones of Somali Region, Ethiopia

(Final Report)

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Submitted by: **FSiAbd Consult**

(Food Security and Integrated Agricultural Business Development)

Contact Person: Mulugeta Tefera; email: mulerfsiabd@gmail.com, muler_t@yahoo.com,
Phone: +251 191 152 2446, +251 1944063953 +251 114 34 87 21

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Table of Contents Pages

List of Tables

List of Pictures

List of Figures

Acronyms

BoANRD	Bureau of Agriculture and Natural Resources Development
BoLPD	Bureau of Livestock and Pastoral Development
CDSDR II-SR	Capacity Development for the Strengthening of Drought Resilience of the pastoral and agro-pastoral population in the Ethiopian arid and semi-arid lands project
DA	Development Agent
DEM	Digital Elevation Model
DVR	Dry valley rehabilitation
FAO	Food and Agricultural Organization
FGDs	Focused Group Discussion
GIS	Geographical Information System
HH	Household
IGAs	Income Generating Activities
IDPs	Internally Displaced Persons
KII	Key Informant Interview
NRM	Natural Resource Management
PAP	Pastoral and Agro-pastorals
SDR	Strengthening Drought Resilience
SWC	Soil and water conservation
TOR	Term of Reference
UNDP	United Nations Development Program
WSW	Water Spreading Weir

Executive summary

1. The baseline study on the current situation of the DVR project intervention areas was intended to generate a the starting points for a successful program intervention and to establish a baseline information as well as benchmarks against which future performance and progress can be evaluated or compared. The study was undertaken in the CDSDR-SR II project intervention zones and analyzed the context of implementation of the project indicators and the existing socio-economic as well as bio-physical conditions in the project areas. The study was conducted in selected dry valleys areas namely, Amadle, Harre, Bolidid, Guboka and Goro Guba (Erer) dry valley in Jigjiga and Erre districts of Somali Regional State, during July 27 to August 12, 2021. The study was undertaken by **FSiAbd Consult** after being selected through competitive bid by CDSDR II-SR project of GIZ, which commissioned and outsourced the capable firm to conduct this baseline assessment.
2. The general objective of this consultancy work is to conduct a baseline study in the project (CDSDR-SR II) intervention zones analyzing the context of implementation of the project regarding the project indicators, The specific objectives of the study were: (i) to analyse the relevant regional strategies and policies regarding agro-pastoralism, agricultural production, drought resilience and watershed management in Somali Region (Outcome Indicator 2.1); (ii) to analyse the spatial and social context of project intervention sites and definition of target numbers of related Outcome Indicators 1.1 and 1.2; and (iii) to evaluate possibilities of integration of Internally Displaced Persons (IDPs) in the project approach (Output Indicator 1.3).

3. To address the above mentioned objectives, the study made use of different methods of data collection, including Household Survey, KIIs, FGD, Observation, Review of Secondary Data and application of geospatial (GIS) techniques. The data collection process was based on the basic principle of participatory approaches involving selected sample HHs, FGDs discussants, project beneficiary's men and female members and the youths. In addition, by means of interactive approaches the study team has made KI interviews and thorough discussions with all stakeholders specifically, clan leader of agro-pastoral communities, key experts in local and regional offices, GIZ project staff, and other pertinent actors to obtain valid and reliable information. Likewise, the data analysis process involves various statistical tools and triangulate findings between different methods mainly HH survey and FGD results. The finding of the study presented in various forms, such as descriptive statistics using tables, charts, crosstabs indicating frequencies, percentages and other values of the analysis. In addition, in this study geospatial maps, photographs, Digital Elevation/Terrain Model (DEM) and GIS environment used for modeling of the dry valleys delineation. The study also used Digital Elevation/Terrain Model (DEM) and GIS environment for modeling of flood events.

4. Amadle dry valley has a catchment area of 9,032.54 hectares of land, while Harre site has the largest catchment area that covers about 47,457.95 hectares of land. This site has larger outreach coverage due to very genteelly slope around 1% that extends for about 24kms from its upstream to remotest downstream area. Boldid and Gobka Dry valleys are found adjacent it each other separated by main road from Harrer

to Jigjiga. The total area coverage of the valleys is 6,051hectares of land, while Goro-Guba or Errer Dry Valley has total area coverage of 2,922 hectares mainly dominated woody vegetation.

5. Currently, there are 34 WSWs that creates about 394 ha of land, which actually under different production activities. At the time assessment, the team observed that most of this areas were under productive activities operated by project beneficiary HHs. The study team measured and showed the Spatial Coverages of each DVR intervention with their respective significant positive effect due to its adequate moisture retention on the land. In this regard, the sum of estimated total potential Spatial Coverages area that could have potential positive impact is about 13,220 ha. This potential area could be reclaimed for agricultural production, natural resources and other related activities if proper support will be given to potential target beneficiaries of the project. The support mainly include, providing various means production and increasing the number and quality of WSWs technology and other structures at proper places so as to rehabilitate land and conserve sufficient moisture that bring Significant Positive benefit to target groups.

6. The total potential target HHs in the 4 selected project sites are estimated to about 393 HHs, while their respective family members were about 2,308 (1216 male and 1092 female) respectively. This potential target population will be expected to be the prospective project beneficiaries in the coming years, when the project will fully executed and reached at ultimate stage. The average family size is estimated to 5.87 ~ equal to 6 person per/HH, which is equivalent to the figure used by regional offices for various purposes such as PSNP, and other development indicators.

7. The study confirmed that 41 sample HHs (18 male and 23 female), including their respective (344) family members are direct beneficiary of the 3 DVR intervention sites (except Errer, with no survey). More specifically, the study confirms that among the 41 HHs and their families members, about 68 women and 108 youths are direct beneficiaries who involved in various production activities and livelihood options, thus, generated additional income, and contribute to their household economy. The interview with these households further revealed that they have got good access to production means/inputs and services such as seed/seedling for animal feed (forage), crop seeds & vegetable seeds, improved milk production, fattening, petty trading etc. and are directly benefited from the positive impact of the rehabilitated land in these DVR sites (outcome indicator 1.2).
8. Furthermore, the study team confidently point out that these DVR project sites with its current situation could able to create additional income for extra 50 women and 50 youths, besides to the above indicated direct beneficiaries, given proper planning, facilitation to accesses rehabilitated land and support to other production means and services.
9. During the field observation across the ongoing Amadle and Harre intervention areas the survey team witnessed that the WSWs creates numerous benefits among others: (i) rainwater infiltration that enables the water table to increase and reduce the depth water availability significantly and create a condition to drill shallow wells for small irrigation and domestic water uses; (ii) create possibility of crop or vegetable farming as many as three rounds in a year including during dry season using supplementary irrigation; (iii) the possibility of renting out or giving land to others after one main harvest, which increased and served as sources livelihood for others unemployed or job less including women and youth; and (iv) WSWs have

far reaching positive ecological, economic and social aspects as they influence the local community and contribute to the emergence of local centers of growth..

10. There is a need to have a User Agreement & Proposition of No of male/female led HHs for each DVR project. DVR has a community development approach and hence it calls for community participation and collective action. It is necessary because individual choices have collective consequences in the DVR framework. Hence, in order to achieve this, the communities develop their own rules, which resolve their conflicting objectives. It is believed that better organized and effective people's participation would yield higher benefits. The user agreement is mechanisms to tie these groups to together. During FGD, formation of user association and creations of executive committee are suggested by participants. FGD also reveals that presence of women group and youth in committee members are vital for sustainable and inclusive community actions in DVR projects.
11. The relevant policies, strategies, and programs focusing on NRC, PAP Development, and Drought Resilience programs supportive to the enhancement of watershed management and DVR programs were reviewed. In the process, the relevant documents and webpages are listed for further scrutiny by interested experts and program staffs. These pertinent literatures of policies and strategies were collected and accessed mainly from Bureau of Agriculture and Natural Resources, Bureau of Livestock and Pastoral Development of Somali Regional State, and different websites. The list of these documents is indicated at (table 15) of this report. It has been learned from key informants at Federal and Regional levels that there was full participation of senior professionals, officials, and even local experts during the preparation of most of the indicated policies and strategies documents. Moreover, it has confirmed that almost all policy and strategy documents are incorporated the importance of NRM, soil, and water conservation, watershed management as well as dry valley rehabilitation etc., including good emphasis given to inclusion of cross-cutting issues such as climate change and gender driven involvement into development programs.

12. The results of the survey showed demographic and socio-economic characteristics of the sample households, and the livelihood options and income sources of the PAP communities residing in each DVR sites. In line with this, the age and sex category, the marital status and education levels, as well as the livelihood and income sources of sample HHs were analyzed and presented in the report. Result of the survey further asserted that mixed farming (livestock and crop production) is the major occupation and source of livelihoods of the sample HHs. In view of that, about 83% of total HHs was mentioned mixed farming as the major income source followed by petty trade which accounts 12%. Petty trade, mainly run by women and includes activities such as milk retail, sales of small ruminant and crop and vegetable products on occasional markets and related undertakings are served as a source of livelihood in study areas.

13. Accessibility to land is possible through inheritance or sharing from family, renting or share cropping or leasing (buying) from those who have excess land or compelled to rent or share their land due to various factors. Parents are predominantly inheriting land to their male children and rarely to female. It is assumed that female get access to land from parents or family of male where they would be married in the future. However, in Goro Guba dry valley of Erer woreda that the system of landholding is different from the above; i.e. land is communal and belongs to one of the Somali clan called Gurgura. Here, only cultivated

land is privately owned and the rest of the land is belonging to the clan. In this case land accessibility is determined by the clan leaders and no one out of the clan is allowed to access the land in this area.

14. To ensure the sustainability of water spreading weirs (WSW) technologies, the integration with other watershed development activities and application of catchment approaches is important. The objective of the Catchment Approach is to ensure proper utilization and development as well as protection of the natural resources, i.e. soil, water, and vegetation. The catchment is seen as a focal area (not necessarily a hydrological catchment) where a community is willing to work towards the conservation of their environment.
15. Managing sustainable use of rehabilitated valleys is an important task of the project management. It is observed and perceived that flash floods control using water spreading technologies distributing runoff to adjacent areas and improve microclimatic (moisture) conditions, and promote permanent agriculture production and agroforestry, so that more or less permanent vegetation covers could be certainly expected to grow on the land. Hence, the project implementers require putting into practice appropriate land use planning and management in coordination and close collaboration with community members or user groups, local governments and experts in the area, agreeing on sustainable land use and management, conferring shared and self-responsivities.
16. The study explored the trends are improving in the rehabilitation and restoration of existing natural resources basis such as water, soils, rangeland and vegetation resources, crop and livestock production, as well as the situation food security status of the communities, alternative income sources and benefit added. This is specially observed in the 2 sample study areas Amdale and Harre from Jigjiga South East areas. While, the intervention in Bolidid and Gobka as well as Goro Guba of Errer Woreda is at its commencement and benefits are not yet accrued.
17. During FGDs and the household interviews discussants or respondents expressed that the community did not have experience with IDPs' problem in their respective areas most recently. It has been learned from the FGD that raising issues related to IDPs problem is considered as sensitive topics where almost all the discussants were not happy to discuss this issue in detail. However, they strongly suggested that if the ongoing DVR project can adapt the best experience and promote good performance, where the rehabilitated piece of land in the dry valleys can be cultivated up to three times per year (using moisture retention by WSWs), it could be possible to integrate IDPs in the respective DVR areas. Consequently, FGDs discussants stressed the importance of ensuring the consent of the community before undertaking the integration of IDPs in any dry valleys areas. Properly rehabilitated dry valleys coupled with willingness of the host communities to welcome the IDPs would benefit both the host and IDPs.
18. Finally, the study identifies and recommends some of the major activities complementing WSW Technology in the implementation of the DVR project. The intention of the project in its present situation is to conserve soil and water in the form of soil moisture so as to create new income generation options, hence to serve the community to involve in different production activities using the conserved moisture and the improved soil fertility even with the absence precipitation. To attain the soil conservation goal, it may only require one or two session of showery rain that can produce soil saturated flood. Once the soil is filled on the upstream faces of weirs, the entire height of the weir (check dam) will be below the surface of the ground. Whereas, the water conservation target is almost always dynamic since the water percolation

is non-stopping. Hence, the service of the project is limited to the width of weir (check dam) and the length and/or spacing between weirs.

19. Therefore, if few infrastructures are incorporated to the existing checks dams, there is a possibility to maximize the positive impact of the project in different ways. These are:
    - Maximizing the area of land that can get water;
    - Maximizing the number of beneficiaries as the result of increased moisturized farm land;
20. The infrastructures need to be added are:
    - Conveyance structure, Canal or level bund;
    - Ponds for water storage;

    Thus, simply provision of these conveyance structures and ponds for water storage will significantly increase the number of beneficiaries and the area to be cultivated. Furthermore, the stored water in pond can also serve for livestock watering which is another dimension of the effects of the project.

1. Introduction

1.1 Background of the study

As stipulated in the TOR, this baseline study is analyzing the context of implementation of the 'Capacity Development for the Strengthening of Drought Resilience of the pastoral and agro-pastoral population in the Ethiopian arid and semi-arid lands (CDSDR II-SR) project' regarding project indicators. According to ec.europe.eu, a baseline study is an analysis of the current situation to identify the starting points for a program or projects; it looks at what information must be considered and analyses to establish a baseline or starting point, the benchmark against which future progress can be assessed or comparisons made.

To conduct this assignment the **FsiAbd Consult** is contracted by the GIZ. This baseline study report is prepared passing through two phases: (i) baseline study preparation phase- that comprised review of secondary sources and rapid field observation at project sites to use as an input for planning to conduct detail baseline survey (data collection) and (ii) Conducted the detail baseline assessment by visiting selected Dry Valley Rehabilitation (DVR) sites, interviewing sample households, key informants or experts at pertinent woreda and regional bureaus and offices as well conduct FGDs.

Moreover, review of documents triangulated and supported by information from physically observation during the field assessment. The report is further supported by geospatial platform that enables to visualize and analyses satellite images of the selected dry valley rehabilitation sites' geo-physical features reinforced by GIS to understand the context of the implementation of the project indicators. More specifically, this report highlights how the study was designed to undertake the analyses of relevant strategies and policies regarding drought resilience and watershed management practices along with the assessment of the spatial and social context of the project and the description of target beneficiaries of the project.

1.2 Objectives of the Assignment

The overall objective of the SDR program is aimed at strengthening the capacities of communities and responsible institutions in the Afar and Somali Region to implement drought resilience measures within a legal, political, and institutional framework reflecting the concerns of pastoralists and agro-pastoralists. It has been designed to respond to the needs and priorities of PAPs in the Afar and Somali regions and to their key problems in the management of the natural resources.

The general objective of this consultancy work is to conduct a baseline study in the project (CDSDR-SR II) intervention zones analyzing the context of implementation of the project regarding the following project indicators:

(i) To analyse the relevant regional strategies and policies regarding agro-pastoralism, agricultural production, drought resilience and watershed management in Somali Region (Outcome Indicator 2.1);

(ii) To Analyse the spatial and social context of project intervention sites and definition of target numbers of related Outcome Indicators 1.1 and 1.2; and

(iii) To evaluate possibilities of Integration of Internally Displaced Persons (IDPs) in the project approach (Output Indicator 1.3).

2. Methods of Data Collection and Sources of Data

2.1 Methods of Data Collection

Appropriate data collection methods (FGDs, KII, Household Survey, and physical observations) using standard tools (questionnaires and topical checklists) were utilized in data collection process. The consulting team applied the right tools to conduct the baseline assessment. Accordingly, the following were used to conduct the baseline assessment:

i. **Review of Documents (Secondary Sources):** The consultants have made thorough review of existing documents, and key national and regional policies and strategies pertinent to examine challenges such as drought resilience and watershed management practices vis-à-vis the pastoral and agro-pastoral livelihoods correlated with the context of the project beneficiaries. Moreover, the team has identified various National and Regional policies and strategies documents from BoANRD, BoLPD, Project offices and from different websites; consulted, reviewed and used as an input to prepare the report (refer table 15 below). List of references and consulted materials are also indicated at the end of this report.

ii. Key Informant Interviews (KIIs)

Key informant interview (KII) was another principal method used to collect information from the relevant key persons with knowledge and important information valuable for the study.

Table 1: List of KI Interviewees participated in the study

N0	Name	Organization	Key issues discussed/support
1	Mohammed Ahmed	GIZ SDR Office, Jigjiga Somali Region	GIZ CDSDR-SR II project & how to access policies
2	Muktar Arbe	GIZ SDR Office, Jigjiga Somali Region	Facilitated the study
3	Amin Abdi	GIZ SDR Office, Jigjiga Somali Region	About WSW
4	Abdi Mohammed	Chairperson of Amdale Kebele (for Amdale & Harre)	About Amdale
5	Hassein Abdulahi	Bureau of Livestock and Pastoral Development	DVR & & Pastoral Policy
6	Badal Kenedid	Bureau of Agriculture and Natural Resource Development	DVR& Policies on NRM & DVR
7	Althir A/Qadir	Shebel Woreda Natural Resource Directorate	About 4 RDV
8	Hashim Eden	Shebele Woreda Livestock Directorate	Livestock in RDV
9	Abdikadir Abuker	Shebele Woreda Women and Children Affairs	Gender issues in 4RDV
10	Bedelgas Yususf	Bolidid	About RDV
11	Abdurman Adem	Bolidid	About RDV
12	Ali Abdi	Gubka	About RDV
13	Mohamed Ahemd	Errer Woreda Crop Team Leader (GIZ-contact person)	About Erer DV

Accordingly, the consultants' team has made an in-depth interviews with key individuals and organizations at different levels from government offices and others partners. Likewise, key informants interviews were conducted with project staffs, DAs, kebele leaders, and relevant experts in government institutions. The thematic area of KIIs covered various issues related to land use and access rights, willingness of the community to participate in DVR project, efforts and achievements with regard to DVR activities, challenges in implementation of DVR project, the role of women and youth in the DVR, major activities of DVR, sustainability of rehabilitated dry valleys, land use plan, land ownership, complementarities of land use policies and strategies with traditional landholding system, etc.

iii. Focus Groups Discussions (FGDs)

FGDs were conducted in four DVR project areas (Amddle, Harre, Bolidid and Gobka) situated in Jigjiga south and Jigjiga Twon, respectively. The criteria used for the selection of the FGDs participants were among many others residency of the targeted dry valleys, age (youth/elder), sex (male/female), role in the society(clan and religious leadership), kebele chairman or manager, women affairs, youth and other common interest groups, etc. Each group comprises 10-12 persons including representatives of men, women, girls, and youths. Accordingly, 3 mixed or general FGDs, 1 women FGD (including working age girls) held with women facilitator, 1 youth were conducted. The mixed FGD comprised community representatives, including members of community-based social organizations, clan and religious leaders, DAs, kebele chairman and manager, kebele women affairs, and youth groups, school teachers and health extension workers.

iv. Baseline Assessment (Households Survey)

The household respondents' interview was held with 41 (56% female) randomly selected sample men and women headed households who are the beneficiary of the selected three DVR project sites (except Errer). The baseline analysis also figure out the total family members of these sample HHs are about 344 (46.8% female) while about 68 (20%) and 108 (31%) are women and youths respectively. The average family size per HH is also found to be 8.3 person, which seems a bit higher than the official figures (6.0) used by the regional bureaus. The survey tools (close ended questionnaires) included many household and demographic characteristics such as family size, household composition by gender, age, level of education, marital status, sources of livelihoods, income generating options by source; status of land holding, and access to land and inputs, access and availability output markets etc. Furthermore, it focussed on issues described in the outcome indicators (1.1, 1.2 and 2.1), as well as output indicator 1.3. The HH interviews were conducted by enumerators who speak local language and know cultural values of the pastoral communities. The survey was guided by the consultants who strictly vigilant to supervise the enumerators during interview and control them from being asking HHs sensitive questions such as names and number of children, their income, Nº of livestock, names and number of wives, etc. for the purpose of moral, ethical and privacy concern.

v. Geospatial imagery Techniques

For extraction of the necessary geographic locations, extent, existing status, and features of the entire catchments of each dry valley rehabilitation projects the following step by step procedures have been employed:

1. The edges and bends, if any, of each constructed facilities have been collected as **point features** using hand GPS by travelling along all structures; the status of all structures was noted by visual observation during the site visit;
2. The GPS point feature data was projected and georeferenced to match the local position of the project;
3. The collected GPS data has been used to calculate the **length** of each water spreading weir, **the space between each** water spreading **weir**, and the **area** between each successive structures; the area between two successive water spreading weir is considered as a moisturized area due the effect of the water spreading weir constructed at its downstream side;
4. The GPS data is point data. The **point** data has been converted into **line** and **polygon** so as to calculate the linear length and the intended intervention area using Arc GIS software;
5. The **summation** of the area of land between each successive water spreading weir is nearly the current moisturized area due to the intervention or the project for one site;
6. The catchment or drainage area of each project has been delineated using arc hydro tool which is an extension of Arch GIS software and 30m x 30m resolution digital elevation model (**DEM**);
7. The land cover land use type of the intended study area has been extracted from 10m x 10m resolution "ESRI 2020 land cover" global map for each drainage area of the project using ArcGIS software;

8. The Dominant soil of the entire drainage area has been extracted from FAO digital soil map using Arc GIS software;
9. The topographic map and couture line of the catchment area was generated from **30m x30m** digital elevation model (DEM) using Arch GIS software;
10. Using couture lines and Arc GIS software, the maximum potential of each existing water spreading weir was measured;
11. The resulting maximum potential from step-10 and existing moisturized lands from step-5 for each dry valley rehabilitation project has been calculated and tabulated for comparison

2.2. Sources of Data

a) Socio-economic and Administrative data sources

In the data collection process, the consultants with support and facilitation of GIZ Jigjiga office were visited and consulted various offices, including regional bureaus and local district offices, and held discussion with the pertinent key officials and experts. The also collected and consulted various documents on policies and strategies in one way or the other related to dry valley rehabilitation. The following were visited/consulted as a sources of data/information:

- The FGDs participants (clan and religious leader, kebele chairman, manager, women affairs, youths, DAs, school teachers and health extension workers etc.,
- The Key Informants (large number of key persons with knowledge and important information) contacted at different offices,
- The 41 men and women headed HH respondents who were interviewed during HH survey,
- Regional Bureau of Livestock and Pastoral development (BoANRD),
- Regional Bureau of Agriculture and Natural Resources (BoLPD),
- Jigjiga Woreda Agriculture and Natural Resources Office
- Jigjiga Woreda Women Affairs office,
- Jigjiga GIZ- Project Offices,
- GIZ focal person from Errer Woreda,
- Errer Woreda Agriculture and Natural Resource office,
- Errer Woreda Administration office,
- Beneficiaries of DVR in four sites
- Various secondary sources (documents and websites)

b) Geophysical and spatial data sources

- Land use land cover data sources (ESRI land cover 2020 image): https://www.arcgis.com/home/item.html?id=fc92d38533d440078f17678ebc20e8e2
- Digital elevation model data: https://asterweb.jpl.nasa.gov/gdem.asp
- FAO digital soil map
- Google earth
- Observation on site

c) Tools used for data collection and analysis of spatial data

- ArcMap GIS 10.5
- Global mapper 11
- Google earth
- GPS apparatus
- Personal computer

2.3 Data analysis and Presentation

In the process of quantitative data analysis, the study team checked, cleaned, and organized the collected data and encoders employed to complete a computer-based data entry process; and the data entry system was developed for household survey questionnaires using SPSS software, for analysis. Then, the result was tabulated in the form of outputs tables, charts, crosstabs frequency tables and summarized using descriptive statistics, mean comparison, and percentage etc. Similarly, all the qualitative data from FGDs and KIIs was categorized and thematically analyzed to supplement and triangulated with the findings from the quantitative data.

