

Draft Inception Report

Providing Training on GIS

Data Collection, Management, and Establishing of Geodatabase for REDD+ Investment Program (RIP) Project Intervention Areas

|  |  |
| --- | --- |
| **Legal Name of Proposing Organization/Firm:** | **Frontier*i Consult (The former BDS Center for Development Research)*** |
| **Country of Registration:** | Ethiopia |
| **Year of Registration:** | 2008 |
| **Name of Signatory for This Proposal:** | Belay Fekadu |
| **Designation of the Signatory:** | CEO |
| **Email:** | [info@frontieri.com](mailto:info@frontieri.com) |
| **Business Address:** | Addis Ababa, Namibia St. Lingo Tower, 8th Floor |
| **Phone / Fax:** | +251116479517/+251116478129; Fax:- +251116479778 |

**RFP No.: UNDP - ETH-00009**

**Contents**

[1. INTRODUCTION 1](#_Toc155359355)

[1.1 Background 1](#_Toc155359356)

[1.2 Objective 2](#_Toc155359357)

[1.3 Scope 3](#_Toc155359358)

[2. TECHNICAL APPROACH AND METHODOLOGY 5](#_Toc155359359)

[2.1 Technical Approach 5](#_Toc155359360)

[2.2 Methodological Approach 6](#_Toc155359361)

[2.3 Field Operation and Assurance Mechanisms 10](#_Toc155359362)

[2.4 Data Usage 14](#_Toc155359363)

[3. OUR PROJECT IMPLEMENTATION STRATEGIES 15](#_Toc155359364)

[3.1 Reporting Mechanism 15](#_Toc155359365)

[3.2 Ethics 15](#_Toc155359366)

[3.3 Risk Assessment and Anticipated Contingency Plans and Mitigation Strategies 15](#_Toc155359367)

[3.4 Client Engagement and Communication 16](#_Toc155359368)

[3.5 Deliverables and Workplan 17](#_Toc155359369)

[4. REFERENCES 20](#_Toc155359370)

[5. TEAM STRUCTURE 21](#_Toc155359371)

# **INTRODUCTION**

## Background

Ethiopia’s forests underpin key sectors of the economy with immense potential to contribute to the social and economic development of the country through a range of environmental, ecological, economic, and social services. In addition to the diverse wood and non-wood products gained from the forestry sector, Ethiopia’s forested landscapes provide a wide range of environmental services, such as watershed protection and associated benefits related to energy and soil protection, ecotourism potential, and biodiversity conservation, which contribute significantly to the health and wealth of Ethiopia. The development challenge for the forest sector in Ethiopia is to reduce the high rate of deforestation and forest degradation while building upon opportunities for forest restoration, increasing landscape productivity, developing and promoting forest enterprises, and generating income. Given Ethiopia’s desire to increase forest cover from the current 15.5% to 30% by 2030, technical capacities need to be expanded beyond what currently exists to support and derive innovation and stronger engagement with private sector and civil society partners who can create sustainable and cost-effective forest sector development models.

The government of Ethiopia supports global climate policies by being a signatory to the Paris Agreement and other international policies. The country developed the innovative Climate Resilient Green Economy Strategy (CRGE), which has been designed to address both climate change adaptation and mitigation objectives. The CRGE strategy, which was officially introduced during COP-17 in Durban in 2011, is a clear manifestation of the leadership’s commitment to pursue a carbon-neutral development regime. The UNFCCC mechanisms for reducing emissions from deforestation and forest degradation (REDD+) have been supported as emission reduction and increased carbon sequestration means in the forest sector, as proposed in the countries Nationally Determined Contribution (NDC), which was submitted in 2017.

The REDD+ Investment Program (RIP) was approved by the Government of Norway and the Ministry of Environment, Forestry, and Climate Change in 2017. The program has three components that contribute towards carbon stock enhancement and emission reduction in the forest sector, namely afforestation and restoration, drivers of deforestation and degradation, and the Forest Sector Transformation Unit. Successful emission reduction may mean the country is eligible for results-based payments as agreed in the bilateral agreement between the governments of Ethiopia and Norway. Thus, ensuring that the activities implemented by the program result in emission reduction is extremely important; this requires the recording of *spatial*, *non-spatial,* and *temporal locations* of activities. In order to collect all this required useful information and reach decisions on the different future management, utilization, and monitoring of the existing forest resources, up-to-date data collected through different techniques and approaches is demanding.