The consultant used GIS and gridded data set to analyze and display the spatial and social contexts of the selected Dry Valleys. These were illustrated by means of maps and geospatial images that indicated representativeness and comprehensiveness of spatial information to reveal actual condition on the ground. The Participatory GIS (PGIS[1]) was used to solicit reality on the background such as land cover & soils, vegetation and actual uses of different land in the dry valley areas. Using PGIS with communities can add value and local knowledge that help creation of real maps that can showed and analyzed the local land uses and land cover including soils and vegetation covers of the dry valley sites. By the use of methods and tools indicated under the methodology topic, the land use land cover, and soil type of the drainage area of all dry valley rehabilitation project has been determined.

2.4 Ethical considerations

For the purpose of ethical concern and privacy, no names of interviewed households or discussants were asked and registered in this survey questionnaires. Furthermore, no sensitive issues and questions mainly related to amount of income, number of cattle, etc. was asked during the survey. All the interviews were conducted after the objectives of the study has been clearly explained and consent of the respondents was obtained. The data/information collected is confidential, shared no one, and only used to prepare the baseline study report without mentioning the name of respondents

3. Results and Discussions

[1] Participatory GIS (PGIS) **community-based mapping**, representing local knowledge, / information. Volunteered geographic information (VGI) creation and dissemination of geographic data contributed voluntarily an for free by individuals.

3.1 Description of Spatial & Social Contexts Project Areas

3.1.1 Landscape and location of the Dry Valley Rehabilitation schemes

The intended projects are located in Somali reginal state, Fanan and Siti zones; Harre DVR, Amadle DVR, Boldid DVR and Gubka DVR projects are located in Fanan zone and ERER DVR project is located in Sitti zone of Somali region.

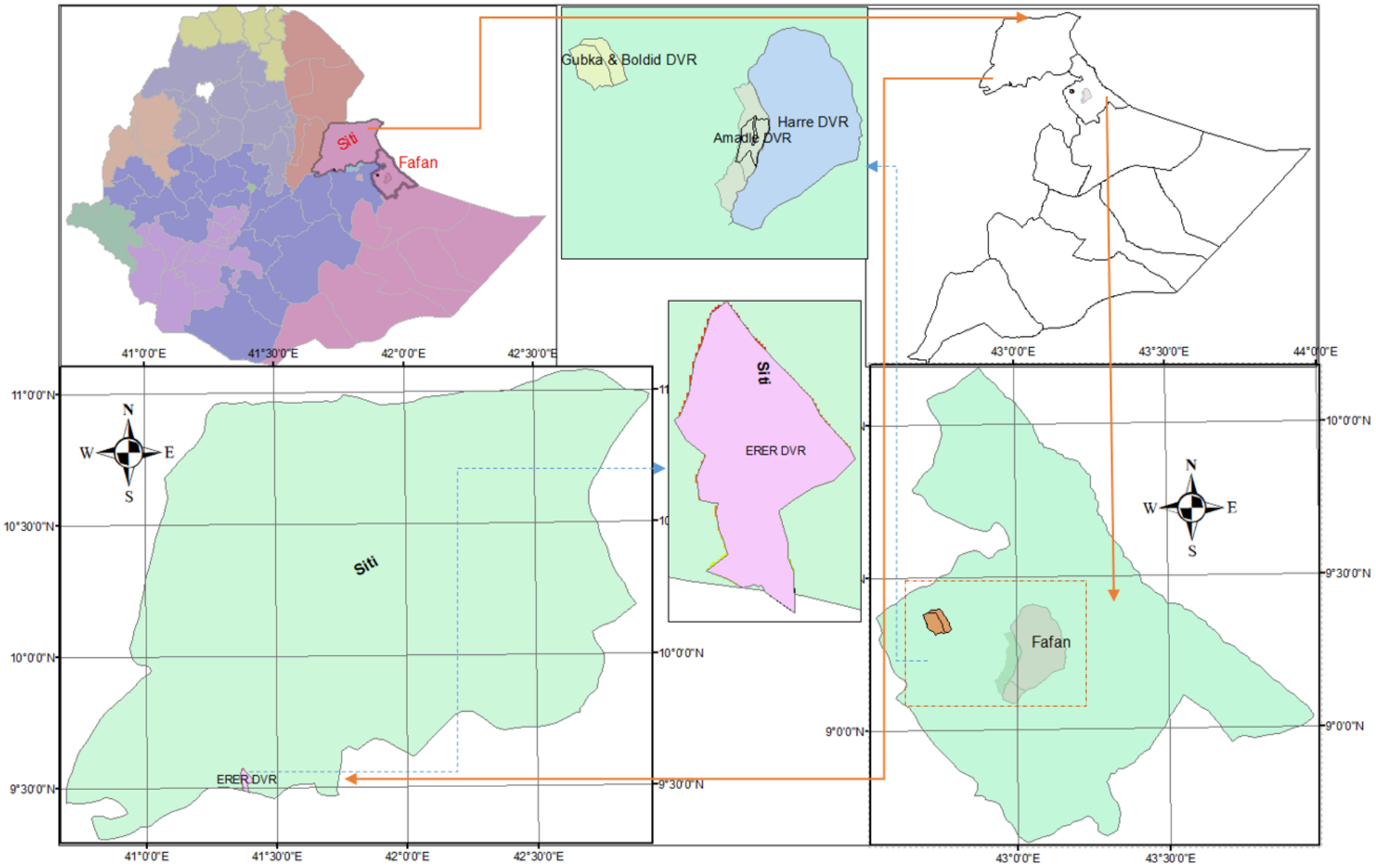


Figure 1: Location map of DVR projects

1. Amadle Dry *Valley*

It is found in Jigjiga plain at twenty kilometers from Jigjiga City, Capital of Somali regional state on the main asphalt road to Gode to ward South East direction. It is characterized by gentle slope of nearly 1% along its longest flow path is about 24km. The main source of water flow for Amadle dry valley is surface water which drains the upland of the valley.

2. Harre Dry valley:

It is found adjacent to *Amadle* dry valley separating by high latitude upland dividing their catchment. It has relatively gently slope in which the flow of water comes from flat surface with relatively in high upland. The dry valley is found on main road to *Gode* just at 10 kilometers from *Amadle* and 30 kilometers from Jigjiga City, Capital of Somali regional state. Amadle and Harre Dry valley make parts of the Jigjiga plain which form a more or less flat terrain at approximately 1700 m above sea level to the west. The plains are added up by limestones covered with a thick layer of loose materials, which are pierced through by 10 to 150-meter-high inselbergs (basalt cones and plugs). (Refer Amadle and Harre Cascaded map at the Appendix, Annex II).

3. Bolidid and Gobka Dry valleys

Boldid and Gobka Dry valleys are found in the north-west direction of Jigijiga adjacent to each other at distance of lessen five kilometers from City. They make part of the peasant associations of JigiJiga city administration of kebele 27 and 28, Gubka and Boldid, respectively. The main source of water flow of the dry valleys is nearby steep Karamara Ridge causing flash floods with a rapid and extreme flow of high water into a normally dry area.

4. Errer - Goro-Guba Dry Valley

This dry valley is found in Errer woreda, Siti zone of Somali regional State at Distance of 62 kilometers from dire Dawa and 3 kilometers from Errer town. Goro-Guba dry valley is uniquely located in the extreme north direction of Somali Region and the valley is characterized by intense gulley created due to water flow from nearby mountain. The flow of water is seasonal; mainly during rain seasons. Due to steep nature of the mountain ridges which is the source of water flow that causes Flash floods, characterized by a rapid rise in water, high velocities, and large amounts of debris and intensive soil erosion during the period of high rainfall. Moreover, the steepness of the hill side at DVR site aggravated flash floods to run with a rapid and extreme flow of high pressure causing this project most vulnerable and required an immediate project interventions.

3.1.2 Topographic features and Coverage of Dry Valley Sites

Amadle DVR site is located at WGS84 datum, Zone 38N, 931624mE-941310mE, and 1009993mN-1033064mN. The drainage area of the catchment is 9,030ha**.** The maximum and minimum altitude 1785m and 1485m above sea level respectively. The average land slope is 1.3% along the flow line of the drainage area.

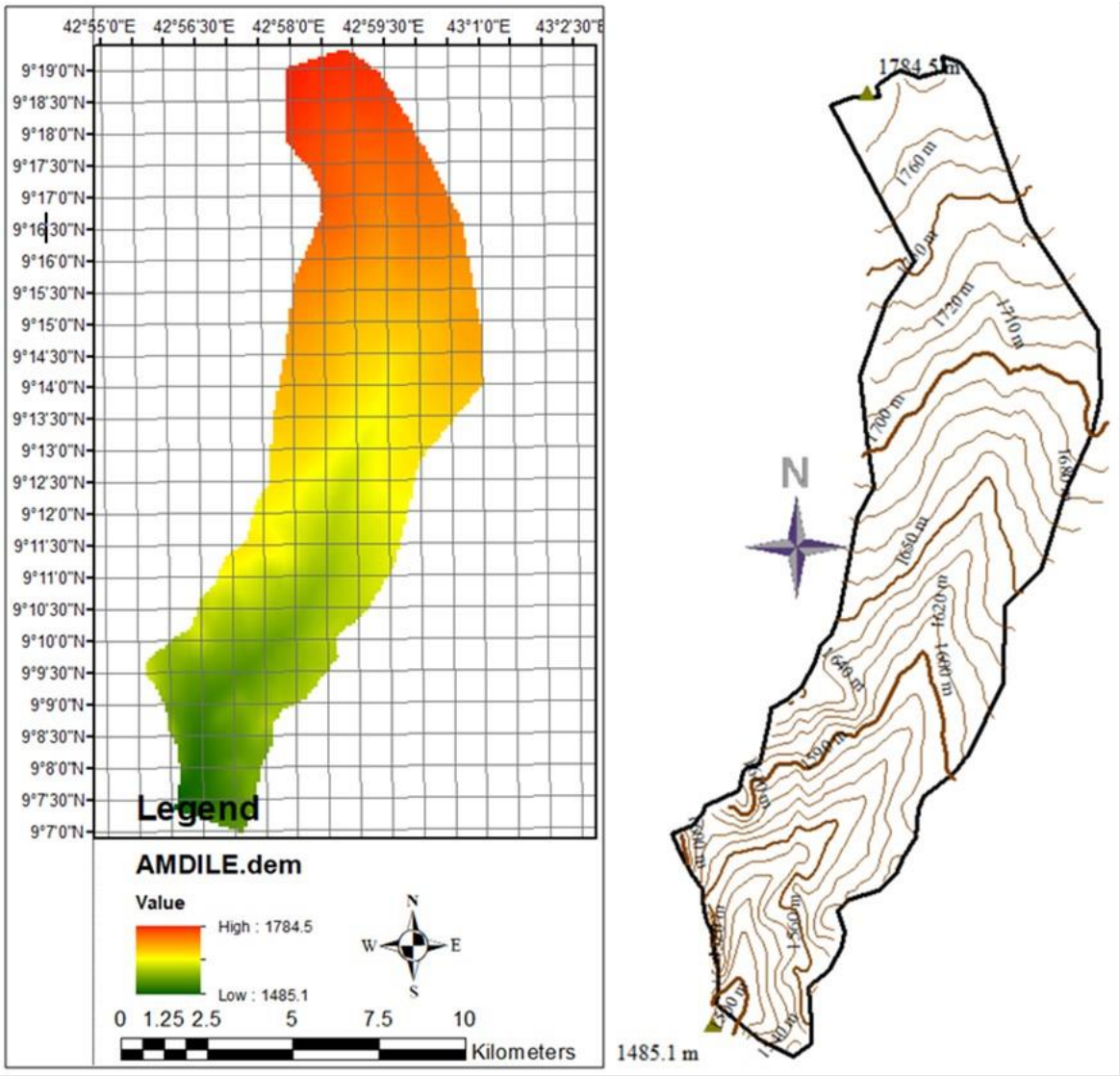


Figure 2: Amadle DVR project catchment topographic features

Harre DVR project is located at WGS84 datum, Zone 38N, 934392mE-957730mE and 1006933mN-1042696mN. The drainage area of the catchment is 47,638ha**.** The maximum and minimum altitude 1890m and 1470m above sea level respectively. The average land slope is 1% along the flow line of the drainage area.

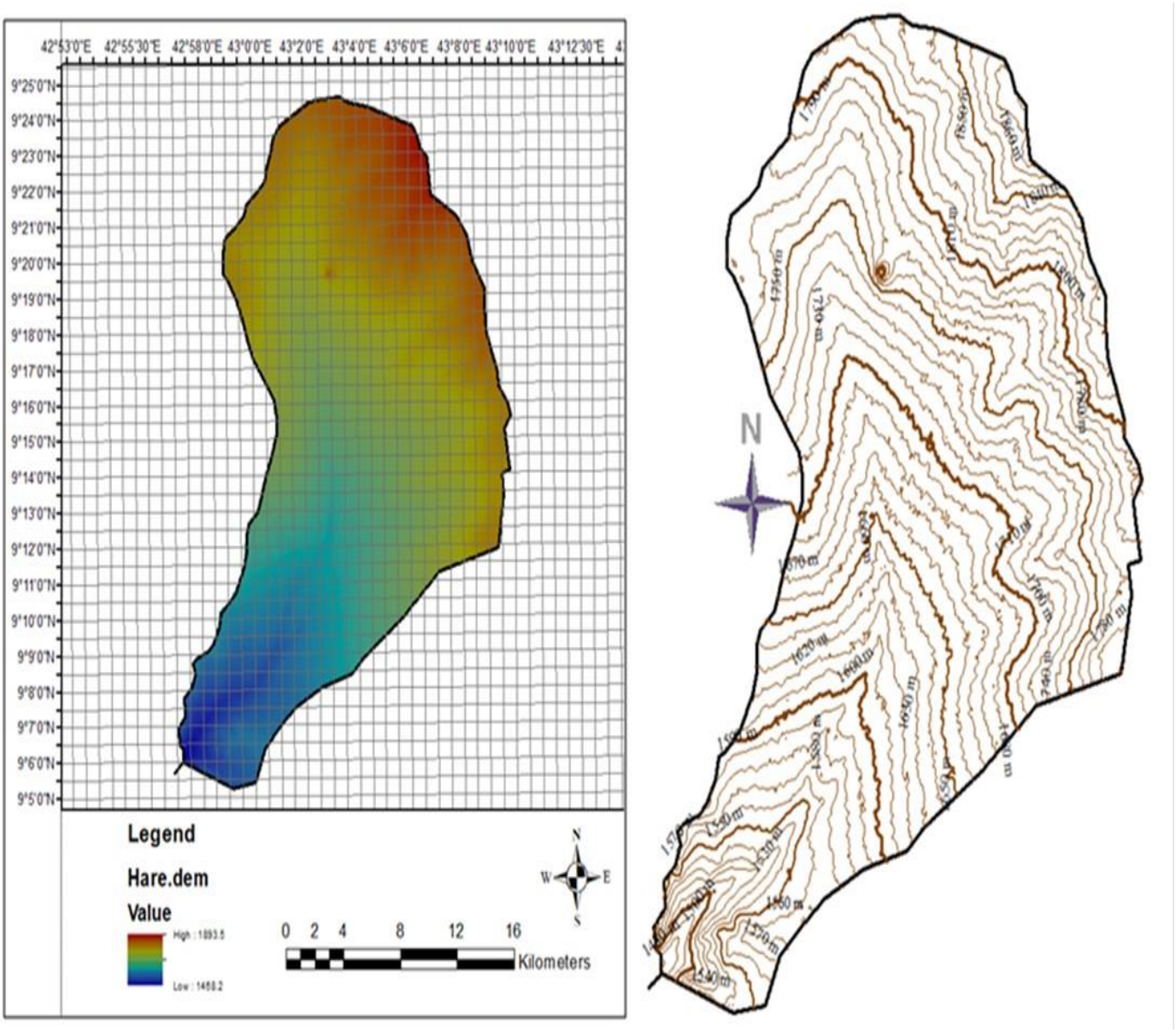


Figure 3: Harre DVR project catchment topographic features

Gobka & Bolidid DVR project is located at WGS84 datum, Zone 38N, 905713mE- 916071mE, and 1031624mN- 1040882mN. The drainage area of the catchment is 6,067 **ha.** The maximum and minimum altitude 2260m and 1620m above sea level respectively. The average land slope is 1.3% along the flow line of the drainage area.

As per the project formulation, this project is divided into two, Gobka and Boldid DVR project. Whereas, the sites are two sites located at different spatial location, but in same small catchment. Hence, here in this report, the two sites are lumped together and the drainage area that contributes direct runoff for each site has been delineated as one small catchment.

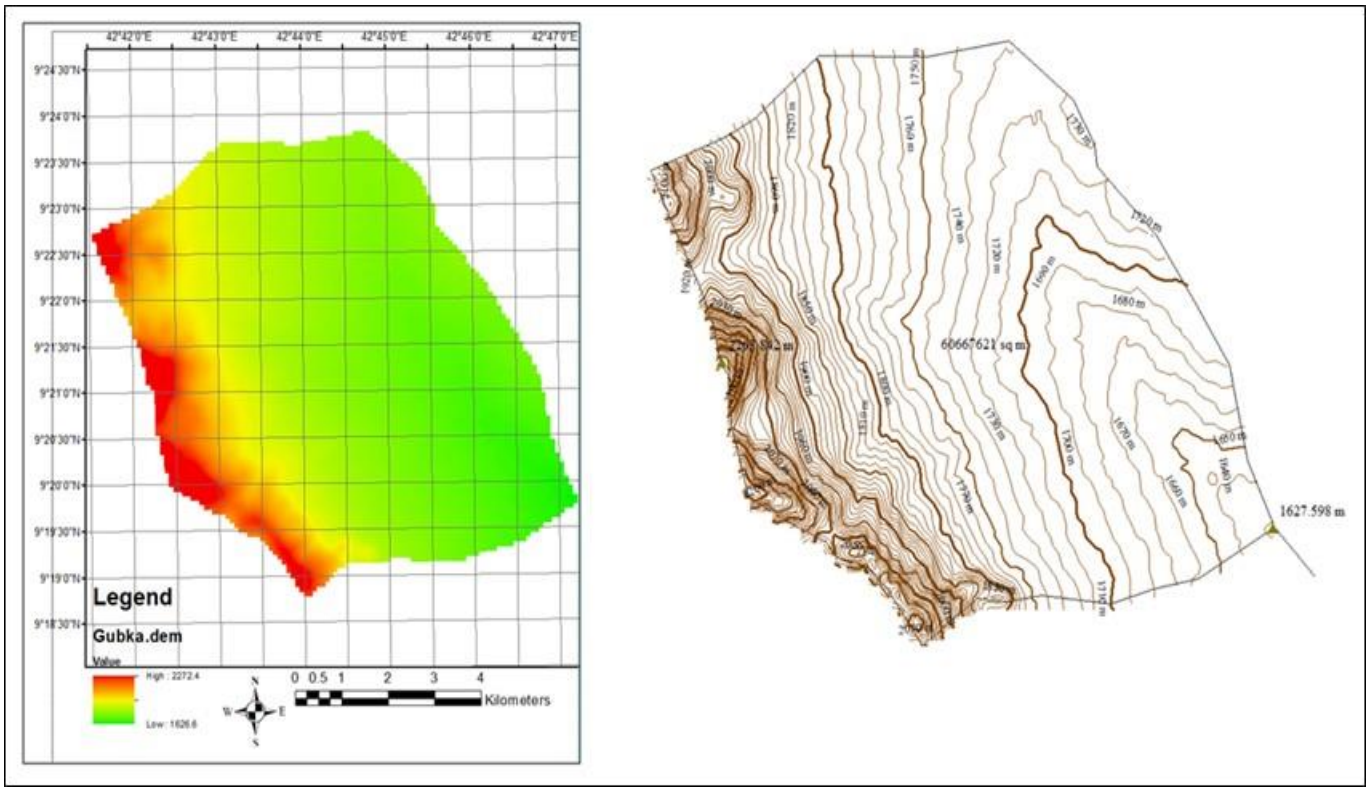


Figure 4: Gubka & Boldid DVR project catchment topographic features

Errer DVR project is located at WGS84 datum, Zone 37N, 758567mE-764522mE and 1048867mN-1059129mN. The drainage area of the catchment is **2,922ha.** The maximum and minimum altitude 1989m and 1056 m above sea level respectively. The average land slope is 10.4%, which is very steep at the upper one-fourth of the reach and slightly gentle slope at the bottom half of the reach, and the middle one-fourth is slightly steep slope.

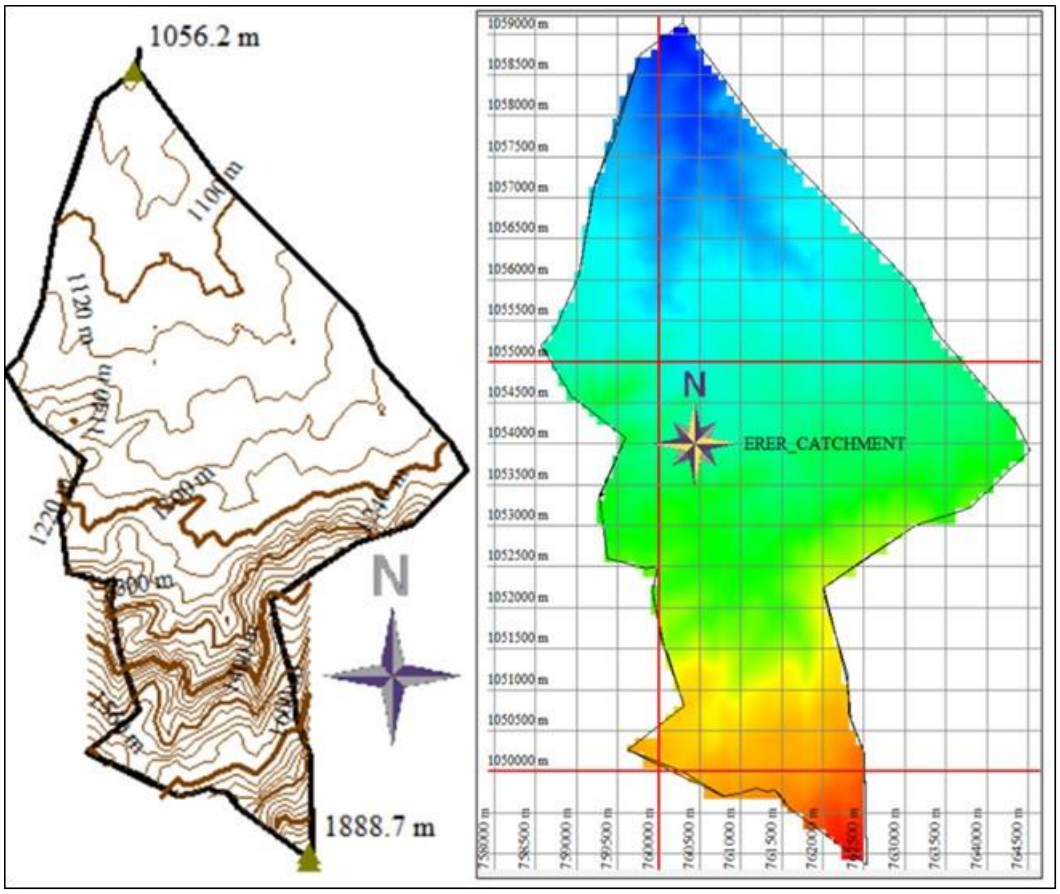


Figure 5: Errer DVR project catchment topographic features

3.1.3 Agro-climatic conditions of the Dry Valleys

Amadle, Harre , Gobka and Bolidid dry valleys have a subtropical highland climate (Köppen climate classification: *Cwb*). extremely wet and lush during rainy season, as with the rest of the Ethiopian highlands, Seasonal differences relate only to rainfall, as temperatures year-round are cool to mild in the mornings and uniformly very warm though not hot during the afternoons.

Amadle, Harre , Gobuka and Bolidid dry valleys are characterized by having a bimodal type of rainfall with an average annual precipitation of less than 200 mm in ERRER and 600 - 700 mm in areas where the rest four dry valleys located. In these dry valleys , there are the onset of the two rainfalls with varying amount resulting in two cropping seasons; the first rainy season comes as the *'dira'* rain which commences during mid-March and extends to the end of May and the second rainy season comes as *'Karan'* rain which starts during the mid of July and ends in late September making the main *meher* rains and the short *belg* rains spans from in April and June., The 'Karan' rain is normally heavier than the 'dira' rain as per the table below in these dry valleys. Both sets of rain are equally important for cultivation and maturation of crops.

According to Kasahun, 2006, the agro-ecology of the Errer where Goro Guba dry valley found includes arid (60%), semi-arid (30%), and semi-desert and rocky (10%) areas. The area is known for its harsh climate and as a result plant growth periods are short, ranging between 40 and 65 days, which is inadequate to support crop agriculture without supplementary irrigation. Hence, the growth and maturity of annual and semi-annual grasses and browses are favored (ADPO, 2004). The rainfall is bimodal which include the short rainy season from April to March (2 months) and the main rainy season from June to August (3 months). For the period 1985 to 2004, the mean annual minimum and maximum rainfall were 200 and 330 mm, respectively. Temperatures vary between 27 OC and 42 OC and the potential evapotranspiration ranges from 1750 to 2000 mm per annum.

Table 2: Thirty (30) year's average Climate Data for Jigjiga woreda and DVR project areas

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C	25.8	26.7	28.2	26.7	27.3	26.7	25.6	25.9	26.5	26.7	26.2	25.6	26.5
(°F)	-78.4	-80.1	-82.8	-80.1	-81.1	-80.1	-78.1	-78.6	-79.7	-80.1	-79.2	-78.1	-79.7
Daily mean °C	16.4	18.4	20.3	20.2	20.9	21.1	20.5	20.6	20.7	18.9	17.4	16.9	19.4
(°F)				-68.4	-69.6	-70	-68.9	-69.1	-69.3	-66	-63.3	-62.4	-66.8
Average low °C	7.1	10.2	12.4	13.7	14.6	15.5	15.5	15.3	14.9	11.2	8.7	8.2	12.3
(°F)	-44.8	-50.4	-54.3	-56.7	-58.3	-59.9	-59.9	-59.5	-58.8	-52.2	-47.7	-46.8	-54.1
Aver. rainfall mm	11	25	47	105	93	101	184	127	101	41	16	6	857
inches	-0.4	-1	-1.9	-4.1	-3.7	-4	-7.2	-5	-4	-1.6	-0.6	-0.2	-33.7
Average relative humidity (%)	49.4	46.7	51.7	61.6	63.1	64.5	63.9	64.1	62.7	57.7	49.9	50.3	57.1

Source: FAO, 2015

3.1.4 Land use, Land cover and Vegetation

1. Land cover

Land cover has an important impact on (micro) climate, biochemistry, hydrology, and the diversity and abundance of terrestrial species in a landscape. Securing a good understanding of how vegetation cover and land use practices are evolving is fundamental to comprehend land degradation processes, assess the status of ecosystems, and design strategic interventions at landscape level. In Amadle , Harre, Boldid and Gubika dry valleys major land covers are settlements, farm land, gullies and grassland. There are woody vegetation covers along mount Karamara in the upstream of Boldid and Gubika dry valleys. The land cover of Karamara Ridge stands out for its rocky surface. Vegetation is limited to some shrubs. Here, the absence of vegetation is increasing run-off rates and limiting climate regulation processes. East of Karamara Ridge, in the Gubika and Boldid dry valleys, cultivated land and grassland dominates the scenery. Agriculture in the area is rain-fed and, thus, the decision to cultivate or not is highly dependent on rainfall. Areas may be cultivated one year, but in the following left fallow allowing grassland to establish. The Gor Guba Dry valley is mainly dominated by wood vegetation and bare land with dispersed grasses in the area.

2. Vegetation coverage and Land use

Amadle and Harre dry valleys are dominated herbaceous grass cover and farm land in valley bottoms along the channel. The grass land is mainly found at the periphery of the valley bottoms mainly sued for livestock and small ruminant grazing mainly sheep and goats. Gubika and Bolidid dry valleys are mainly dominated by farm lands and woody plants in Mount Karamara.

The vegetation of the Gora Guba dry valley is dominated by woody plants with herbaceous grass cover. Encroachment of undesirable plants is indeed considered a major threat to the grazing lands in this dry valley. There is bare land under the canopy of woody plants. The herbaceous layer consisted of grass species of the genera Eragrostis, Panicum, Echinochloa, Dactyloctenium, Cenchrus, Sorghum, Sporobolus, Eleucine and Leptochloa. The woody vegetation included species of the genera Acacia, Clotolaria, Cadaba, Cissus, Commiphora, Crotolaria, Gompho, Grewia and Ziziphus. Forbs and shrubs were also present, while non-palatable woody plants such as Acacia nubica and A. mellifera and weeds such as Xanthium Abyssinia, Parthenium hystherophorus and species of the Malvaceae were observed encroaching in the different plant communities of the various rangeland types.
The following figure 6 to Fig 10, and table 3 below depicts the land use Land cover and vegetation cover of all project catchment areas.

Picture 1: Shrubs and Woody vegetation cover in Amadle , Harre, Boldid Dry valleys.

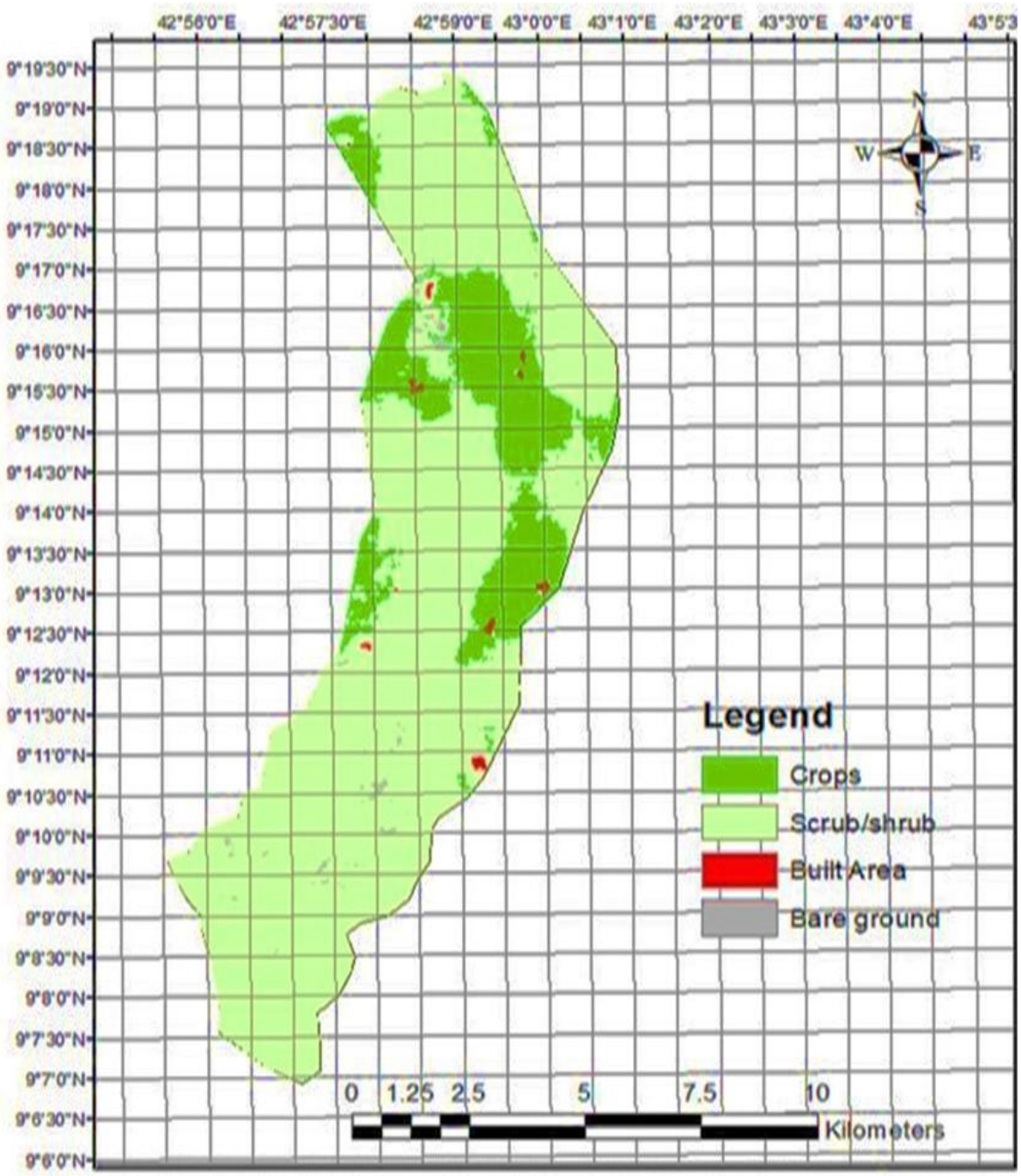


Figure 6: Amadle DVR project catchment LULC

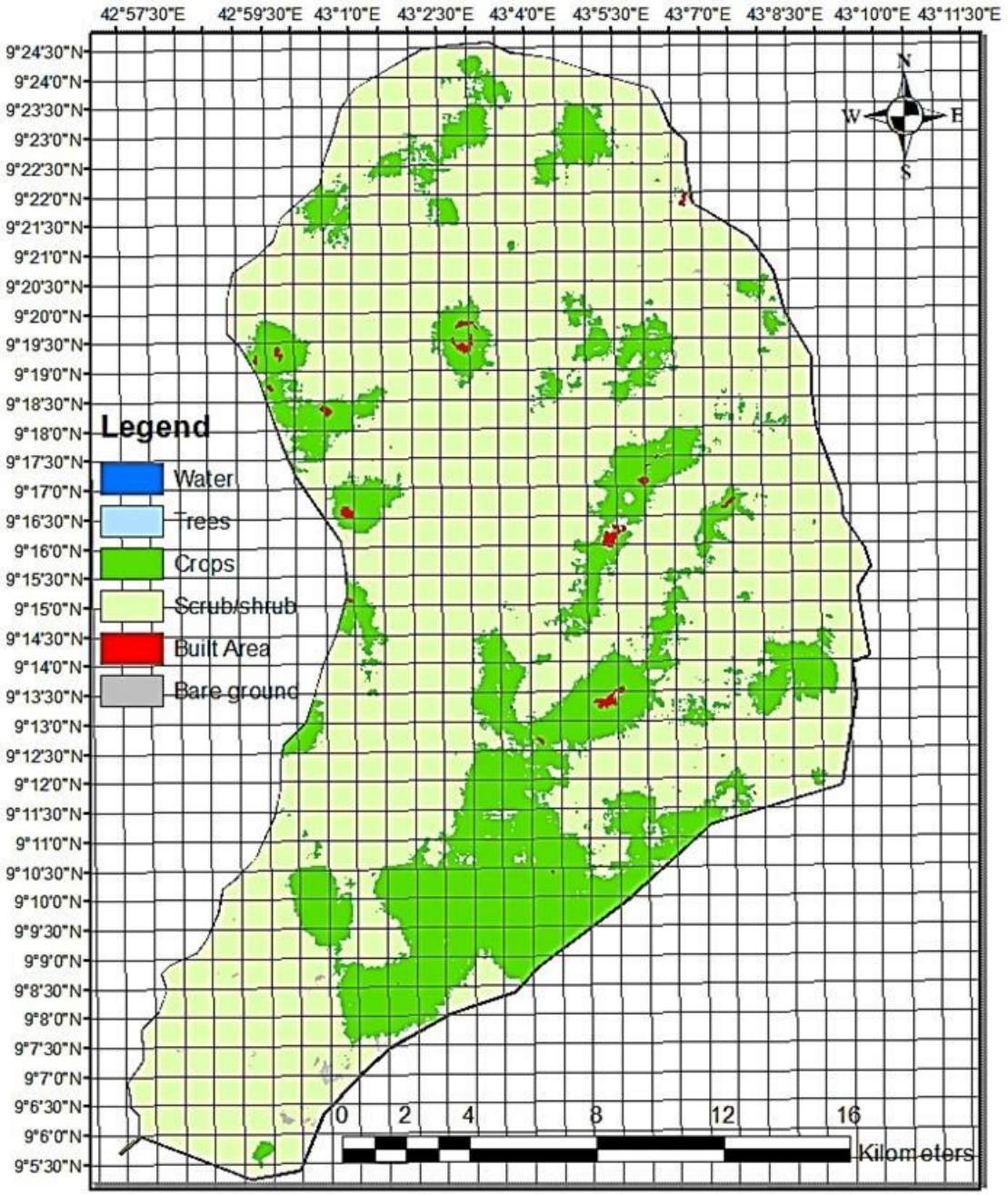


Figure 7: Harre DVR project catchment LULC map

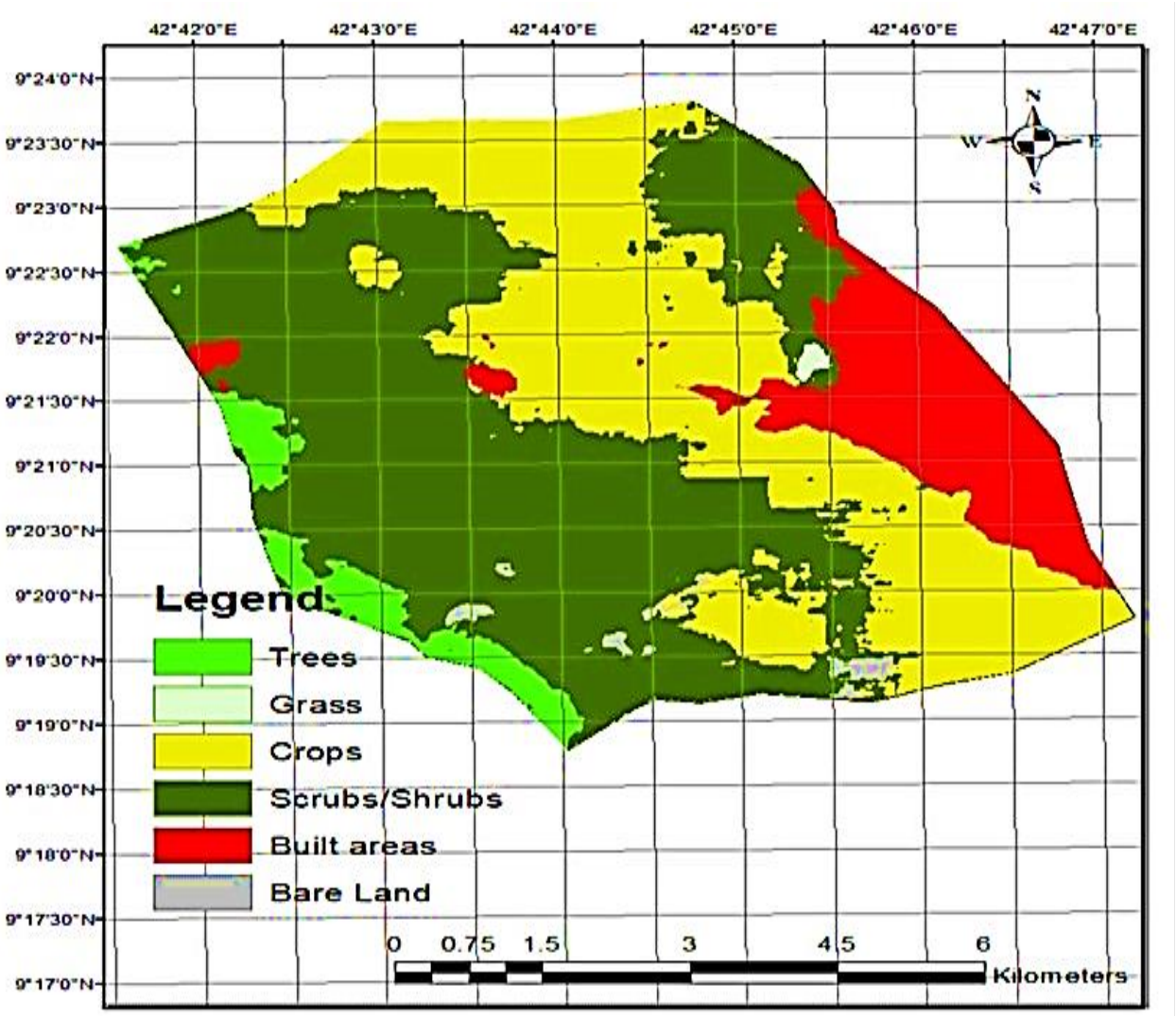


Figure 8: Gubka & Boldid Dry valley project catchment LULC

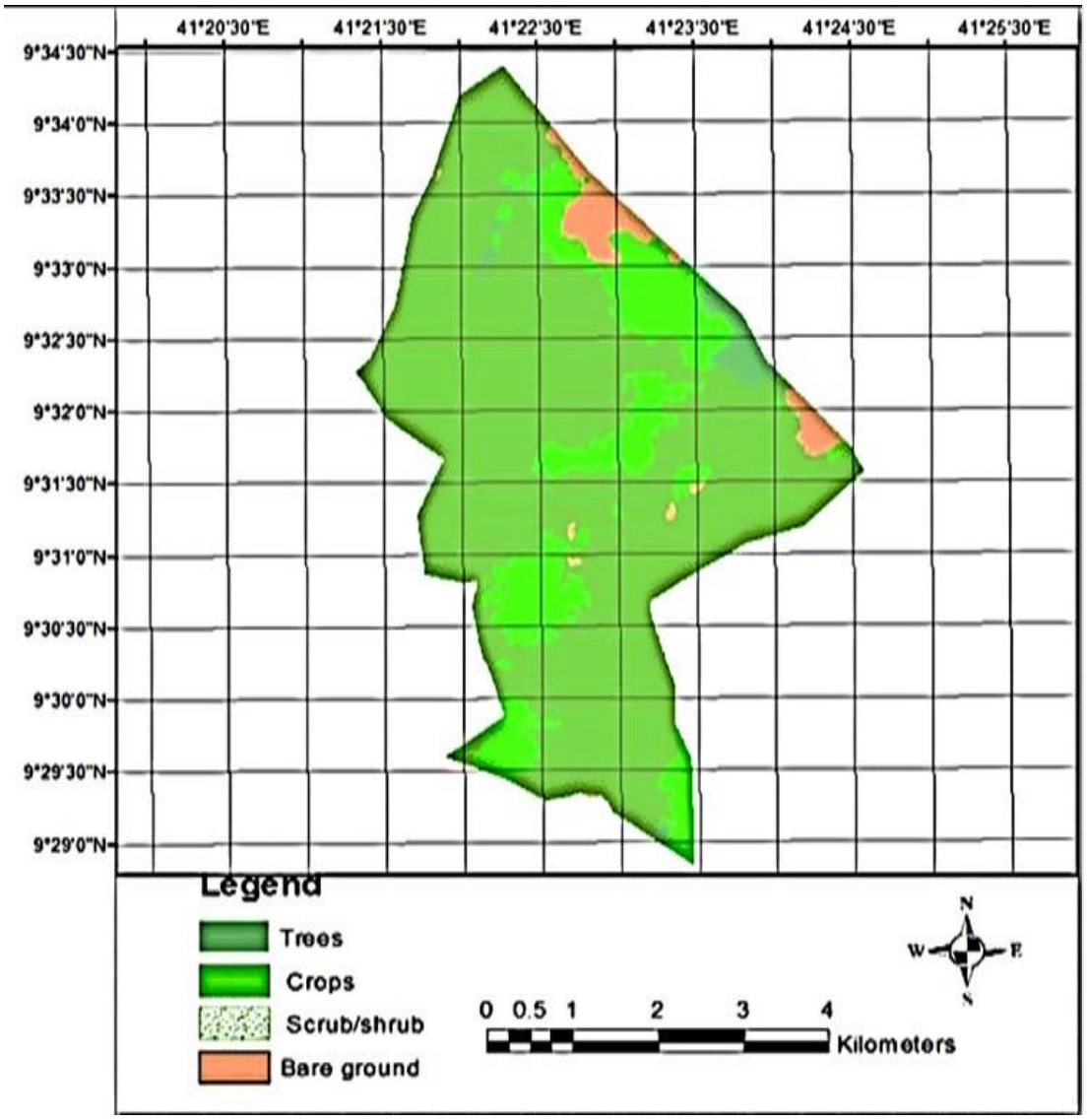


Figure 9: Errer DVR project catchment land use land cover map

Table 3. Summary of land use Land cover of all project catchments

S.No	Project Name	LULC	Area (ha)	%age
1	**Harre DVR**	water	0.69	0.00
		trees	0.08	0.00
		Crops	10,977.20	23.13
		Shrubs/Scrubs	36,250.80	76.39
		Built area	140.95	0.30
		Bare land	88.23	0.19
Total area			**47,457.95**	**100%**
2	**Amadle DVR**	Crops	1,784.10	19.75
		Scrubs/Shrubs	7,146.99	79.12
		Built area	35.03	0.39
		Bare Land	66.42	0.74
Total area			**9,032.54**	**100%**
3	**Gubka & Boldid DVR**	Trees	252.86	4.18
		Grass	11.13	0.18
		Crops	2,067.75	34.17
		Scrubs/Shrubs	2,950.10	48.75
		Built area	723.30	11.95
		Bare Land	46.15	0.76
Total area			**6,051**	**100 %**
4	**Errer DVR**	Trees	65.70	2.25
		Crops	516.05	17.66
		Scrub/Shrub	2,225.81	76.19
		Bare Land	113.93	3.90
Total area			**2,922**	**100%**

Source: Global LULC map of 2020

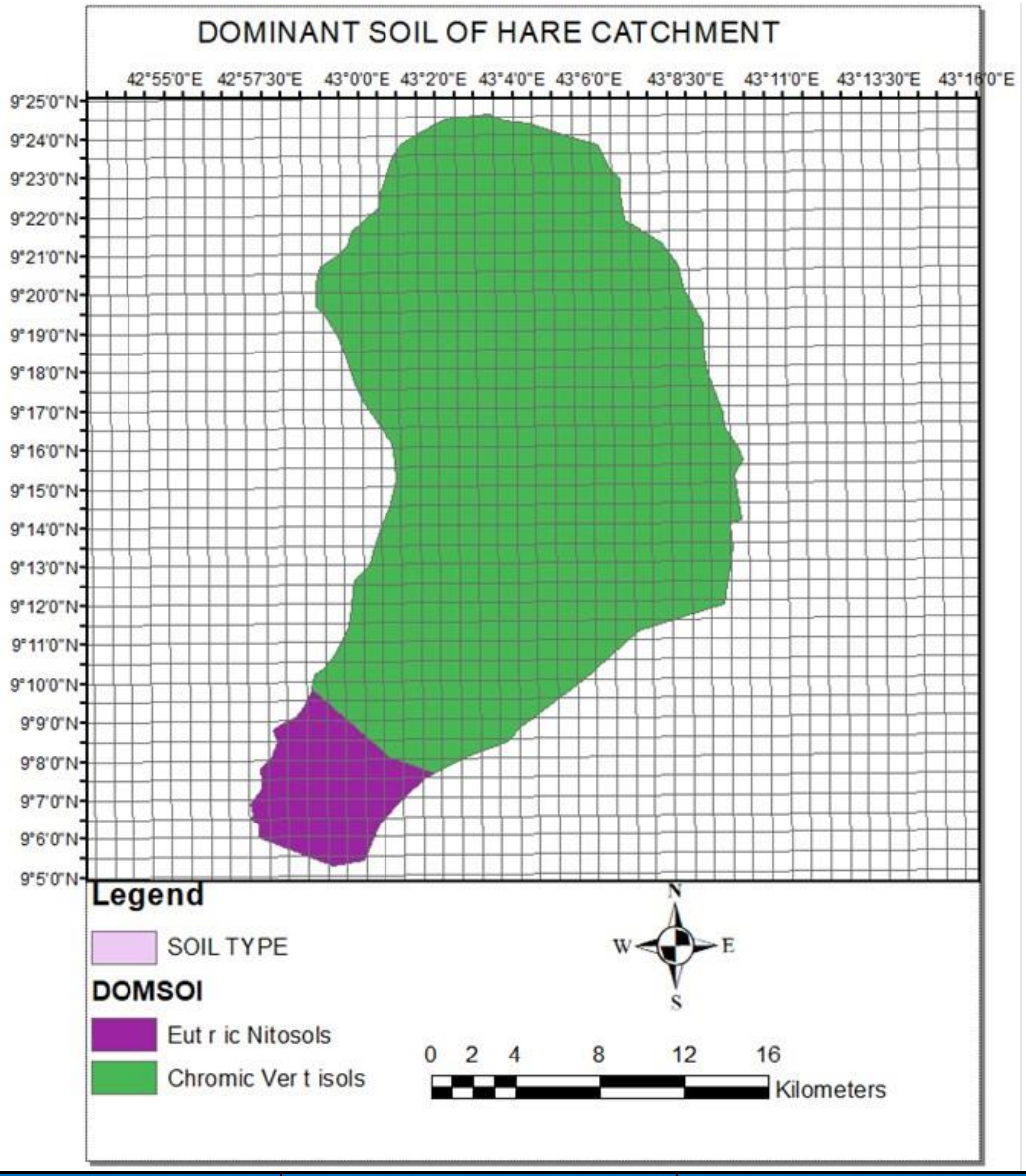
3.1.5 The Soil types

According to the FAO/UNDP (1984) classification of Ethiopian soil, the soil of the grasslands is classified as vertisols (heavy clay in areas of pronounced dry areas), mainly dark pellic vertisol and chromic vertisols and fluvisols (young soils developed in recent alluvial deposits). The soil classification for the open savannas also includes vertisols (mainly chromic vertisols) and fluvisols. The soil of the closed savannas includes nitosols (clayey red soils with argillic B horizon) and regosols without profile development and with loose soil material.

Soils of Amadle, Harre , Gubuka and Bilodid dry valleys are mostly cambisols and luvisols, which are suitable for agriculture if proper management is applied. These soils are typically well-drained sandy loams, loams and sandy soils, and are characterized by the absence of accumulated clay, humus, or oxides.

Cambisols are known for their reasonable fertility and suitability for (mechanized) agriculture (UN FAO 2009). There are also vertisols, also known as black cotton soils in Amadle and Harre dry valleys. Vertisols are normally black or dark grey soils with very high clay content. Because of the heavy soil texture and presence of expanding clay minerals the soils' range be-tween moisture stress and water excess is very narrow. The soils are sticky when wet and crack when dry. Due to swelling the infiltration capacity is extremely low, resulting in high runoff rates. Vertisols are typically low in organic matter, have a medium

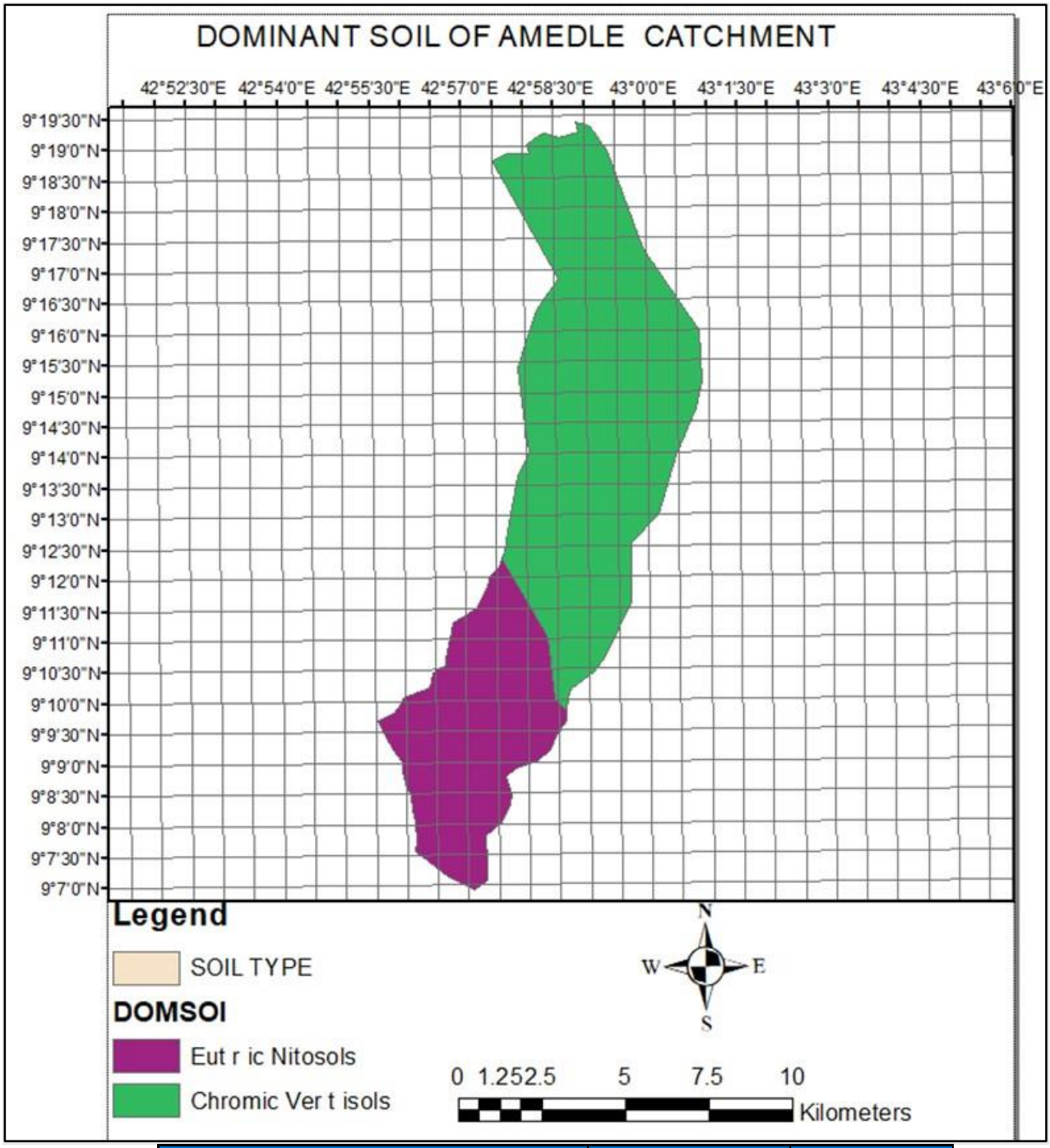
moisture storage capacity, have a poor drainage capacity, and are very prone to erosion. Patches of calcisols are present throughout the landscape. Calcisols develop on highly calcareous parent material and can be highly productive. Stoniness and dryness, however, are limiting factors. Drought tolerant crops can be grown rain-fed, preferably after a few fallow years, but Calcisols reach their full productive capacity only when carefully irrigated.



Dominant soil (FAO classification)	Area (ha)	%age
Chromic Vertisols (Vc)	43,653.90	91.64
Eutric Nitosols (Ne)	3,981.06	8.36
Total	**47,634.96**	**100**

Figure 10: Dominant soil of Amadle and Harre DVR site

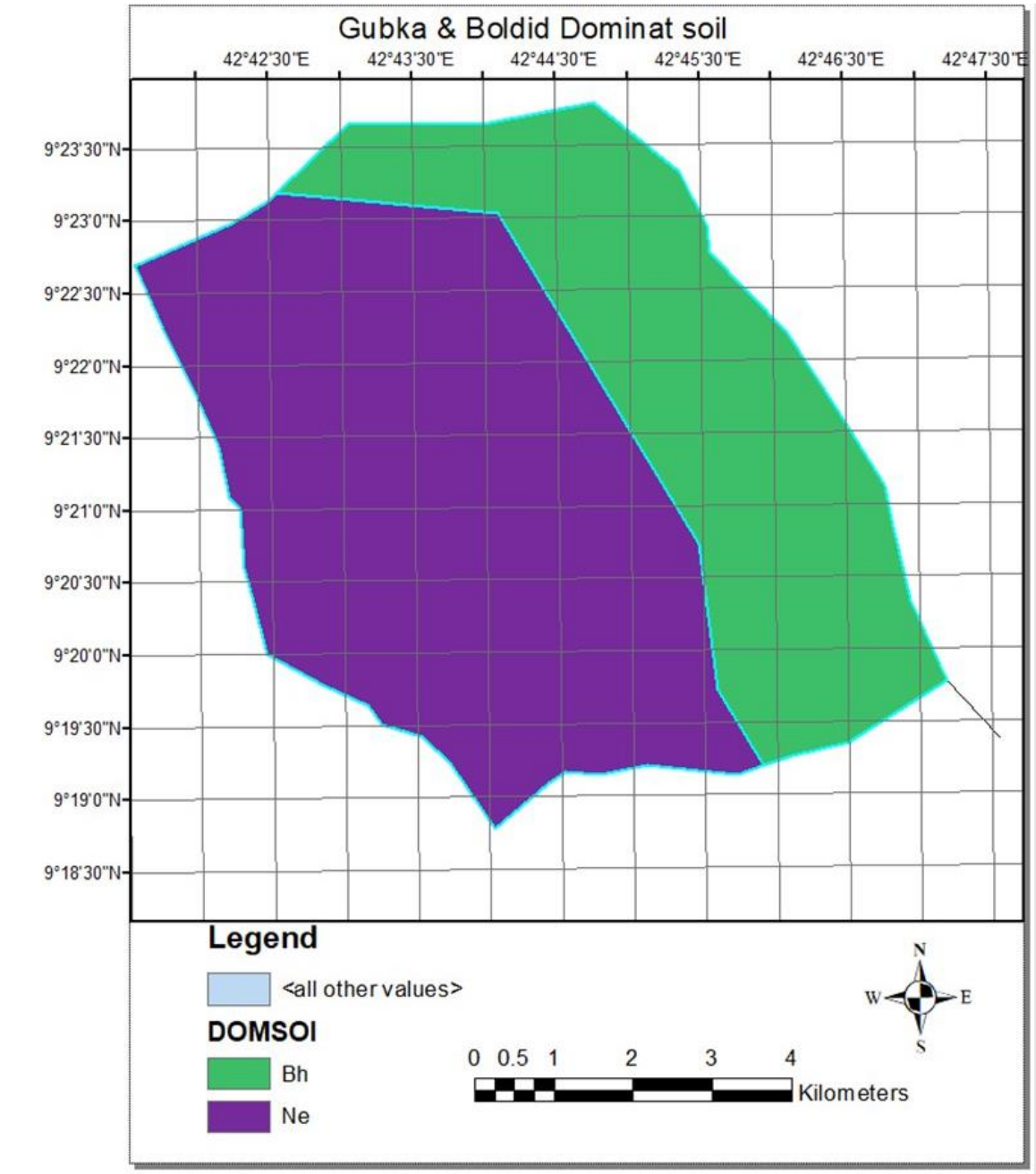
Source: Digital soil map/ FAO classification



Dominant soil (FAO classification)	Area (ha)	%age
Chromic Vertisols (Vc)	6,248.83	68.94
Eutric Nitosols (Ne)	2,814.70	31.05
Total	**9,064**	**100**

Figure 11: Dominant soil of Harre DVR project site

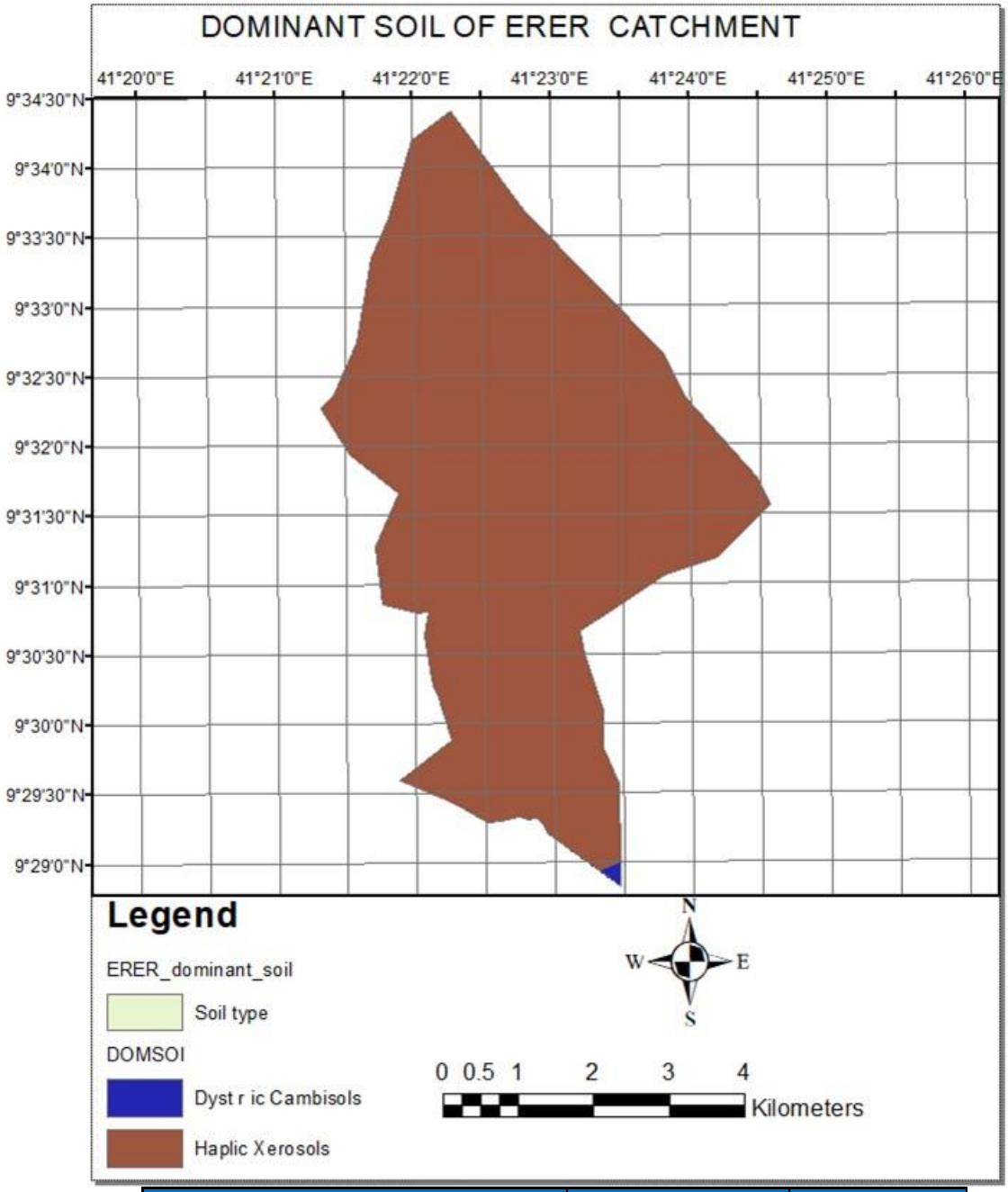
Source : Digital soil map/ FAO classification



Dominant soil (FAO classification)	Area (ha)	%age
Humic Cambisols (Bh)	2301.1328	37.90
Eutric Nitosols (Ne)	3765.2138	62.10
Total	**6,066**	**100**

Figure 12: Dominant soil of Gubka & Boldid DVR project site

Source : Digital soil map/ FAO classification



Dominant soil (FAO classification)	Area (ha)	%age
Dystric Cambisols (Bd)	4.54	0.155
Hamplic Xerosols (Yh)	2916.73	99.85
Total	**2921**	**100**

Figure 13: Dominant soil of Errer/Gor Guba DVR project site

Source : Digital soil map/ FAO classification

Table 4: Summary of Dominant soils of all project sites

Dominant soil (FAO classification)	Sand		Silt		Clay	
	sand % topsoil	sand % subsoil	silt % topsoil	silt % subsoil	clay % topsoil	clay % subsoil
Dystric Cambisols (Bd)	32.7	29.8	30.3	37.6	37.1	32.3
Hamplic Xerosols (Yh)	54.8	52.4	20.6	21.5	24.9	26.3
Humic Cambisols (Bh)	55.2	60.4	21	16.5	23.8	23.2
Eutric Nitosols (Ne)	68.4	57.8	10.5	10	21.2	32.2
Chromic Vertisols (Vc)	22.4	20.8	24.5	23.5	53	55.7

Source : Digital soil map / FAO classification, 2015

3.1.6 Settlement patterns and Land Tenure

1. Settlement patterns

Settlement pattern of Agro-pastoralist populations in and around the DVR project area has some characteristic demographic features. According to the FGD and KI interview made with target beneficiaries, settlements are showing an increasing & growing trend, fuelled by urbanization and population pressure, which currently Appreciated by the emergence of the DRV project intervention. Accordingly, during the survey, the study team physically observed scattered settlement of the community mostly at the margin of the delineated areas towards the periphery or peri-urban areas including the suburban parts Jigjiga town adjoining the project areas. Most settlement pattern of this agro-pastoralist community concentrated around potential resources (notably land within rehabilitated areas with WSW that gives them positive benefit to earn some cash income from agriculture and related activities (animal feed/forage, crop and vegetable production; improved milk production, fattening of small ruminant and petty trading etc.

2. Land tenure is a social relationship between individuals and groups or tribes consisting of a series of rights and duties with respect to the use of land. Land tenure issues are becoming increasingly important worldwide. Problems such as high population pressure, increases in resource degradation, food shortages, etc. have brought the land issue to the public's attention (Wold Bank, 1992). Therefore, land tenure has fundamental importance for efficient resource management and utilization everywhere.

Traditionally, in the whole pastoralist society of Somali Region including the agro-pastoralists in the dry valley areas, land belongs to the community is held under a controlled access system that is communal in form to a group or family that is linked by descent or cultural affiliation. The agro-pastoralist societies in the dry valleys area are more or less the same as the pastoralists where land belongs, to a group or family that is linked by descent or cultural relationship. In the Amdale, Harre, Gubka and Boldid dry valley areas which are dominated by agro-pastoralists, farmlands and land use belong to individuals, who are members of the clan or sub-clans.

In Goro Guba dry valley, dominated by the grazing land is a common property belonging equally to all members of the grazing group and natural vegetation utilization for construction and fuelwood collection are a common property belonging equally to all members of the group.

3. Gully and its intensity in dry valleys

During FGDs, it was learnt that flood is the major threat to communities living in the Dry valleys. The main causes of this flood are mainly rainfall which is intense/showery with short duration accompanied by flood with high speed and pressure resulting in degradation largely an erosion challenge prevailed in the form of gulley. **Gullies** are more found on both grasslands and cultivated lands. The rills continue to enlarge unhindered on lands. There are a number of with different size of gullies observed during field observation.

Picture 2: Photos of gullies in Amadle, and Gubuka, Boldid DVR sites

From field observation, it can be inferred that lack of appropriate soil and water conservation measures, such as contour bunds, terraces, and cut-off trenches, poor land use planning can also be the major factor broadening the extent gullies on top of rainfall nature in the area. Wind erosion is less visible but is no less detrimental than gully erosion. Wind erosion is also one of the cause's especially in Gubka and Boldid dry valley that may aggravate detaches the uppermost fertile soil layer.

In Gora Guba, Gubka and Boldid dry valley the observations indicate that erosion is largely a consequence of poor land use and management, including: overgrazing; tree cutting for wood collection, construction

purposes, fencing and charcoal production; land clearing for crop production; agriculture on poor soils and steep slopes without considering proper soil and water conservation measures; and encroachment of agriculture into flooding are-as and wetlands.

As a consequence, mismanagement can lead to severe soil loss by water and wind erosion across all types gully. Close to Jigjiga Town, a big gully causes mudslides, boreholes, houses, and power lines etc., have been destructed by the expansion of gullies (see the above pictures). To avert the problems the government has been constructing check dams and gabion enforcement walls. Seemingly these are merely relocating the problem. Also, the small stone bunds and terracing developed by communities are unable to address the ongoing erosion processes. This can signify that any conservation practices need to be integrated activities.

3.2 Distribution of WSWs, Actual & Potential Areas under the DVR intervention sites

The project is intended to develop water spreading weir technologies as a rehabilitation measure to reduce flash flood that causes big gulley and enormous soil erosion in the Dry Valley Project areas. The major ways and means applied are improvement of gully catchments to reduce and regulate the run-off volume and peak rates are alteration of runoff water upstream of the gully area, so that rehabilitate land and create moisturized areas that could be used for various production activities.

The project beneficiary and agro-pastoral communities within and around project areas were articulated that they are well aware of the benefit of the on-going construction of water spreading weirs (WSW) technology as flood control, soil and water conservation tools. They fully accepted that the technology is a good soil and water conservation (SWC) measures that could positively increase crop and forage yields, soil-water retention and increase land values. Besides, they appreciated the effort made by DVR project to participate the target community and users of the valleys, in the planning process before the commencement of construction of water spreading weirs. The following picture indicates how the WSW stabilize and rehabilitate gullies and restore lands by reducing runoff and sever soil erosions.

Picture 3: Photo-water spreading Weir technology in Gubka and Harre Dry valley project Sites

The study team has made visual observation and measured the actual and potential capacity of WSW wet/moisturized areas that have positive impact on their surrounding areas. The result of measurement of the areas under spatial coverages of each site is indicated in table 5 below. Accordingly, there are 34 WSWs that currently creates about 394 ha potential wet area, which partly under production activities by beneficiary HHs using its moisturizing effect. The study also measured the total potential area to be under spatial outreach of the DVR sites, which is about 13,220 ha. The estimated area would have good potential if sufficient moisture is retained by WSW technology, which in turn brings Significant Positive benefit to target groups. The study also indicated areas under each WSW in the respective sites that directly corresponds to the spatial coverage of Significant Positive Effects on the benefit of beneficiaries if proper support and means production including appropriate capacity building will be given during full project intervention. In line with that the project intervention through rehabilitated or restored soil and water conservation will contributed to the Significant Positive Effects of the areas.

Table 5: The Actual and Potential Area under Spatial Outreach of Significant Positive Effects by DVR site

S.No.	DVR schemes	Quantity of weirs (No)	Existing Actual command area by weirs (ha)	Potential maximum command area (ha)	Remarks
1	Amadle Scheme	13	200	2,940	if conveyance and pond is added
2	Harre scheme	9	91	4,330	if conveyance and pond is added
3	Boldid scheme	4	80	2500	if conveyance and pond is added
4	Gubka scheme	8	23	450	if conveyance and pond is added
5	Errer Scheme	-	-	3000	if conveyance and pond is added
	Total	**34**	**394**	**13, 200**	

Source: Own field observation and GPS point measurement of constructed Check dams (water spreading weirs/WSW) by consultants and Key informants, July 2021

3.3 Description of Household Characteristics and Livelihood Systems

3.3.1 Socio-demographic Characteristics of Sampled Households

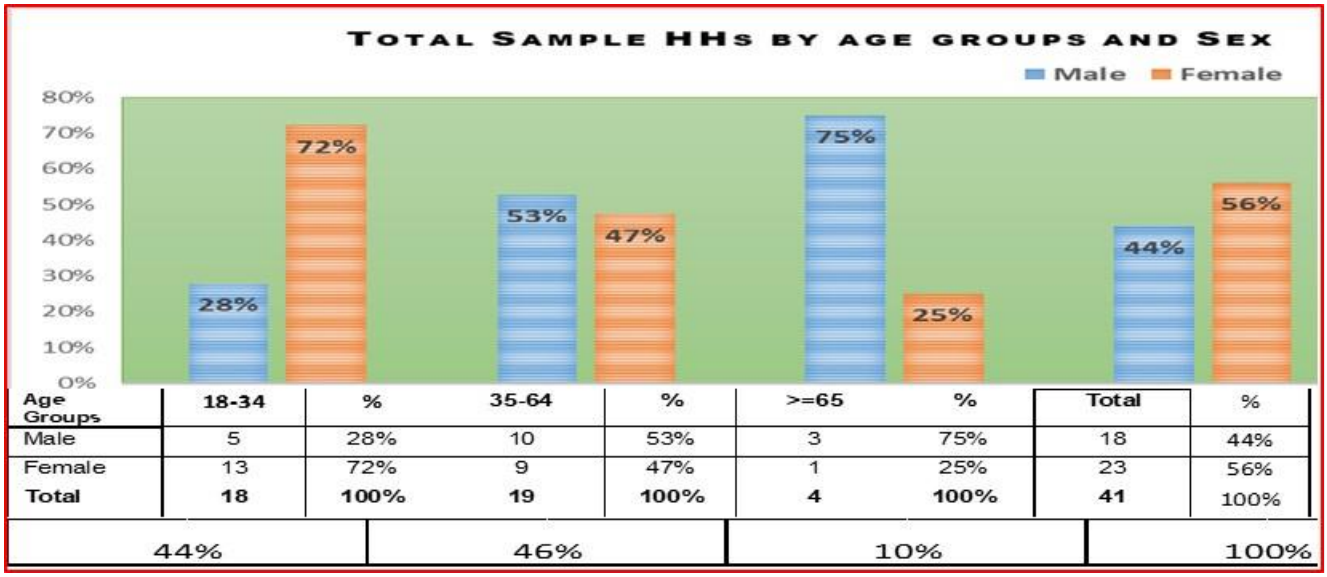
A total of 41 randomly selected sample household respondents were contacted for household interviews from the four DVR sites. The survey involved both men and women headed households comprising youth groups who are beneficiary of the selected DVR sites. Accordingly, among 41 sample households interviewed during the survey, 23 or about 56% of the total were female HHs. With regard to the size of family members there are about 344 total family members under 41 interviewed sample HHs. Table 6 below depicts details of the sample HHs.

Table 6: No of Sample HHs and total size of family members sex and proportion of females HHs by DVR site

Name of Dry Valley	Sampled HHs	Sampled HHs by Sex		Proportion of Female	total size of family members sex		
	No	Male	Female		Male	Female	Total
Amdale	11	6	5	45%	55	51	106
Harre	9	3	6	67%	40	35	75
Boldid	9	5	4	44%	50	32	82
Gobka	12	4	8	67%	38	43	81
Total	**41**	**18**	**23**	**56%**	**183**	**161**	**344**

Source: Survey result, July 2021. No Baseline survey has been conducted in Errer

With regard to socio-demographic characteristics of sample households, the result of data analysis shown that the age of sample respondents categorized into three group, where majority (90%) of the HH respondents are in age groups 35-64, while specifically, about 46% and 44% are with in age group of 35-64 and 18-64 respectively (refer the following figure 14). In terms of the sex categories, female HHs accounts for about 56% of the HH interviewed. The remaining 10% HHs are found within the age group (>=65).



Age Groups	18-34	%	35-64	%	>=65	%	Total	%
Male	5	28%	10	53%	3	75%	18	44%
Female	13	72%	9	47%	1	25%	23	56%
Total	**18**	**100%**	**19**	**100%**	**4**	**100%**	**41**	100%
44%		46%		10%			100%	

Figure 14: Sample HHs by age groups and sex proportions of four DVR project site

Source: Survey result, July 2021.

With regards to marital status of the HH respondents, on average 85.4**%** or 35 HHs are married, while 4.9% and 9.8% are reported to be widowed/divorced and unmarried respectively. The survey result of educational levels of the sample households reveals that about 80.5% of the respondents in the DVR sites were illiterate or unable to read and write, while those who read and write were 19.5%. (See table 7).

Table 7: Surveyed sample HHs by Marital Status and Level of Education (No and %) at each DVR site

Dry valley	No & %	Marital status				Surveyed HHs by Level of Education (No and %)					
		Married	Widowed	Unmarried	Total	Illiterate	Basic	Gr 1-4	Gr 5-8	> 10 Gr	Total
Amadle	No	8	2	1	11	10	0	1	0	0	11
	%	19.5	4.9	2.4	26.8	90.9	0	9.1	0	0	100
Harre	No	9	0	0	9	7	1	0	1	0	9
	%	22	0	0	22	77.8	11.1	0	11.1	0	100
Bolidid	No	9	0	0	9	6	2	0	0	1	9
	%	22	0	0	22	66.7	22.2	0	0	11.1	100
Gobka	No	9	0	3	12	10	1	0	1	0	12
	%	22	0	7.3	29.3	83.3	8.3	0	8.3	0	100
Total	**No**	**35**	**2**	**4**	**41**	**33**	**4**	**1**	**2**	**1**	**41**
	%	**85.4**	**4.9**	**9.8**	**100**	**80.5**	**9.8**	**2.4**	**4.9**	**2.4**	**100**

Source: Survey result, July 2021.

According to culturalatals.sbs.com.au (IES, 2021), in Somali culture the basic household structure is traditionally large and multi-generational family; it is customary for women to move in with their husbands' family at marriage; and therefore, a traditional Somali household usually consists of three generations: (the eldest couple; (ii) their sons, sons' wives and any unmarried daughters; and (iii) the grandchildren from their married sons.

In line with that, according to the FGDs every Somali household comprised father (husband) usually considered as head of the family, mother (wife), and children and in some family relatives such as grandfather, grandmother, and others. It has been learned from the FGDs discussion held that in every dry valley a household comprises household head that could be predominately male and rarely females. It was explained that females become head of family usually either when their husbands passed away (widowed) or separated from their husbands (divorced). Family members have traditionally established roles and responsibilities. Family heads are playing the leading roles and engaged in various economic activities. Wives/women playing vital role for the reproduction and continuation of generation. Obviously, women's role in raising children is reported very critical.

Education is a key for any form of change or transformation of the society. Education is also a vital for the positive change in the family where the level of education of every family member is a key to realize relatively better livelihood system for better life. In line with that, the data analysis indicated in the above table shows that among total interviewed households about 81% have no basic education and unable to write and read, implying the very low status of the target community with respect to universal goals of education. The FGDs result was complemented the finding from the household survey analysis result. As a result, it was used as means of triangulation to verify findings and infer the status of the wellbeing of the community in general and the women in particular. The survey result and FGDs are substantiated that it is the role of women and youth in the family are affected by the level of education of the family head.

3.3.2 Livelihoods and major Income Sources of Sample HHs

i. Existing Livelihoods Sources & major Occupations of Sample HHs

Result of the FGDs and household survey conducted in the visited DVR sites asserted that mixed farming (livestock and crop production) is the major occupation of the sample HHs used as a sources of livelihood or income in the survey areas. Accordingly, mixed farming is the mainstay of about 83% of the total HHs while petty trade also accounts to 12% respectively. Petty trade includes activities such as milk retail, sales of livestock and crop products on occasional markets and related undertakings predominantly by women, serve as a source of livelihood sources in study areas (table 8).

Table 8: Major Occupations & Livelihood Sources

DVR project	No/%	Crop Farming	Livestock rearing	Mixed Farming	Petty Trade	Total
Amadle	No	0	1	9	1	11
	%		9.1%	81.8%	9.1%	100%
Harre	No	0	0	9	0	9
	%			100%		100%
Boldid	No	1	0	8	0	9
	%	11.1%		88.9%		100%
Gobeka	No	0	0	8	4	12
	%			66.7%	33.3%	100%
Total	**No**	**1**	**1**	**34**	**5**	**41**
	%	**2.4%**	**2.4%**	**82.9%**	**12.2%**	100%

Source: Household survey result 2021

Among livestock types sheep (blackhead Ogaden species), goats, cattle and rarely camels as well as crop such as sorghum, maize, onion, and haricot beans are major items that are produced and played an important role in ensuring livelihood of the beneficiaries of dry valley areas as indicated above.

ii. Livelihoods and typical income source of women and Youths in the DVR project areas

Women participated in FGDs strongly affirmed that women can easily and efficiently created income if they have given small working capital and production assets. Nevertheless, as reiterated on the FGDs and indicated in several studies women in PAP communities have poor access to and control over production assets. The FGDs further acknowledged the meticulous and robust capacity of doing business to create income. As a case in point, even in such partial asset ownership conditions, few women who are actively engaged in livelihood diversification and IGAs and achieved significant improvement in socio-economic wellbeing and good experience in decision making ability. This shows that if there is an improvement in women accessibility to production assets and sources of livelihoods, they could supplement their household income engaging in various production activities. Moreover, women and youth in the DVR sites could generate income by engaging in various agricultural (on farm) and non-farm activities mainly cultivation of high value crops such as vegetable crops (tomato, onion, potato, etc.), fruits (mango, avocado, etc.), pulses (haricot bean), etc. These are crops that give high yield per piece of land as well as labor intensive.

By the same token, the survey result revealed existing source of livelihoods for women and youths in the dry valley areas. Accordingly, the cross tabulation of survey results indicated that Livestock Rearing and Mixed Farming accounts to 46% and 42 % share respectively and considered as a typical income source of Women, while the same survey result indicates that inversely mixed farming (39%) and livestock rearing (33%) are typical income sources of Youths groups in the DVR project sites (refer figure 15 below).

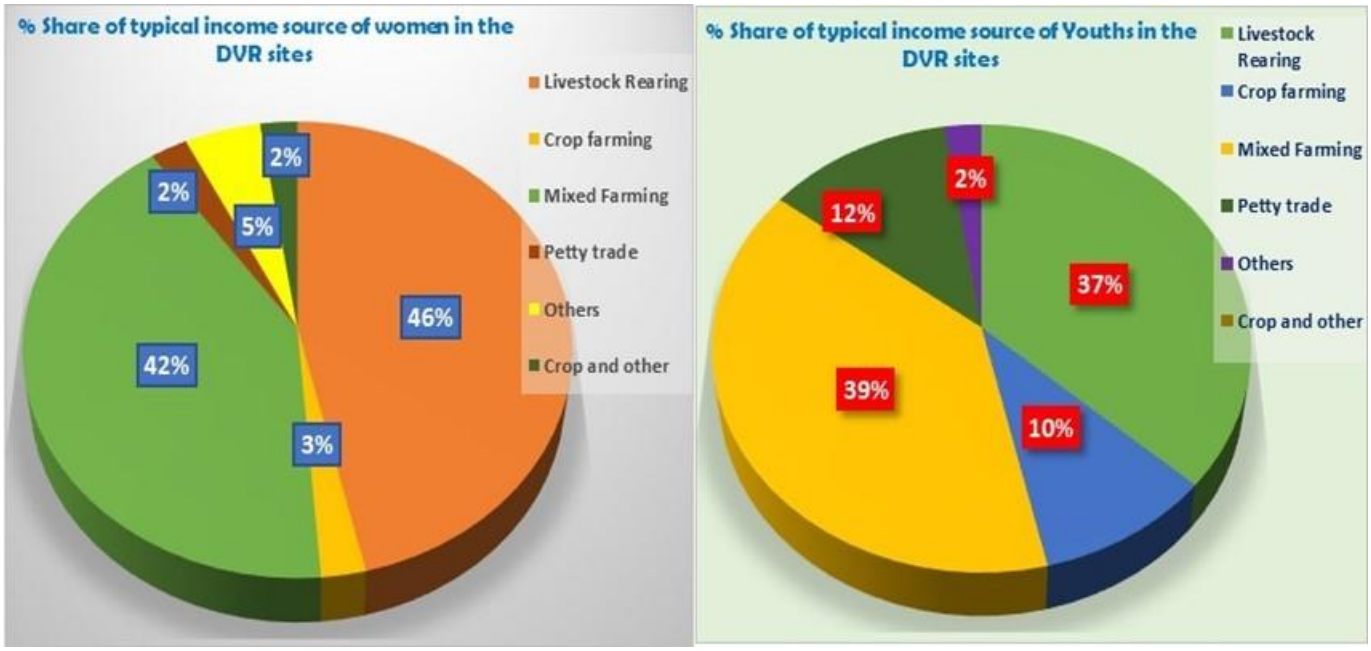


Figure 15: % Share of typical income source of women and Youths in the DVR project sites

Nevertheless, community members and FGDs participants during discussion strongly expressed that the challenge with agriculture in general and livestock and crop production in particular is associated to decline of soil fertility of farm lands caused by soil erosion. Currently, heavy flood water (runoff) wash away fertile top soils and led the land to form wide spread shallow to deep gullies in the dry valley areas. They stressed, if quick and appropriate soil and water conservation measures were not taken promptly the shallow gullies easily changed to deep and large gorges. The mentioned the envisaged DVR project would expect to control erosion through afforestation, use of appropriate soil and water conservation technologies including water spreading weir, etc. so as to reduce the ongoing the hazardous incidence of the environmental problem.

iii. Landholding system and Land Availability in Dry Valleys Areas

It has been learned from the FGDs discussion held in all visited dry valleys (except in Errer), land is privately owned, and there is no communal land particularly in Jigjiga Woreda.

According to Fiona (2011), privatization and individualization of resources can have a number of negative impacts on women: where land access have been formalized often women miss out; fences and other barriers mean they have to walk further to collect water and other resources; and the breakdown of communal support systems leave women highly vulnerable[2].

Accessibility to land is possible through inheritance or sharing from family, renting or share cropping or leasing (buying) from those who have excess land or compelled to rent or share their land due to various factors. Parents are predominantly inheriting land to their male children and rarely to female. It is assumed

[2] Changing Nature Of Gender Roles In The Drylands Of The Horn And East Africa: Implications For Drr Programming By Fiona Flintan1, December 2011

that female get access to land from parents or family of male where they would be undertaking mirage in the future.

It was expressed during the survey that in Goro Guba dry valley of Errer woreda that the system of landholding is different from the above; i.e. land is communal and belongs to one of the Somali clan called Gurgura. Here only cultivated land is privately owned and the rest of the land is belonging to the clan. In this case land accessibility is determined by the leaders of the clan and no one out of the clan is allowed to access the land in this area.

Table 9: Size of landholding by household Heads

Dry Valley	Number and /%	Size of land owned by household			Total
		< 1hectar	1-2 hectare	>3 hectare	
Amadle	%	9.1	18.2	72.7	**26.8%**
Harre	%	11.1	33.3	55.6	**22.0%**
Bolidid	%	0	11.1	88.9	**22.0%**
Gobka	%	0	0	100	**29.3%**
Total	**Count**	**2**	**6**	**33**	**41.0**
	%	**4.9**	**14.6**	**80.5**	**100.0%**

Source: Survey result, July 2021

The above table shows that majority of the interviewed households were reported to own three hectares and above (including land under homesteads, grazing parcel and farming land).

3.3.3 Gender Roles in HH Economy and Accessibility to land in dry valleys sites

i. Gender roles and women Participation in the Households

Gender roles are clearly defined in Somali where men are traditionally hold the most authority and decision-making power; and responsible for the financial well-being and safety of the family. Meanwhile, women are expected to fulfill different, complementary obligations including responsibility for acquiring and preparing foods, raising children and undertaking other domestic activities. For example; there is a Somali saying that "while a man is the head of the household, a Somali woman is the neck that helps direct the position of the head". This describes how women have significant influence in their home life. Moreover, Somali women are renowned for being entrepreneurs and business people; they are often the main income earners for their families.

Women's role in every household is numerous comprising collection of firewood, fetching water, preparing food for the family and engagement of various social and income generating activities. Children support their families engaging in various agricultural activities, being herder of cattle and small ruminants and collection of firewood.

Throughout all sectors of Somali society, parents and elders are highly respected; it is highly inappropriate for children to talk to back to or disobey anyone who is older than themselves. Most people's decisions continue to be influenced by their parents in adulthood, especially for women; and elders family members are cared for by their children and grandchildren into their old age.

ii. Accessibility to land in dry valleys sites

Detail and repetitive discussions were held regarding women and youth accessibility to land during FGDs conducted in all visited dry valleys. As stated above the major accessibility of land is through inheritance or sharing from parents. But land inheritance or sharing is culturally possible only for male children and rarely female children. If the family is only having female children, inheritance of parents' land was expressed automatic; but if they have both female and male children, the culture is favoring male than female children. Hence, the possibility of land accessibility of male youth is by far better than female youth as well as women.

In effect, the ownership of sources of the livelihood such as land and livestock are predominantly owned by men. According to Bikila Ayele (2019), there is still high gender disparity in access to and control over livelihood assets in the pastoral community; and the critical livelihood assets such as land, livestock, and household's financial capitals were more accessed and controlled by men[3].

Regarding land accessibility it is important to note that both women and youth have equal opportunity to access land for renting or leasing land as far as money required to pay for rent or lease is not a constraint. According to Fiona(2011), in Ethiopia women's rights are enumerated, discrimination is prohibited and equality of rights to use, transfer, administer and control land has been laid down in Articles 25 and 35 of the Constitution; and the 1997 and 2005 Federal Land Administration and Utilization Proclamations also support women's equal rights[4]. However, this needs further investigation to what degree such rights are protected at the grass-root level in practice and/or are reflected in policy/legislation in agro-pastoral and pastoral areas.

iii. Beneficiaries' perception of water spreading weirs (WSW)

It has been observed that water spreading weirs (WSWs) construction is started in all visited dry valleys (Amadle, Harre, Bolidid and Gobka); expect Goro Guba of Errer Woreda. It has been confirmed that no construction of WSWs is started in Goro Guba dry valley of Errer Woreda. The construction WSWs started in initially in Amadle and expanded to the rest of the dry valley sites indicated above.

The beneficiary's perception about the WSWs is very positive. The FGDs discussants expressed that commencement of the construction of WSWs is not only beneficial to the present beneficiary households but it can be extended beyond present beneficiaries and vital to save the future generation. Moreover, they stated that the benefit is not only limited to a single locality or region but possibly linked to the national and the global level as it is in one way or the other linked to protection of the environment or conservation of soil and water. They expressed that construction of WSWs contributed a lot to conserve soil and water in the dry valleys. They witnessed that as a result of the construction of the WSWs, the fertility, or quality of soil shown improvement within this short period and rain water infiltrate deep in to the soil and the water table has risen. Moreover, the construction of WSWs created alternative employment opportunity for the

[3] Revisiting The Status Of Pastoral Women's Access To And Control Over Livelihood Assets; Evidences From Fafan Zone, Somali Region, Ethiopia; Bikila Ayele, 24 April 2019

[4] Ibid(2)

beneficiaries of the dry valleys as some of them trained as local Crafts Men and Mason and gained additional skill because of the commencement of construction of WSWs.

Generally, the contacted community members and others asserted that water spreading technology is vital and have multiple advantages comprising cconservation of soil and water, increasing soil fertility/quality which is key for the increment of productivity of crops and livestock; which essential to deter people migration to towns and other places. WSWs construction seems costly but its positive impact on soil and water conservation is immediate or showing fastest response. The technology implemented in the region involving all the beneficiaries and pertinent government actors. The points raised as limitation were that the technology is expensive and land is privately owned in Jigjiga areas and others who don't have land can't easily get access to land unless and otherwise rent/lease it.

iv. DVR as an alternative source of income generation

Construction of WSWs has several benefits including conservation of soil and water which is essential to broaden income generation opportunities for the beneficiaries of the dry valleys comprising women and youth. According to the information from GIZ similar intervention or experience in West African Countries (GIZ,KFW,2012), the construction of WSWs in dry valleys realized several benefits among many others: (i) rainwater infiltration enables the water table to increase and as a result average depth of water table in the valleys decreased from 12.5 meters before intervention to 3.5 meters after intervention; (ii) possibility of harvesting during dry season (after main harvesting) is possible or after rehabilitation of dry valleys as many as three rounds(crops) a year could be grown in most of the valleys (a rainy season or rain fed crops, a post rainy season crop and a third irrigated crops that can be watered from shallow wells thanks to replenished water table) ; (iii) the possibility of owners give land to others after one main harvest increased and served as sources livelihood for others unemployed or job less including women and youth; and (iv) WSWs have far reaching positive ecological, economic and social aspects as they influence the local community and contribute to the emergence of local centers of growth (for example; Amdale).

Moreover, the rehabilitated dry valleys are suitable to grow different types of fodders and the crop aftermath (residue) used to feed dairy cows and goats as well as best option to undertake fattening shoats and cattle. It is expected that similar intervention could create similar benefits in these study areas. This is tangible fact that substantiate the rehabilitated dry valleys have multiple benefits to their respective residents. In the study areas the dry valleys rehabilitation could serve as a new income generation option for all the target groups in general and enable women and youth to be engaged in various income generating activities in particular. But to properly exploit the positive opportunity created, it is imperative to provide targeted extension services and awareness creation to the community so that this resource or opportunity would be properly and fairly (equitably) utilized. There are traditional factors that impede women and youth access to sources of livelihood mainly land. This has to be reversed and resources need to be fairly utilized by the community members. All beneficiaries expected to exert all round efforts to make the rehabilitated dry valleys center of growth within the shortest possible time; for example, to start with Amdale and expand to others.

4. Characterization, Estimation of Spatial Outreach and Target Numbers by indicators 1.1 and 1.2

4.1 Estimation of Catchment area and Spatial Outreach of significant positive effects of the DVR Measures

4.1.1 Estimation of total Catchment area of the DVR sites

During the field work at each DVR project sites, the study team considered the following important criteria to estimate and delineate the total catchment areas of each DVR intervention area. These are standards for controlling gully, geomorphological and hydrological nature of the dry valleys, social and economic natures of the dry valleys and anticipated watershed development and management activities that need to be carried out in the next phases of the project. On other hand, gulley formation as a result of flood depends on various factors of the valley landscape and human activities that need to be taken into consideration during rehabilitation and provision of other conveyance structures and ponds for water storage. The rehabilitated areas reinforced by other structures will also have significant positive impact and enhance the number of beneficiaries and the area to be under production activities (cultivated). Furthermore, the reserved water in ponds can also recharge the ground water raising the water table to shortest depth enabling to dig the shallow wells that serve for human and livestock watering which is another dimension of the significant positive benefit of the project.

In this study, Digital Elevation Model (DEM) in GIS environment was used for modeling of flood events. The dry valleys total catchment/ drainage or entire watershed areas and their respective Spatial Coverage of was measured and delineated by GIS and the DEM software *(refer part 2, section 2.1 and point v for detail*). Once a total catchment areas of each intervention areas are obtained, the Spatial Outreach of Significant Positive Effects at each dry valleys could be estimated based on expected benefits as a result of improvement in moisture availability, soil fertility, and land rehabilitation by the project given the provision of various means of production and services to beneficiaries in the sites. The total catchment or drainage area that covers the entire watershed and drainage areas of all dry valley sites are measured as the sum of the length between GPS points *(refer part 2, section 2.1 and point v for detail*) of all sites and add up to about 65,463.49ha. More specifically, the catchment area of each DVR site has been measured and indicated in Table 10 and Fig. 6 to 9 above. Accordingly, **Amadle** dry valley has a catchment area of 9,032.54 hectares of land, while **Harre** site has the largest catchment area that covers about 47,457.95 hectares of land.

This site has greater outreach coverage due to very genteelly slope around 1% that extends for about 24kms from its upstream to remotest downstream area where the last water spreading weir (WSW) was constructed in the valley bottom. Bolidid and Gobuka Dry valleys are found adjacent it each other separated by main road from Harrer to Jigjiga. The total area coverage of the valleys is 6,051hectares of land. Goro-Guba or Errer Dry Valley has total area coverage of 2,922 hectares mainly dominated woody vegetation.

Table 10: The total Catchment or Drainage area by DVR sites

S.No	DVR site	Area (ha)
1	Amadle DVR	9,032.54
2	Harre DVR	47,457.95
3	Gubka & Boldid	6,051
4	Errer	2,922
	Total	**65,463.49**

Source: Survey result July 2021

Note: The catchment or drainage area of each project has been delineated and measured using arc hydro tool which is an extension of Arch GIS software and 30m 30m resolution digital elevation model (DEM);

4.1.2 Estimation of the Spatial Outreach of significant positive effects of the DVR Measures

Estimation of the Spatial Outreach of Significant Positive Effects of each dry valley sites indicates an areas that the target HHs (direct beneficiaries) can accessed to work and/or reside and get considerable positive benefits in terms of additional income and other livelihoods options that contributed to their household economy in that particular DVR site. The positive effect of the project could be raised as a result of the emergence of newly introduced livelihood options due to DVR interventions measures. All the positive effect could be created as a result of rehabilitation and restoration of natural resources through physical land rehabilitation measures complemented by soil erosion prevention using vegetative measures and the water-spreading weirs (WSW) technology, etc.

The result of measurement of the areas with actual and potential spatial outreach of each site is indicated in table 5 above. Currently, there are 34 WSWs that actually creates about 394 ha rehabilitated area under the 4 DVR sites, which mostly under production activities by beneficiary HHs using its moisturizing effect. The rehabilitated dry valley area under each 4 sites was 91ha, 200ha, 80ha, and 23ha for Harre scheme, Amadle scheme, Boldid and Gubka scheme respectively.

On the other hand, the study team also measured the potential spatial outreach of each the DVR sites, which sum up to about 13,220 ha. The estimated potential area could have good prospective if sufficient number of WSW technology would be constructed at proper place in each DVR site. Specifically, if canal or conveying structure and ponds are added to water spreading check dams at the proper site, the current potential area in the DVR intervention site will be doubled or tripled. This will definitely boost the efficiency of each scheme in such a way that it will significantly increase the size of command area that can be watered from the scheme and the number of users from the schemes.

Generally, if properly implemented, the DVR measures could bring significant positive changes on the income of target beneficiaries, in addition to its impact on environmental, economic, social, and bio-physical conditions of the project sites that in turn enhance production and productivities of agriculture and related activities.

4.2 Assessment of Land Use and Access Rights in the DVR project areas

There is inbuilt social structure among agro-pastoral and pastoral communities that land tenure is a social bond between individuals and groups or tribes consisting of a series of rights and duties with respect to the use of land. Land tenure issues are becoming increasingly important worldwide. Problems such as high population pressure, increases in resource degradation, food shortages, etc. have brought the land issue to the public's attention. Therefore, land tenure has fundamental importance for efficient resource management and utilization everywhere.

Traditionally, in the pastoralist society of Somali Region land and rangeland resources are belongs to communal groups, clans, and Communities. However, in the agro-pastoralists and some farming communities including the surveyed DVR areas, land is privately owned except Goro Goba of Errer woreda. In Goro Guba land belongs to the community or clan. The agro-pastoralist societies in the surveyed dry valleys area are different from the pastoralists where land belongs to a group or family that is linked by descent or cultural relationship. In the Amadle, Harre, Gubka and Bolidid dry valley areas are dominated by agro-pastoralists, farmlands and land use belong to individuals, who are members of the clan or sub-clans. In Goro Guba dry valley, dominated by the grazing land is a common property belonging equally to all members of the grazing groups while natural vegetation utilization for construction and fuelwood collection are also common property belonging equally to all members of the groups. In these dry valleys, Youth are get access to land mainly by inheritance from their fathers. But they can also *access through lease and* rent if they need for different purposes.

With regard to *access rights* in the areas expected to have positive impact of DVR project at Amadle, Harre, Bolidid and Gobka areas, the surveyed households confirmed that construction of WSWs *(Water Spreading Weir*) conserved soil and water as well as improved the fertility /productivity of land. Hence, as fertility of soil (land) improved, more ground water, more soil moisture available to plants, more and longer-lasting bodies of surface water and floodwaters conserved confirm that the positive impact of the DVR technology such as WSW increase to the extent a piece of land cultivable up to three times per year. The next picture is a good indication that construction WSWs is showing good progress in conservation of water and soil within shortest period of time.

Picture 4: Picture- Water and soil conserved captured during field survey in one of the WSWs at Harre & Amadle

In connection to this point it is imperative to review similar intervention carried out as a result of construction of WSWs several economic and other benefits realized comprising an additional irrigated crop is possible, higher productivity of rain fed and post- rainy season crops, more arable land available, diversification in crops is possible, reduced costs for water wells construction, easier access to water for drinking and watering livestock and more natural vegetation and greater biodiversity were realized. It is believed similar benefits could be harvested by the beneficiaries of the DVR areas stated above.

It is assumed that the possibility to cultivate three times would be created as a result of WSWs intervention which requires more labor most probably beyond the capacity of a single household. When a household failed to cultivate the land three times per year due to various factors including shortage of labor and other inputs, this would create an opportunity to rent or lease or share the land to others including unemployed rural youth and needy women. It is confirmed that the WSWs intervention increases the fertility

(suitability) of land for various crops such as cereals, vegetables, fruits, variety of animal feed, etc. For example; the next picture is a widowed female (family head) who planted mango seedlings in addition to sorghum on her piece of land positively affected by the DVR in Amadle site.

Picture 5: A widowed woman having 5 children planted mango seedlings and maize crops at Amadle DVR site

This all reveals that more people are benefited as the land becoming productive or the areas treated by DVR project are expected to enhance production and productivity that create positive impact of DVR areas. This increased demand and higher accessibility to land with others who are land less or having shortage of productive land. It is suggested that as productivity of land increased access to land for others will improve even under prevailing land access rights.

4.3 Assessment of HHs and family structures Accessing areas with expected Special outreach (Coverage) of positive impacts

Analysis of baseline data result shown the demographic and household characteristics of the surveyed HHs in each dry valley except Erre site, where there no baseline survey due to various problems including conflict. The household structure comprises father (husband) usually considered as head of the family, mother (wife), and children and in some family relatives such as grandfather, grandmother and others. It has been learned from the FGDs discussion held that in every dry valley a household comprises household head that could be predominately male and rarely females. It was explained that females become head of family usually either when their husbands passed away (widowed) or separated from their husbands (divorced). Family members have traditionally established roles and responsibilities. Family heads are playing the leading roles and engaged in various economic activities. Wives/women playing vital role for the reproduction and continuation. From household survey analysis it shows that the numbers of female

household members are high inferring the significance of involving these group in any development endeavor.

The consultant team together with local /kebele chairman, kebele manager, & DAs of each sites were tried to estimate potential number of target HHs and their respective family members who could benifited within expected Special Coverage of the DVR sites. The estimation of these potential target population of the project was made with the involvement of of key experts, DAs, and kebele and clan leaders during the FGDs in each DVR sites, where available information and evidences, including lists HHs obtained from the surrounding kebeles, or clusters of DVR sites. This estimated number of the potential target HHs of all the 4 project sites including Errer/ GoroGuba was endorsed with local and kebele leaders, but not verified with CSA population data, as the population projection by Statistical Authority was made at woreda, zones, and regions levels.

As a result, the total potential target HHs and their respective family members of all the project sites were sum up to about 393 HHs and 2,308 (1216 male and 1092 female) respectively. These population could be expected to be potential beneficiaries who can access areas with expected Special Coverage with positive benefits in each DVR site in the coming years if the project continues expanding to full stage. The study revealed that these households and their family are potential population, not currently benefited as direct beneficiaries from positive impact of the DVR project measures.

Nevertheless, during the physical field observation made by the consultants at each site, the above estimated households and their respective family members (population) are not fully benefitted by direct positive impact of the DVR measures currently, but are expected to be prospective target beneficiary who would be benefited when the DVR project will fully executed. Refer the following table for target prospective population.

Table 11: Estimation of HHs and family members accessing expected positive effects within Special Coverage

Dry valley site	Estimated Number of Total population (Family members) of Project areas			
	HHs	male	Female	Total
Amdale	78	243	225	**468**
Harrey	90	286	254	**540**
Boldid	75	275	176	**450**
Gobka	100	282	318	**600**
Errer	50	130	120	**250**
Total	**393**	**1216**	**1092**	**2,308**

Source: Estimated based on the information given by local /kebele chairman, kebele manager & DAs of each sites and substantiated by evidence (on list of HHs) with the respective DVR sites, July 2021

Note: The total potential target HH and population of the project areas was estimated based on the information given by local /kebele chairman and kebele manager, & DAs of each project sites and substantiated on the discussion and evidence of registered list of HHs by villages and/or clusters. The respective average family size was about 5.87 per HH which is equivalent to average 6 used by regional offices, i.e. each HH could have about 5.8 ≈ 6 family members.

4.4 Validation of typical income sources of women and youth in HHs

The result of FGDs with women and youth revealed the role of women and youth in the envisaged DVR project is irreplaceable in the process of generating household income through engagement in various activities. For example, in Amadle the FGD with women and youth confirmed that their current main sources of income (for women) are sales of livestock mainly sheep & other small ruminants, sales of milk, and other petty trade. The income generated solely from crop cultivation is low or inexistent, because what ever amount produced would not sold for cash income, rather consumed. The FGD discussants further explained that the ongoing effort to conserve soil and water through construction of WSWs would create good opportunity for women and youth to earn additional income. The income generation opportunity would be comprising fattening of small ruminants using different forages (grasses) and crop aftermath to be harvested from rehabilitated dry valleys, cultivation of different types of crops, vegetables, fruits, etc. on rehabilitated land.

As highlighted above improvement of productivity of land as a result of soil and water conservation by WSW technology could encourage crop production activities and the crop residues in turn used for feeding animals and increase milk production and fattening of animals. This could create an opportunity for the women and the youths to supply more milk and fatten (condition) sheep and goats to the nearest Jigjiga market.

To substantiate the above mentioned outcome of FGDs, the consultant has made detail analysis on HH survey data and tried to triangulate and/or validate what exactly typical income sources of women and youth in households and how many women/youths could engaged in various income generating activities. In view of that, the analysis of HH survey results as indicated in figure 15 above and table 12 below, about 46% and 42 % of women involved in Livestock Rearing and Mixed Farming respectively, while the same survey result indicates that mixed farming (39%) and livestock rearing (33%) are typical income sources for Youths groups in the DVR project sites.

Table 12: Typical income source of women and Youths of the sample household by DVR Site

DVR Site	No /%	Typical income source of **Women** in the household by DVR areas							Typical income source of **Youths** in the household by DVR areas					
		Livestock	Crop	Mixed farming	Petty trade	Others	Crop & other	Total	Livestock	Crop	Mixed farming	Others	Crop & other	Total
Amadle	No	5	0	6	0	0	0	**11**	2	1	7	1	0	**11**
	%	46%	0%	55%	0%	0%	0%	**100%**	18%	9%	64%	9%	0%	**100%**
Harre	No	5	0	4	0	0	0	**9**	5	0	3	1	0	**9**
	%	56%	0%	44%	0%	0%	0%	**100%**	56%	0%	33%	11%	0%	**100%**
Boldid	No	3	1	4	1	0	0	**9**	3	2	4	0	0	**9**
	%	33%	11%	44%	11%	0%	0%	**100%**	33.3%	22%	44.4%	0.0%	0.0%	**100.%**
Gobeka	No	6	0	3	0	2	1	**12**	5	1	2	3	1	**12**
	%	50%	0%	25%	0%	17%	8%	**100%**	42%	8%	17%	25%	8%	**100%**
Total	**No**	**19**	**1**	**17**	**1**	**2**	**1**	**41**	**15**	**4**	**16**	**5**	**1**	**41**
	%	**46%**	**2%**	**42%**	**2%**	**5%**	**2%**	**100%**	**37%**	**10%**	**39%**	**12%**	**2%**	**100%**

Source: Household survey result, 2021

4.5 Estimated Actual number of HHs benefited by direct positive impact of the DVR measures (indicator 1.2)

The consultants tried to estimate the number of direct beneficiary HHs and their respective family members who are directly benefited from the positive effect of the DVR intervention measures implemented by the project in the 3 dry valleys sites (except Errer). The estimation of these direct beneficiaries of the project was obtained from the survey data, which include sample HHs who were interviewed during the survey.

In view of that, a minimum number of households (agro-) pastoralist men and women who are currently benefited from direct positive impact of the rehabilitated land in the 3 DVR project sites, include 41 HHs and their family members (344) of which 108 and 68 are youths and women respectively (indicator 1.2).. According to the information from the survey result, the least possible number of HHs benefited by the ongoing DVR project intervention measures include these 41 HHs and the above mentioned women and youths from their family members. These HHs and their family members residing and working in the 3 DVR sites are considered as direct beneficiary population of the DVR interventions, yet, there is more number of HHs/population who didn't cover by the study but have benefited by direct positive impact of the intervention measures.

Meanwhile, the survey concluded that the estimated number of HHs (table 13 below) are benefited by direct positive impact of the DVR measures in the 3 sites (Amadle, Harre and Boldid- Gobeka) and currently they could generated income and improve their livelihood status through newly emerged livelihood options aligned to rehabilitated land. In effect, they accessed some production means/inputs and services by the project and extension agents (DAs). These include, animal feed (forage), crop production, water or moisture retained for vegetable, improved rangeland resources, improved milk production, fattening, petty trading etc.

Table 13: Direct Beneficiaries: Number of HHs & Family members (men, women and youths) directly benefited by positive impact of DVR project interventions

DVR Project site	Sampled HHs Interviewed	Actual family size by sex and age groups (women & Youth)						
		No of Youth Age groups (18-34)			No of Women group(18-64)	All age group by sex		
Name	No	Male	Female	Total	Female	Male	Female	Total
Amadle	11	33	20	53	28	55	51	106
Harre	9	12	7	19	12	40	35	75
Boldid	9	8	4	12	11	50	32	82
Gobeka	12	11	13	24	17	38	43	81
Total	41	64	44	108	68	183	161	344

Source: Baseline survey result, 2021, the family size sample HHs was obtained from survey data analysis and result given there are an average of (8.4 ≈ 8) family member per HH for each DVR sites.

Note: *No Baseline survey has been conducted in Errer site, but the estimated total population was given from Agriculture office of Errer woreda.

4.6 Proposed target numbers of the Output Indicator 1.2

From field observation and key informant interview, the rehabilitation of dry valleys based on *catchment*[5] *approach* would ensure the sustainability of the rehabilitated dry valleys, and created considerable impact on surrounding bio-physical and socio-economic environments that enable different production activities. By taking into consideration factors such slope gradient and drainage area, topographic gully threshold indices, precipitation, groundwater/surface runoff, land-use, land cover and soil parameter, the DVR project (rehabilitated land) could ensure the emergence of newly adopted livelihood options and production activities that enable generation of additional income that improve the livelihood status of the HHs. This could in turn enhance household resilience in these drought-prone DVR project areas so that communities are positively adopted improved agricultural (crop & vegetable) and animal husbandry supported by forage production. If the above factors and other appropriate watershed development activities are considered and implemented along with technical capacity support to the user communities and implementing partners, the rehabilitated DVR sites could support the livelihoods of large number of target population.

Accordingly, the consultant team was estimated and proposed total potential target HHs and population (total family members) that can possibly access the rehabilitated land and have got significant positive impact in the 4 DVR sites. Hence, the total proposed potential target population comprises about 393 HHs and 2308 (**1216** male and **1092** female) family members (table 14 below).

The proposed potential target population, was estimated based on evidence (list of HHs & poeple), by villages, clusters to and kebeles within and around the each DVR sites. On this estimation process local /kebele chairman and kebele manager, & DAs of each project sites were all involved on the discussion to endorse and crosscheck available information at each sites. The following table indicates details of the proposed potential target number population.

Table 14: Proposed potential target Population in selected dry valleys

Name of Dry Valley	Size of Estimated Potential HHs Heads by Sex			Estimate Number of Total Potential Family Members (population)		
	HHs	Male	Female	Male	Female	Total Family
Amdale	78	41	**37**	243	225	**468**
Harrey	90	48	**42**	286	254	**540**
Boldid	75	46	**29**	275	176	**450**
Gobka	100	47	**53**	282	318	**600**
Errer	50	26	**24**	130	120	**250**
Total	**393**	**207**	**186**	**1216**	**1092**	**2,308**

Source: The total potential target HHs and population of the project areas was estimated based on the information given by local /kebele office and substantiated by the evidence (on list of HHs) with experts & DAs of each kebele, July 2021.

[5] The Catchment Based Approach (CaBA) is a community-led approach that engages people and groups from across society to help improve our precious water environments.

4.7 Proposition of number of male/female led HHs to be included in the user agreements for DVR project (indicator 1.1)

1. Proposed Number of Male/Female HHs

The DVR intervention is a community development approach that calls for active community participation and collective action. Henceforth, user agreement or end-users agreement is a mechanisms or (a legal contract entered) to tie together the community or user groups with project operators or public bodies.
A user agreement is a legally binding contract between a between the community or individuals user and the, operator, or service provider.

With regard to the proposition of the number of male/female led HHs targeted as direct beneficiary and to be included in the user agreements prepared for DVR project as indicated in (outcome indicator 1.1), the consultant team proposed the following. For the initial phases, the consultant proposed the 41 sample HHs (18 male & 23 female) and their adult family member 68 women and 108 youths, who are direct beneficiary of the project could be eligible for user agreement and can able to get into contract with DVR project operators at the 3 sites. This could be taken as an initial and pilot phases to practice the user agreement contract between the direct beneficiaries and the project promotors on the ongoing 3 DVR sites.

2. Community and End-users Groups

Involving community organization, formation of working groups and/or user groups to plan and govern improved management of the natural resources is necessary. During FGD and key informant interview, participants were strongly recommend that active community participation is fundamental prerequisite for the success of dry valley rehabilitation project. It is necessary because individual choices have collective consequences in the DVR framework. Action of one group of farmers in one location affects (adversely or favorably) another group of farmers in a different location (off-site impact). Such externalities influence the performance of the catchment or drainage area at large. Often the different groups and locations have conflicting objectives with respect to their investment priorities and enterprise choices. These need to be converted into opportunities. The actions of all the farmers in the watershed should converge in such a way that the positive externalities are maximized, and negative ones are minimized. To achieve this, the community or stakeholders have to develop their own rules, which resolve their conflicting objectives. It is believed that better organized and effective people's participation would yield higher benefits. The agreement is mechanisms to tie these groups to together. During FGD, formation of user association and creations of executive committee are suggestions by participating committee. FGD also reveals that presence of women group and youth in committee members are also suggestions by FGD.

Besides, Involvement of local stakeholders in planning, development, and execution of the valley rehabilitation activities is crucial. During Field observation, focus group discussion and key informant interviews, it was reveal that the engagement of key stakeholders such respective government office especially woreda level respective departments, project and user community is crucial to ensure the sustainability of the technologies and its outcomes. These should be tied by agreement between woreda

level Agricultural natural resources directorate and user community. The project has also many roles to play. In general adapting Ethiopia national watershed development guidelines for the formation different institutions at different level including user community can yield a lot for sustainable utilization and management of dry valley potentials. The role of women and youth are also very crucial and their must representation of youth and women in committee to be formed.

From Analysis of FGD findings and review of experiences in the area of land rehabilitations the following roles and responsibilities of key stakeholders in this been suggested by this study.

3. Government Partners: (which include all relevant public organizations such as woreda level offices - Agricultural and natural resources, pastoral development, Land administration, and Environmental protection, women and children affairs and others)

The user Association will constitute the DRY valley Rehabilitation committee (DVRC) to implement the Dry valley rehabilitation project with the technical support of the woreda level DRY valley rehabilitation team. The community in the dry valleys may elect/appoint any suitable person from the community as the Chairperson of Dry Valley Rehabilitation Committee. Headman and /or ward member/ Village council members may also be member/ Chairman of WC. The Dry Valley Rehabilitation Committee (DVRC) will comprise of at least 10 members, half of the members shall be representatives of User Groups of mal headed households, women, youth, and landless persons in the community constituting the rest. One member of the WDT shall also be represented in the Dry Valley Committee (DVRC). Where a dry valley project covers more than one Village council separate committees will be constituted for each Village council. The Dry Valley Rehabilitation Committee (DVRC) would be provided with an independent rented office accommodation. The Dry Valley Committee will open a separate bank account to receive funds for dry valley projects and will utilize the same for undertaking its activities.

For Government, including woreda offices such as Agricultural and natural resources, pastoral development, Land administration and Environmental protection, women, and children affairs and others:

- Establish, strengthen, and enforce policies, legislation, structures, and mechanisms for development planning in the dry valleys that provide for a more devolved, integrated, participatory, flexible, and adaptive approach that better reflects realities on the ground.
- Establish, strengthen, and enforce policies and legislation that protect the rights of local dry Valleys users to their land and resources.
- Invest in the building of capacity of local government authorities in order to better understand the characteristics and requirements of dry Valleys environments and communities, and to support their transformation into more sustainable and productive entities, as appropriate.
- Ensure that coordination mechanisms and structures are functioning and well resourced, in order to support multi-sector integrated planning.
- Develop comprehensive land use plans for the country, with input from dry Valleys communities. Land use plans should also be developed for regions, counties, or zones as appropriate.

- Work with the commercial sector and facilitate its greater involvement in development planning processes, in order to more effectively develop the provision of services that are well managed by communities.

4. The Project (CDSDR-SRII) Operators

- Improve and develop processes and interventions that take a systems approach to development and environmental management, such as resilience-building.
- Build the capacity of their own staff so that they better understand dryland/dry Valleys Systems and are able to plan and develop appropriate activities that support them.
- Building skills such as conflict resolution, facilitating negotiation and consensus building, and participatory research, and planning is also important.
- Plan and implement programs and activities at a scale appropriate for dry Valleys s; this should follow the "nested" governance and management systems that exist in dry Valleys.
- Pilot different planning and management initiatives that contribute to the collection and
- Sharing of good practice in order to influence better planning processes at government and community levels. This should be done in conjunction with research-focused organizations and local government, and with independent evaluations carried out.
    - Assist governments in building the capacity of their staff in land administration, land use planning, integrated development planning (of which land use planning should be a part), institution building, and participatory approaches.
    - Improve collaboration and coordination of activities and information sharing with other NGOs, governments, and communities.
    - building local stakeholders' capacity to autonomously conduct the iterative cycle of planning, implementation, monitoring, evaluation and preplanning at the community level;
    - creating among local institutions a core group of professionals and field workers sensitized to approaches to participatory and integrated catchment management; and
    - Establishing or strengthening forums for negotiation and decision-making involving all watershed stakeholders (grassroots organizations, local governments, line agencies, NGOs, international projects, the private sector, etc.).

5. Analysis of Relevant Policies & Programs to Sustain DVR Sites **(Outcome Indicator 2.1)**

5.1 Analysis of Policies, Strategies & Programs on PAP, agriculture, DR & watershed management in the Region

The consultants have made thorough review of existing key national and regional policies and strategies pertinent to Agro-pastoralism, agricultural production, drought resilience and watershed management in Somali Region. The study team first discussed with GIZ Jigjiga Office staff advised primarily to visit and discuss with the right persons in two bureaus; Somali Region Bureau of Livestock and Pastoral Development and Somali Region Bureau of Agriculture and Natural Resources. Accordingly, KIIs conducted with Director

of Pastoral Development Directorate of Somali Region Bureau of Livestock and Pastoral Development and Director of Natural Resource Preservation and Utilization Directorate of Somali Regional Sate of Bureau of Agriculture and Natural Resource. During the discussion, it has been learned that there are various pastoral and agro-pastoral policies, strategies, guidance, and proclamations prepared at regional and federal level in one way or the other linked to natural resources conservation and drought resilience. List of some of the pastoral and agro-pastoral policies and strategies documents reviewed and accessed, from different bureaus and websites are presented below:

Table 15: List of policies, strategies and program documents Consulted

No	Title of policy/strategy Document	Sources of the documents	Available in
1	National Strategy for Watershed Development in Ethiopia, MoA, June 2019	BoANRD of SR	Soft copy
2	Community-based Participatory Watershed and Rangeland Development: A Guideline (Part1), Second Edition, MoA, January 2020	BoANRD of SR	Soft copy
3	Community-based Participatory Watershed and Rangeland Development: A Guideline (Part3)-(InfoTech's on Technologies for Watershed and Natural Resource Development for Pastoral Areas), Second Edition, MoA, January 2020	BoANRD of SR	Soft copy
4	National Agroforestry Development Strategy (2020-2030), MoA, December 2019	BoANRD of SR	Soft copy
5	Proclamation N0.1223/2020 Development, Management and Utilization of Community Watersheds Proclamation , FDRE, 25th days of August, 2020	BoANRD of SR	Soft copy
6	Capacity Development Strategy (Draft), MoA, April 2021	BoANRD of SR	Soft copy
7	Pastoral Development Policy and its Implementation Strategy (□□□□□□□ □□□□□□ □□□□□□□ □□□□□□ □□□□□□□□□ □□□ □□□□ □□□□□□□ □□□□□□)□ □□□□□ □□□□□□□ □□□□□ 2013 □ □	BoANRD of SR	Hard copy
8	Ethiopia Country Programming Paper to End Drought Emergencies in the Horn of Africa, MoA, November 2012	Website	Soft copy
9	National Policy and Strategy on Disaster Risk Management, FDRE, July 2013	Website	Soft copy
10	National Startegy for Prosopis Julifora Management Strategy, MoLF, January 2017	Websites	Soft copy
11	Climate Resilient Green Economy (CRGE) Facility Gender Mainstreaming Strategy 2020 to 2023	Website	Soft copy
12	Somali Region Durable Solutions Strategy 2017-2020	Website	Soft copy
13	African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa (Kampala Convention), December 2012	Website	Soft copy
14	Ethiopia's Climate Resilient Green Economy: Climate Resilience Strategy Agriculture and Forestry, FDRE	Website	Soft copy

Source: Accessed from different bureaus and websites, July 2021

5.2 Analysis of Drought Resilience & PAP Development Policies and Programs & their local level Implementation

1. Policy formulations in Ethiopia

Ethiopia has a long history and experience in medium and long-term planning/policy formulation starting with the three consecutive 5-year plans of the 1957-1961 period followed by the ten-year plan of 1984/85-1993/94 period. Because of the past political systems and other factors several past national development oriented regional policies were not capable of addressing real regional development problems. Afterwards, Ethiopia adopted a new constitution called Federal Democratic Republic of Ethiopia Constitution (FDRE Constitution in short) in 1995 that brought some constitutional, political changes and of course, influenced the policy making process in the country. It established a new federal structure of government, whereby power is shared between the center and the regional government both being autonomous in certain clearly defined areas. The regional governments are responsible for a administering their areas except for foreign relations, defense, and general policies of common interest and benefit, which are the responsibilities of the Central Government.

During interview with regional and local government offices it was found out that most of the functioning sectoral policies are emanated from federal government and cascaded to regional states for its implementation. Accordingly, policies relating to resilience, pastoral development, watershed development and agricultural policies are formulated at federal level and cascaded to regions for its endorsement and application. This is contrary to article 89(6) of Federal Democratic Republic of Ethiopia constitution that stated the government shall at all times promote the participation of the People in the formulation of national development policies and programs; it shall also have the duty to support the initiatives of the People in their development endeavors. Article 43 of Federal Democratic Republic of Ethiopia constitution also stated that the people, nations, and nationalities of Ethiopia have the right to development, and particularly, the right to participate in national development and to be consulted with respect to policies and reject projects affecting their community. Therefore, it implies that there is a limited room *fo***r** public and stakeholders' participation in the process of Ethiopia policy formulation.

Moreover, during key informant interview it was revealed that the current political and socio-economic problems and challenges that have an impact on the integrated regional development policy process in Ethiopia. The political tension between the federal and regional states and among the regional states in the country is result in the current social problems such as exclusion, marginalization, inequalities of individuals and ethnic groups and absence of equal access to rights, opportunities and resources, and low level of country's economy. The studies show that exclusion prevents individuals and groups not only from contributing to the economic, social, and political life of their society, but also it could lead to social tensions and conflicts and negatively affect the effective integrated regional development policy formulation.

1.1 Ethiopian Resilience policy and Strategy

The government of Ethiopia (GoE), following the promulgation of National Policy on Disaster Prevention and Management (NPDPM) 1993, has received support from aid agencies to enhance its capability in preventing, preparing and responding to disasters. In 1996, GoE appealed for support to build the capacity of the DPPC in three main: the popularization of the disaster management policy and strengthening of coordination; strengthening of the early warning system; and linking relief to development through labour intensive employment generation schemes. The Institutional Support Project (ISP), funded by The Canadian International Development Agency (CIDA) from 1997 to 2006, and implemented by Save the Children (Canada) was tasked was to assist the GoE in building institutional support to enable it prepare for, prevent and mitigate.

The three big government programs for resilience building are Ethiopia's Program of Adaptation to Climate Change, the Productive Safety Net Program (PSNP), and the Agricultural Growth Program. All fall under the government's Climate-Resilient Green Economy (CRGE) Strategy and its Growth and Transformation Plans (GTPs). In addition, substantial programs are targeted at pastoralists in lowland areas. Key among these is the Intergovernmental Authority on Development's Drought Resilience and Sustainable Livelihoods Program (DRSLP), which covers pastoralist areas across the Horn of Africa, and the Pastoral Community Development Project (PCDP). "

Established in 2011, the CRGE Facility is one of the world's first institutions set up to coordinate climate finance delivery in this manner. Ten years after its establishment, it aims to consolidate and enhance its capabilities and continue to improve development and resilience outcomes for marginalized citizens. The policy is the most relevant policies for resilience building in Ethiopia identifying green economy opportunities that can help Ethiopia reach middle-income status by 2025 while keeping greenhouse gas emissions low.

Water-spreading weirs are designed to stop gully erosion in valley floors and to establish a drainage pattern corresponding to that of intact valley floors; in other words, they promote the inundation of the valley floor and the deposition of fine soil and organic matter. In order to do so, the structures must span the entire width of the valley floor. Depending on user preferences, the primary goal may be: i) agricultural use, ii) agro-pastoral use, or iii) the replenishment and raising of the water table. Similarly ERGE strategy provide emphasis on natural resources rehabilitation and movement to mitigate climate change, vulnerability by increasing the capacity of the groups and improving their livelihoods.

1.2. Pastoral Development Policy

Over the past five decades, the Government of Ethiopia (GoE), with the support of key development partners, has made efforts to develop the low-land pastoral and agro-pastoral (PAP) areas of Ethiopia. These efforts ranged from exploitation of livestock resources and provision of basic services to combating drought and enhancing food security. Although some notable achievements arose because of these efforts (such as expansion of socio-economic services, control of livestock disease, and enhanced trading opportunities), the impacts have been compromised by lack of clear policies and strategies and inadequate

investment and support systems, as well as institutional fragmentation, violent conflict, and recurrent droughts.

Despite half a century of development efforts, multidimensional deprivation and vulnerability to shocks remain a serious problem in Ethiopia's pastoral areas. A review of past and ongoing pastoral and agro-pastoral (PAP) development efforts in Ethiopia, analysis of the current socioeconomic situation in relation to PAPs, and an extensive literature review of emerging knowledge on the topic point to the need for future PAP development to focus on resilience, transformation, and sustainability. This study, which was commissioned by the World Bank and the International Fund for Agricultural Development (IFAD), proposes six strategic pillars: livelihood support for improved pastoral and agro-pastoral production; livelihood diversification and improved agro-pastoral extension; integrated rangeland and water development, and secure access to key resources; transformation and commercialization of the livestock industry; enhanced access and use of basic social and economic services; enhanced social protection and disaster risk management; and institutional and human capacity development. In addition, intervention-planning needs to be sensitive to conflict, should mainstream gender issues and nutrition, and should emphasize women and youth employment, climate change and adaptation, information technology, action-oriented research, and knowledge management and documentation.

Recently, Ministry of peace has formulated pastoral development on four issues such:

Issue 1: Increasing the income-generating capacity of pastoralists and improve their living standards through four strategies: (1) Maximizing animal productivity and ensuring an increase in benefits for pastoralists; (2) Improving water resources development and administration in order to maximize benefits for pastoralists; (3) Expanding the agricultural activities of pastoralists in tandem with modern soil and water conservation practices; and (4) Conducting a pre-planned and well-organized voluntary commune program in order to ensure that pastoralists are beneficiaries of settled life.

Issue 2: Expansion of infrastructure in pastoral areas that takes the livelihood and income source of pastoralists into account. There are four sectoral strategies which include; (1) Increasing accessibility of quality health services in pastoral areas; (2) Increasing accessibility of quality education services in pastoral areas; (3) Expanding pastoral urban areas integrating them with industry; and (4) Expanding infrastructure development activities in line with pastoral ways of life and sources of income.

Issue 3: Building the implementation capacity of pastoralists and grounding good governance and constitutional democracy on a strong foundation in order to ensure maximized participation and benefit for pastoralists. 'The main consideration of this policy issue is to ensure that good governance and constitutional democracy are taking root, and rule of law is established, and pastoralists are active participants and beneficiaries' through two sectoral two sectoral strategies. These are: (1) Building good governance and guaranteed democracy that centers on the customs and knowledge of pastoral communities and (2) Building the human resources development and implementation capacity that centers on the lifestyle and work culture of pastoral communities**.**

Issue 4: Ensuring sustainability and reliability of the development and progress of pastoralists by treating critical cross-sectoral issues; economic, social, capacity building, and good governance. There are three sectoral strategies identified to implement these Policy issue. These are: (1) Prevent and resolve disputes sustainably on the basis of the pastoral community's customs and knowledge; (2) Strengthening good customary practices and discouraging harmful customary practices, and also expand the participation and benefit sharing of women and youth and (3) Strengthening forest and natural resources conservation and development activities in pastoral areas.

1.3. Watershed Development Policy

Planning the development of watersheds for Ethiopia started in the 1980's. Since then, rural development efforts by the government (as well as most non-government organizations) have been based on the 'watershed-logic.' While this approach is particularly relevant to Ethiopia given its hydro-geology, it applies equally well in several regions across the world. Participatory Watershed Development is now placed firmly at the center of Ethiopian development policy. In 2005, the federal government published a set of national guidelines. The document consolidates various regional-level data, scientific methodologies, and socio-economic analysis. It serves to coordinate watershed development activities being carried out at various levels by a variety of actors (regional government/ communities/ *NGOs etc*.)

Accordingly, the federal and regional governments, and several non-government agencies have launched watershed development initiatives to tackle some of the generic problems, aiming to develop soil conservation, improve land productivity, and promote appropriate technologies for efficient and sustainable use of natural resources. According to watershed guidelines, 2005, holistic approach targeting sustainable natural resource management and utilization for the improvement of the livelihood of the community in the watershed. This approach has brought success across the areas where watershed management measures applied in Ethiopia at some extent.

However, indifferent part of the country, failure of the watershed management measures was observed tragically in resource poor nation Ethiopia. There are causes for the failure of the watershed management measures. The causes for the failure are constraints during application of the measures in watershed. For this review, some of the constraints were identified systematically. The constraints are policy and strategy application limitations, socio economic and biophysical constraints, technical capacity constraints, financial and incentive constraints, lack of awareness and poor linkage and information sharing between concerned institutions.

In general, the constraints are policy and strategy application limitations, socio economic and biophysical constraints, and technical capacity constraints, financial and incentive constraints, lack of awareness and poor linkage and information sharing between concerned institutions.

1.4. DVR technology and Pastoral Development Policy

DVR technologies can be an integral part of the natural resources conservation and development initiatives of recent pastoral development policy, under issue 4, strategy 3, it states 'Strengthening forest and natural

resources conservation and development activities in pastoral areas' is priority. The strategy is aiming to act on these premises in the following directions:

1. Conducting a 'wide range of activities in soil, water, natural resources and forest conservation' to 'sustainably protect pastoralists from vulnerability to disaster and adapt to climate change';
2. Examining 'experiences of other pastoral places in the country and outside which were implemented and effective', and adopt them 'in line with the objective reality of the regional states';
3. In relation to carbon trading, the youth shall be organized in associations and shall be assisted to develop mountainous areas. They shall be encouraged to develop commercial fruit trees in flat land areas so that they would become beneficiaries. Settlement areas shall be made green, clean, and convenient to live [in]';
4. 'Climate change in pastoral areas shall be given due consideration';
5. Mobilizing people to undertake activities for forest development, natural resource protection and conservation, and protection from degradation and environmental pollution – taking the livelihood and ecology of the area into consideration.

Hence, flood control and converting to gullies to productive use of land is parts and parcels of natural resources conservation and development initiatives.

1.5. DVR Technologies and Watershed Development

Today, there is a massive movement in watershed management in almost all regions of Ethiopia. However, watershed management has merely been considered a practice of soil and water conservation where only technological approaches were adopted from the earlier successful projects and from the lessons related to institutional arrangements were neglected. Yet, integrated watershed management goes beyond the conservation activities. It emphasizes strengthening local institutions, income-generating activities through alternative sources, and creating markets to improve financial livelihoods. Failure of different watershed management measures was observed across the country as a result of various constraints of watershed management in Ethiopia. Identifying the major constraints of watershed management in the country could help the policy makers to find alternative solution in tackling the constraints for the successfulness of the watershed management measures and improve the livelihood of the watershed. Some of the major constraints of watershed management in Ethiopia are lack of awareness among policy makers of the extent and impacts of land degradation, policy and strategy related constraints, socio-economic and bio-physical constraints, capacity constraints, resource and incentive constraints, and lack of community awareness.
DVR technologies are important tools in the area of soil and water conservation and watershed development endeavors in general.

1.6. DVR Technologies and Agricultural Policies

Agriculture is the backbone of the Ethiopian economy. This particular sector determines the growth of all other sectors and consequently the whole national economy. According to Rolling rural development policies and programs are usually developed to suit the condition of progressive farmers. The government

in Ethiopia has implemented various agricultural policies such as market liberalization, structural adjustment, Agricultural-Led Industrialization, Sustainable Development and Poverty Reduction Program, Participatory and Accelerated Sustainable Development to Eradicate Poverty and successive Growth and Transformation Plans I and II to raise productivity in agriculture between 1991 and 2016. Since 1991, the government abolished all subsidies and price support measures to agriculture. A structural adjustment program reduces the role of the government and increases the role of demand and supply forces in the allocation of resources in the Ethiopian economy. All these policy interventions have been implemented to increase agricultural productivity and production which, in turn, reduce poverty and food insecurity.

In Ethiopia's agricultural sector policy and investment framework (2010-2020) increasing productivity in smallholder agriculture is the Government's top priority. This recognizes that: (i) smallholder agriculture is the most important sub-sector of Ethiopia's economy; (ii) there remains a high prevalence of poverty among smallholder farming communities; and (iii) there is a large potential to improve crop and livestock productivity using proven, affordable and sustainable technologies. The productivity issue is recognized by the Government and its partners under CAADP Pillar IV (Improve the Agricultural Research and Extension System). Within the broad strategic thrusts of Pillar IV and the FYGTP, there is an issue of how and where to deploy the available resources in pursuit of the productivity objective. Over the last two decades the Government and its development partners have tended to channel investments towards the chronically food-insecure sectors of the population, and natural resource conservation, which tend to be concentrated in areas of lower agricultural potential. It is also one of the key priority areas of recent policy.

One of the most important economic effects of water-spreading weirs is the expansion or reclamation of productive land through use of Water spreading weirs as reviewed from past experiences by BZM/GIZ, 2012. The land area above and below a weir thus benefits and becomes useful once again. This practice has been observed in Amadle dry valley where the water spreading weirs have been constructed earlier in 2019. The degree of agricultural use of the flooded land area may be depends upon the farming system. Otherwise, due to increased land improvement in terms of fertility and soil moisture, it plays a significant role in agricultural productivity of land and production of improved crop varieties. Hence, DVR technologies have direct alliance with the agricultural policies in the regions and nation.

5.3 Analysis of Local Policies on Land Access Rights & Integration of Gender-Sensitive Aspects of DVR Intervention

Basic facts provided above with regards to policies in general asserting that most of the policies designed at the Federal level. The efforts made from the Somali Region perspective was reported that right person from pertinent bureaus would be delegated and participated to make the policies to consider local context of the Somali regional sate. Generally, in Ethiopia, land is belonging to the Government, but the mother of all rules and regulations, the Ethiopian Constitution asserted that every citizen has land use right. Every citizen has the right to use land as well as responsible to protect it from misuse and damage. Every citizen is responsible to protect the soil from loss associated to erosion while cultivating to produce crops as well as using land for grazing of animals.

Policies technical, economic and gender inclusiveness is another important area that need due consideration. It is assumed that rehabilitated dry valleys could have the potential to serve as a 'growth center' for the beneficiary households in and around dry valleys. When we say dry valleys are rehabilitated it means many things as stated above. Soil and water enormously conserved. Galleys prevented. Fertility of soil highly improved. Vegetative cover of land including grasses improved. The suitability of cultivating land for the different crops increased. The possibility of cultivating land both with rain fed and irrigation will be increased. Therefore, to make women and girls to properly utilize this created opportunity, making policies gender inclusive, technically feasible and economically sound by making it to consider local or grass root level context has of paramount importance.

5.3.1 Alternative Income Generating Activities for Women

Women's participation is essential for sustainable development and climate change adaptation. It is also commanding to achieve women's empowerment by enabling women to achieve equal control over the factors of production and to participate equally in the development process. This includes involving women in the decision-making process to achieve balance of control between men and women over the factors of production, without one in a position of dominance. If women are in a position to exploit natural resource conservation results and engage in income generating activities they can play strong role in adopting low-carbon technologies, spreading knowledge about climate change, and urging government and businesses to take action. This will enable women to access information and technologies, cultivate entrepreneurial and marketing skills, and gain the ability to discuss and negotiate and understand policy issues that affect them as farmers.

Clues from FGD and key informant interview show that women are the more vulnerable to climate change effects than men in that all they are forced to shoulder all the HH responsibilities even in crisis periods. That is when men flee in search for better zones for pasture and water, women stay there with the crisis with the remaining family members facing the challenges. In this baseline study, in bid to explore income generating opportunities that can be managed and controlled by women, the following are identified. These are:

1. **Traditional Milk processing:** This includes milk producing and making of different milk products such as butter and cheese. Given the location of the dry valleys, there will not be market problem in the mentioned areas for dairy products as all of them located on main roads as well as proximity to Jigjiga Town.
2. **Petty trades/Small Business Ventures:** The social settings around the communities in all the assessment dry valleys observed to be quite convenient to establish shops/ kiosks for selling various items with high demand in the area. For instance, there is high demand for grains/cereals, textiles, footwear, sanitation items, spices, sugar, food items, refreshments, and the like in the mentioned areas.
3. **Vegetable and fruit production:** Empower women to harness water through the development of hand dug wells, boreholes and earth dams for improved health and sanitation. This can enable them put up gardens and produce vegetables for household consumption and sell the surplus as well. All

areas can have some potential for this in various extents provided that they get support in accessing water sources.

4. **Bee keeping**. There are potentials for bee keeping along the ridges of karamara mounts which are high upstream for Gobuka and Bolidid dry valleys around Jijiga and good woody vegetation in Goro Guba dry valley for bee keeping. These areas have got high possibility for honey-harvesting. So, empowering young women and men to form cooperatives for engagement in the IG activity earns an immense merit for the idle youth and those in a fertile age category of these aforementioned areas.
5. **Small Scale Agriculture:** The landscape has also been seen to have some potential for watershed land use management. Hence, it would wise if young men form groups and engage in farming activities by using small irrigation. They can produce crops, vegetables, fruits and the like for consumption as well as for sale.
6. **Animal Fattening: In all assessment areas, there are** various animal types. Based on capabilities of adaption to ever changing climatic hazards, availability of livestock varies from place to place. Nevertheless, it would be possible to fatten animals in each area depending on availability and adaptability nature of the animals. In line with, animal fattening can include keeping animals under special care for a while and then take to the market for better profit. This can be practical in all dry valley areas. Associated water & pasture harvesting should be carried out in wet seasons for this purpose. Due to scarcity of pasture &water in the areas it is better to engage in small ruminants fattening than cattle. Women can be engaged in this activity and should be encouraged to do so especially for small ruminants.
7. **Fodder production:** This could be done in wet seasons and using rain and irrigation. If they are harvested properly used to feed animals or sold to earn income.

6. Opportunities to Integrate Internally Displaced Persons (IDPs) in the DVR project **(Output Indicator 1.3)**

6.1 General

"Internally Displaced Persons" are persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border (Kampala Convention, AU,2009)[6].

Internal displacement of people is a problem prevailing in some parts of the country including Somali Regional Sate. Several efforts were underway to alleviate this problem by the Regional and Federal Government. One of the efforts was development of a Durable Solutions Strategy for the Somali region. The purpose of this strategy is to serve as tool or guidance for the efforts being made to reverse the situation in this region in a very coordinated way. According to Global Report on Internal Displacement (GRID)

[6] African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa (Kampala Convention), 2009

(2019)[7], a Durable Solutions Strategy for the Somali region was developed in 2017 in line with the Guiding Principles of the Kampala Convention, a regional treaty on IDPs' protection and assistance. This strategy is prepared with several objectives including:

(i) to address displacement in a way that goes beyond 'care and maintenance' of displaced communities to one that builds resilience and the ability to withstand future shocks, preserves safety and dignity in order to improve the lives and self-reliance of displaced populations while simultaneously addressing the impact on host communities;

(ii) to provide an approach to implement rights and needs based programming that addresses physical safety (safety and security), material safety (an adequate standard of living and access to livelihoods) and legal safety (access to documentation, family reunification, participation in public affairs, and access to effective remedies and justice) of communities in protracted displacement and the communities which are hosting them;

(iii) to achieve a multi-sectoral response to displacement that bridges the humanitarian-development divide, involves all key line-ministries, firmly embeds the protection and assistance needs of the displaced, host communities and other drought affected communities, paying attention to the particular needs of women, the elderly, disabled, youth and children within the region's and national development plans;

(iv) to promote joint planning, responsibility and commitment amongst governmental and nongovernmental (humanitarian and development) actors towards implementation of durable solutions;

(v) to strengthen the normative, legal and institutional framework for identification and provision of durable solutions for those in ongoing and protracted displacement; and (vi) to provide a mechanism that enables key decision-makers at regional and national levels to develop a nationwide approach to finding timely and durable solutions in response to ongoing and future displacements.

Furthermore, it is important to note that the Somali Region Durable Solutions Strategy was prepared aligned to the: (i) UN Guiding Principles on Internal Displacement (1998), (ii) IASC Framework on Durable Solutions, (iii) UN Secretary General's Decision on Durable Solutions and Operational Guidelines (2016), (iv) IGAD Draft Regional Strategy on Forced Displacement and Mixed Migration (2017-22), and (v) IOM's global framework for Progressive Resolution of Displacement Situations (2016).

It was also documented that when this Durable Solution Strategy designed to establish linkages to other Ethiopian Program and policy frameworks, including the: (i) Draft National Disaster Recovery Framework and its follow up action plans, (ii) 2017 Humanitarian Response Plan and successive versions, (iii) UN Development Assistance Framework for Ethiopia, (iv) Somali Regional Development Plan (GTP II), and (v) Somali Region Early Recovery Plan (2018). The important point that needs due consideration with regards to the topic under discussion is that the Durable Solution Strategy is prepared in such a way that it is all inclusive and in line with various Programs and Policies of which implementation time span is over as well as the Strategy which was prepared for the period 2017-2020 and now need updating or revision.

[7] Global Report on Internal Displacement (GRID), 2019

6.2 Strategies and Approaches applied to integrate the IDPs into host communities and livelihood options

As stated above Durable Solutions Strategy of the Somali Regional Government of Ethiopia 2017-2020[8] is a strategy developed by Somali Regional State and Federal Government of Ethiopia to resolve the problem of IDPs' in line with Guiding Principles and the Kampala Convention and Ethiopian Program and policy frameworks. There are various root causes or driving factors for the IDPs. According to Durable Solutions Strategy of the Somali Regional Government, the driving factors of IDPs in the Somali Region are: conflict, environmental degradation, natural and manmade disasters, changing livelihoods strategies in an evolving political economy, poverty, and progressive depletion of coping mechanisms. Knowing the root causes is vital for the efforts being made to resolve this problem. Different sources revealed that the problem of IDPs require durable solution. The durable solutions for the IDPs encompass three options: (i) voluntary return to places of origin, (ii) local integration in areas of displacement, or (iii) resettlement in another location.

To maximize sustainability of this strategy, need to be aligned with the IASC four core Principles on Internal Displacement, without which it is not possible for displaced persons to have a Durable Solution. These are: long term safety, security, and freedom of movement; Livelihoods and Building Resilience; Access to Public Services; and access to justice and civil rights.

When efforts made to resolve the problem of IDPs including DVR, it is essential to make sure that above factors are properly considered and the process is integrated with hosting communities and livelihood options.

6.3 Assessment of possibilities of Integration of IDPs in the DVR and productive use approach

During FGDs held in surveyed dry valleys, question was raised to the discussants that weather or not the beneficiaries have accumulated experience in settling IDPs in their respective areas. They expressed that have no experience and no problem of IDPs confronted in their respective areas, so far. It has been learned during the survey that raising even such questions related to IDPs problem considered as sensitive question and almost all the discussants were not happy to discuss in detail on this issue.

It has been mentioned above repetitively that construction of WSWs is vital to conserve soil and water which is in one way or the other useful to increase the fertility and productivity of the soil. The experience in West African Countries, revealed that a rehabilitated piece of land in dry valleys can be cultivated up to three times per year and this asserts that DVR is a good opportunity for integration of IDPs. But before thinking to undertake the integration of IDPs in any dry valleys ensuring consent of the community is very vital. Willingness of the host communities to welcome and willingness to share sources of livelihood in line with Durable Solutions Strategy of the Somali Regional Government of Ethiopia 2017-2020 is vital and require due consideration of all the key actors.

[8] The Durable Solutions Strategy of the Somali Regional Government of Ethiopia 2017-2020

7. Risk characterization in Dry Valley Areas

From review literatures about major hazards in the Somali regional state are found to be drought, floods, outbreaks of human and animal disease, infestations of crop pests, conflicts, land degradation which include landslides and gullies affecting the livelihoods of pastoral and agro pastoral communities (Oxfam, 2013). In the regions recurrent drought and floods remain two leading hazards. The magnitude, frequency, area coverage, and impacts of droughts are now, more severe than in earlier times. During FGD in four dry valleys, drought and flood are sorted as the major hazards in their respective followed by land degradation, crop pest, and human and animal disease with similar perception in all FGDs conducted. During Focus group discussion the following major hazards are identified.

Table 16. Major Disasters/Hazards identified in DVR areas

S/N	Major disasters/ hazards	Ranking Order as per the FGDs & KIIs
1	Drought and Long Dry Spell Seasons	1
2	Flood and Gulley widening	2
3	Land Degradation and Sever soil erosion resulting in loss of soil fertility and lack vegetation cover	3
4	Crop pest and diseases	4
5	Livestock diseases	5

The analysis of the FGD and KII, reveal that the impact of these hazards are wide and affecting the bio-physical, socio-economic contexts of the DVR areas as indicated below:

Decreased pasture availability, leading to shortage of pasture, overgrazing and land degradation, Decreased water availability, Lack of forage and Emaciation of livestock, Death of livestock, Decreased livestock productivity, Decreased resistance of livestock to disease, Decreased livestock prices, Reduced incomes, Women walking longer distances in search of water, Increased human diseases and death, Increased conflicts over natural resources, Crop failure, Food insecurity and malnutrition, Increased school drop-out rates due to migration, Interruption of development activities, Increased human diseases and death, Loss of farm lands, and Displacement in residential etc.

8. Conclusion and Recommendation

8.1 Conclusion

The baseline study on the current situation of the DVR project intervention areas was intended to generate the starting points for a successful program intervention and to establish a baseline information as well as benchmarks against which future performance and progress can be evaluated or compared. The study was undertaken in the selected dry valley areas (Amadle, Harre, Bolidid, Guboka and Goro Guba (Erer)) and analyzed the context of implementation of the project indicators and the existing socio-economic as well as bio-physical conditions in the project areas. The study was conducted during July 27 to August 12, 2021 by **FSiAbd Consult** after being selected through competitive bid by CDSDR II-SR project of GIZ, which commissioned and outsourced the capable firm to conduct this baseline assessment.

This study assessed the benefit of water spreading weir (WSW) technology in building drought resilience capacity of communities in dry valleys areas. In line with this, the situation of prior to DVR project areas was characterized by soil erosion, gulley formation and loss of soil fertility on cultivated lands, low productivity level and an alarming rate of land degradation and environmental imbalances due to poor management of natural resource. Flood, gulley formation, and land degradation have negatively affected the natural resource management of the studied dry valley areas. The resultant of these problems has been resulted shrinking of dry valley resources, degradation of water resources and acceleration of soil erosion that obviously could lead to decline of per capita food production d over time.

However, currently significant changes have seen in some of DVR project areas. The study team physically observed during the survey that the introduction of technologies like water spreading weirs (WSW) has brought positive impact in the restored lands across rehabilitated dry valleys. The WSW is increasing soil moisture, flood control, arresting of soil loss, improved land quality, and productivity is found to be a promising in dry valley communities affected by flood, drought, and land degradation. The location and proximity of the dry valley areas to the main roads and peri urban areas has brought better advantages to beneficiaries, for example, good access to markets within and outside the area to sale various products from the valleys. Presence of public services such as roads and communication infrastructures, social groups, educational and religious centers makes the dry valleys ideal for integrated natural resources Management (INRM) technology transfer through development and exposure visiting programs using relevant institutions.

8.2 Recommendation & Key Areas of Intervention

8.2.1 General Considerations for Sustainability of Dry Valley Rehabilitation

Floods occur when the discharge of the stream becomes too high to be accommodated in the normal stream channel. When the discharge becomes too high, the stream widens its channel by overtopping its banks and flooding the low-laying areas surrounding the stream. The areas that become flooded are called *floodplains*. Gulley formation as a result of flood depends on various factors of the valley landscape that need to be taken in to consideration during Rehabilitation. Hence, pondering factors related to Valley Gully Formation such as, the Slope Gradient and the Drainage Area, Topographic Gully Threshold Indices, Precipitation, Groundwater/Surface Runoff, Land-Use, Land-Use Change, and Soil parameters is imperative.

To ensure the sustainability of the technologies, the integration with other watershed development activities and application of catchment approaches is important. The objective of the Catchment Approach is the proper utilization and development, as well as the protection of the natural resources, i.e. soil, water, and vegetation. The catchment is seen as a focal area (not necessarily a hydrological catchment) where a community is willing to work towards the conservation of their environment. The method is based on a participatory community process, with actual physical planning of soil and water conservation measures at the farm level. The intention is for local communities to be involved in the analysis of their own farming and conservation problems, and decisions being made with their active participation, and the participation of the other stakeholders (governments, extension, NGOs, etc.).

The concept encompasses mobilization and participation of the entire community and takes into account farmers needs and priorities. It also involves support of local leaders, government departments and other agencies. Rehabilitation of Dry Valleys (soil and water conservation) is not viewed from a narrow perspective but is considered together with the whole farming system and the costs and benefits to the farmer. It makes use of participatory rural appraisal techniques to learn about the experiences, problems and opportunities of the community, and to collect information for planning. At the catchment level, the main erosion problems are identified, analyzed, and discussed jointly by specialists and the community. A list of recommendations that must complement DVR technologies are identified to be developed. The farmers' views and preferences together with the socio-economic benefits are also taken into account

Managing for sustainable use of rehabilitated valleys: it is observed and perceived that flood control using water spreading technologies improve microclimatic conditions, and to promote permanent agriculture and agroforestry, so that a more or less permanent vegetation covers is guaranteed. Hence, requires putting in practice appropriate land use planning and management in coordination and close collaboration with community members or user groups, local governments and experts in the area, agreeing on sustainable land use and management, conferring shared and self-responsivities. Along streams and gullies riverbank protection against grazing, arable farming and tree cutting, is recommended.

Soil and water conservation: soil conservation practices for weak soils. Widespread implementation and optimization of soil and water conservation practices in the area could allow intensification of agriculture, production of higher value crops, and support conservation and recovery of ecosystem services that are fundamental for long-term sustainability, such as nutrient cycling and soil structure development. To counteract both wind and water erosion it is important to start with the application of basic soil and water conservation measures. To reduce the detachment and transport capacity of water, run off should be slowed down. Soils should be kept covered as long as possible, either with vegetation or organic mulch, and flow velocities should be lowered with, for example, soil bunds. As most of the soils belong to the very fragile type of vertisols, it is also recommended to consider the experiences and approaches described in the manual for management of vertisols.

The target people who may live in or near the dry valleys are very important in the rehabilitation and conservation process. Successful valley rehabilitation relies on the participation of the population in planning, utilization, and monitoring. Moreover, these people are those whose livelihoods depend on the endowments of natural resources from the valleys. The valleys are part of their culture and identity. It provides goods and services, such as food, water, livelihoods, and safety that they rely on for development and survival. Dry valleys rehabilitation need to take into consideration that people living in or near the dry valleys are ensured with:

- Increased access to products and services in the landscape, contributing to improved livelihoods and social security in the long term
- More economic opportunities through restoration-related jobs and activities, and through trade and value-addition of forest products and services

- Improved grassroots institutions and multi-stakeholder platforms as a pre-condition which contributes to addressing inequality gaps in gender, resource access and benefits, participation and representation
- Enhanced overall resilience and adaptive capacity, especially for marginalized groups

For Gubuka, Boldid (Jigjiga areas) and Goro Guba (Errer) dry valleys areas:

These areas are very prone to erosion due the slope from which the source of flood is emanated. In this dry valleys, protection of denuded slopes through vegetative and soil treatment measures is help full and minimize the damages to the water spreading weirs downstream. Accordingly, it is necessary to take the following measures:

- Vegetative and soil treatment measures are particular important in the protection and stabilization of denuded slopes when there is an abundance of vegetative material, natural vegetation is easily propagated and established, structural works are unsuitable or unnecessary, and aesthetic values are important. Measures include the (re)vegetation of exposed slopes to protect against erosion, and the stabilization of slopes with living or dead plant material.
- Stabilizing slopes through vegetative and soil treatment measures is often more sustainable and requires less maintenance than the use of engineering structures. Vegetative measures may not always be sufficient, however, for example in dealing with torrents and landslides, in which case check dams, retaining walls and other engineered structures may be necessary.
- Minimizing surface runoff is essential for gully control. Poor land management practices, intense rain, prolonged rain of moderate intensity, and rapid snow melts can result in high levels of runoff, flooding, and the formation of gullies. So it requires improving gully catchment to reduce and regulate peak flows; the diversion or retention of surface water above gully areas; and stabilizing gullies by structural measures and accompanying revegetation.

Structural measures should be considered only after appropriate land-use management measures have been explored and adopted in the watershed.

Landslide Prevention. Landslides are natural phenomena that may occur in areas characterized by fragile geology, steep topography, and high precipitation. It is difficult to predict when landslides will occur, and the volume of soil movement they will involve, but human activities may promote them. The conversion of forest to grasslands, road and dam construction, logging, and other activities can cause changes in slope stability and therefore increase the risk of landslides. Watershed managers can play important roles in preventing landslides by making appropriate land management decisions. Note, however, that landslides caused by tectonic processes cannot be prevented or ameliorated through watershed management.

8.2.2 Key Areas of Intervention Complementing WSW Technology

The intention of the project in its current situation is to conserve soil and water in the form of soil moisture so as serve the community to produce using the conserved moisture at the absence precipitation. To attain the soil conservation goal, it may only require one or two session of showery rain that can produce soil

saturated flood. Once the soil is filled on the upstream faces of weirs, the entire height of the weir (check dam) will be below the surface of the ground. Whereas, the water conservation target is almost always dynamic since the water percolation is non-stopping. Hence, the service of the project is limited to the width of weir (check dam) and the length and/or spacing between weirs.

Whereas, if few infrastructures are incorporated to the existing checks dams, there is a possibility to maximize the positive impact of the project in different ways. These are:

- Maximizing the area of land that can get water;
- Maximizing the number of beneficiaries as the result of increased moisturized farm land;

The infrastructures need to be added are:

- Conveyance structure, Canal or level bund;
- Ponds for water storage;

Thus, simply provision of these conveyance structures and ponds for water storage, will significantly increase the number of beneficiaries and the area to be cultivated. Furthermore, the stored water in pond can also serve for livestock watering which is another dimension of the effects of the project.

9. References

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7. Revisiting the status of pastoral women's access to and control over livelihood assets; evidences from Fafan zone, Somali region, Ethiopia; Bikila Ayele, 24 April 2019

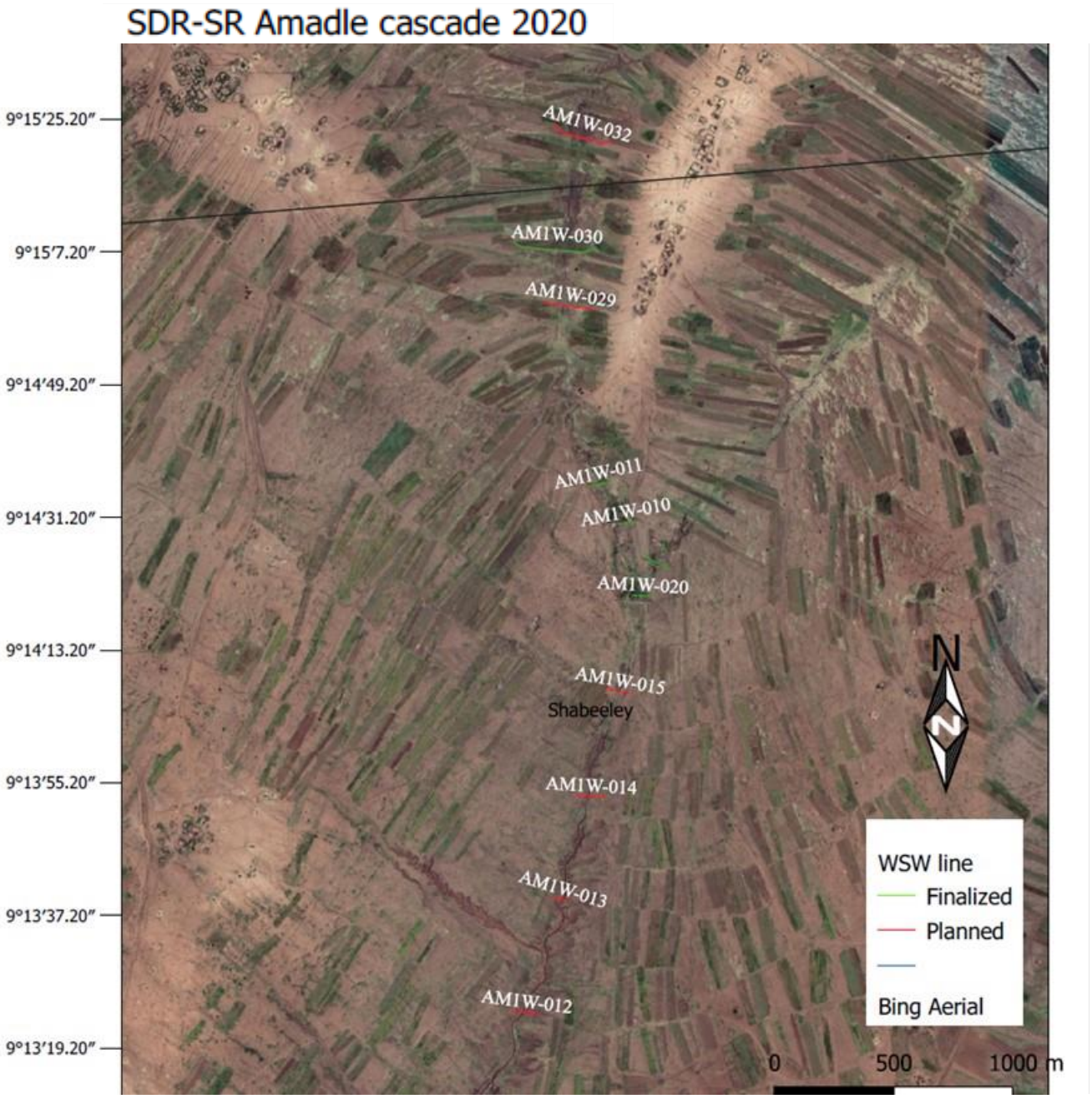
Appendix

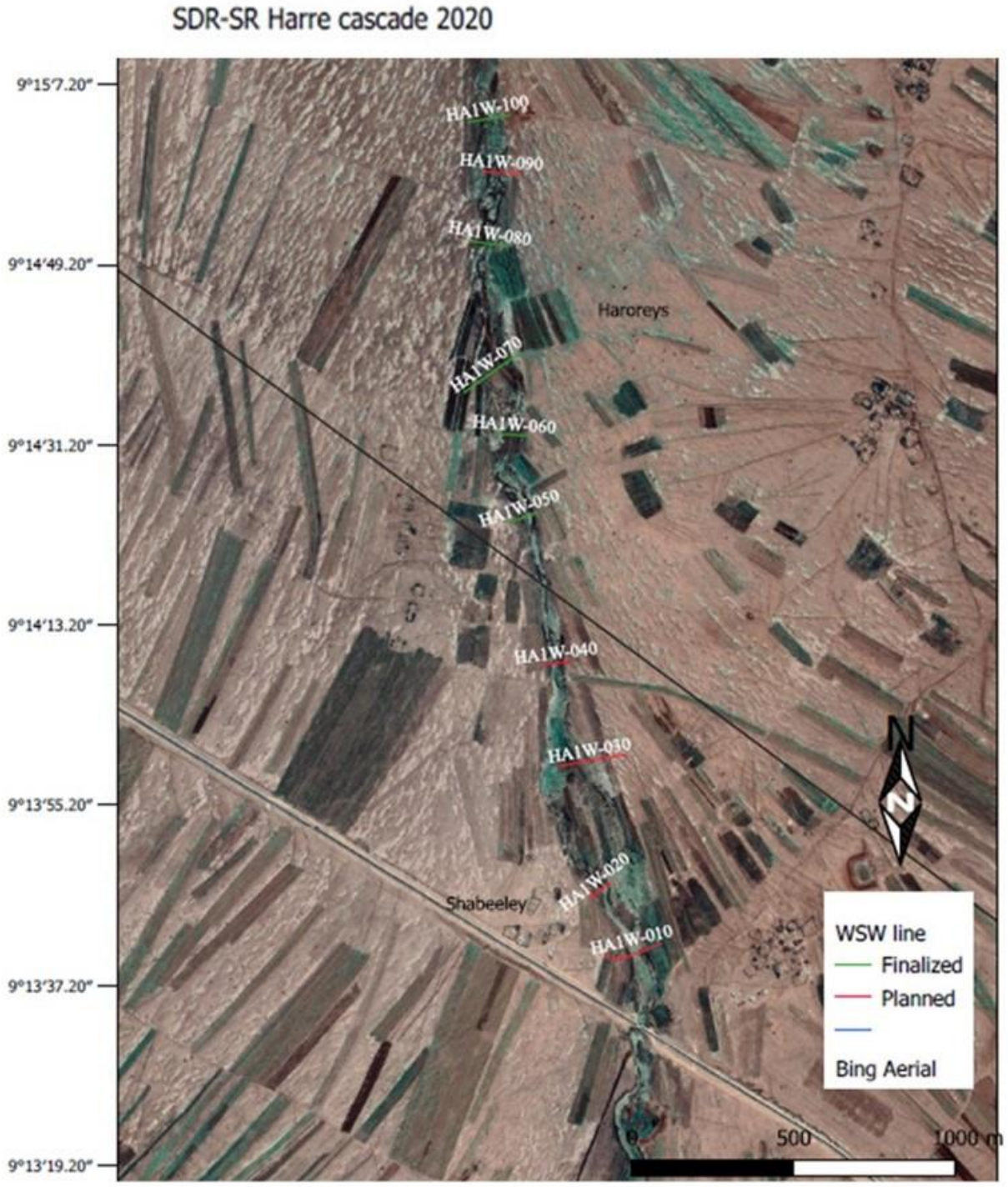
Annex I

List contacted persons by their organization

N0	Name	Organization	Telephone
1	Mohammed Ahmed	GIZ SDR Office, Jigjiga Somali Region	0915741177
2	Muktar Arbe	GIZ SDR Office, Jigjiga Somali Region	
	Amin Abdi	GIZ SDR Office, Jigjiga Somali Region	0915404985
3	Abdi Mohammed	Chairperson of Amdale Kebele	
4	Mr Hassein Abdulahi Takele	Bureau of Livestock and Pastoral Development (BoLPD)	0911988263
5	Mr Badal Kenedid	Bureau of Agriculture and Natural Resource Development (BoANRD)	0913241469
	Mr Althir A/Qadir	Shebel Woreda Natural Resource Directorate	0913440171
	Mr Hashim Eden	Shebele Woreda Livestock Directorate	0905616822
	Abdikadir Abuker Abdi	Shebele Woreda Women and Children Affairs	0939876988
6	Bedelgas Yususf	Bolidid	
7	Abdurman Adem	Bolidid	
8	Ali Abdi	Gubka	
9	Mohamed Ahemd	Errer Woreda Crop Team Leader (GIZ-contact person)	0982937084

Annex II: Amadle and Harre DVR Project Areas

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