Accurate, consistent, and representative information on forest resources, products, and services is important to improve forest resources and sustainable forest management, given the reporting requirements for countries to access results-based payments for REDD+. Nevertheless, at the national or even regional level, there is no accurate, comprehensive, and up-to-date information on forest biomass and volume for natural high forests, woodlands, plantations, and bamboo forests that is important to develop strategic management planning and forest policy processes (FDRE, MEFCC, 2016). There is limited information based on research and accurate data at the national or regional level for measuring and monitoring the status and changes of forest and tree resources. Despite these facts, most existing estimates of forest coverage and its changes are based on outdated inventories, which are reported to be costly and require more time. Similarly, in order to derive adequate and accurate information about the resources' location and plan for sustainable utilization, ensuring high location accuracy and a standardized geodatabase are particularly essential. The lack of map accuracy and inconsistency in data collection could cause difficulty in monitoring and evaluating the availability of resources, thereby leading to a higher risk of misuse of the data in decision-making, which may in turn lead to significant legal, social, and economic impacts.

The availability of up-to-date geospatial data will help facilitate inventory, monitor changes, and assess impacts of climate, land use, and environmental changes on carbon, agriculture, and livelihoods to support planners, decision-makers, academia, and other development actors in making decisions and investing to enhance productivity, utilization, and sustainability of land resources (Abbadi, 2016, 2017, 2022). Such information has huge potential in environmental and NRM GIS applications. There is a critical need to develop innovative and cost-effective methods for regional-level C-Sequestration (CS) assessment through the integration of remote sensing (RS), GIS, statistical, direct field measurement, and laboratory analysis methods through space and time dimensions.

Inventory and monitoring, spatiotemporal change detection, impact assessment and quantification of ecosystems, ecological, vegetation dynamics, carbon stock, and other interventions are vital for up-to-date decision-making by policymakers and other actors assisted by decision support tools. Databases and data infrastructure are critical inputs for information systems. Geospatial data infrastructure in the GIS environment and platform helps to generate accurate data (spatial and non-spatial) and information. We need to know what, where, and to what extent changes through space and time in development efforts. This can be done through GIS and requires capacity building in infrastructure and human resources. This training of staff in GIS will equip them to handle, analyze, manage, and interpret data on the GIS platform (Girma et al. 2015; Abbadi, 2017).

Therefore, the main purpose of this assignment is to train project district staff to collect and manage all spatial and non-spatial data on project intervention activities, including (but not limited to) afforestation, assisted natural regeneration, exclosures, participatory forest management, nurseries, livelihood activities, forest boundaries, and building a geodatabase.

## Objective

The overall objective of the assignment is to provide training and supervise project staff to collect spatial data using GIS, GPS, geodatabase and Remote Sensing and design and establish a standard spatial database that serves as a knowledge management platform for RIP projects, and to closely follow up spatial data collection activities, do quality assurance of the data collection processes, and finally build a geodatabase by the project staff.

**The specific objectives of the assignment are to:**

* Train 119 forestry experts from RIP-AR, RIP-DD, and FSTU woredas (i.e., 63 from RIP-AR; 60 from RIP-DD; and 6 from FSTU) to collate, compile, document and organize a database and library of spatial and non-spatial data and advise on compatibility of datasets and acquisition of additional data
* Closely follow up and do quality assurance of the data collection and building of geodatabase by the project staffs.
* Develop an operational manual and guideline.
* Create Meta data for each shapefile produced, the database should include all relevant spatial data, GPS files, georeferenced photographs etc.
* Design a GIS database to record all spatial data of project interventions such as Afforestation/Reforestation (AR), Assisted Natural Regeneration (ANR), reducing Deforestation and Degradation (DD) and Restoration Model sites.

## Scope

As stated in the ToR, the scope of this assignment is to train 119 forestry experts drawn from RIP-AR, RIP-DD, and FSTU project woredas in Amhara, Oromia, Gambella, SNNP, Sidama, and South-West regions of Ethiopia. The training will focus on the basics of GIS (spatial data handling and processing), GPS, remote sensing, maintaining, creating geodatabases and metadata, and checking the quality of the existing project data. Preparation, geodatabase development, training and all field activities and data quality control and final delivery/completion of all activities is planned to be completed within 60 days. The training will be conducted at four locations in Ethiopia namely *Adama*, *Awassa*, *Jimma*, and *Bahirdar* for 10 days each in parallel. The training participants will come from four regions namely *Oromia,* *Amhara*, previous *SNNP* (now, split in to *Sidama and South West Region*) and *Gambella* regions. In a nutshell, the training will cover introduction and hands-on exercise (10 days) on GIS, GPS, and where possible other data collection tools (tablets and smart phones) and spatial database.

In addition to the training, Frontieri, will be engaged in (2) the follow-up field-experts during data collection and quality output production, (3) designing and developing a unified geospatial database to store, manage and display data/information from either newly collected data, secondary data and already existing spatial data, and introduce quality assurance mechanisms including appropriate metadata which will be disaggregated at regional/project office level (4) preparation of training manual, operational manual and guideline, and (5) establishing a monitoring system. And, the whole assignment should be designed to significantly support decision making processes related to RIP and interventions, monitoring and evaluation and project reporting in almost near real time (depending on internet connection) of data collection.

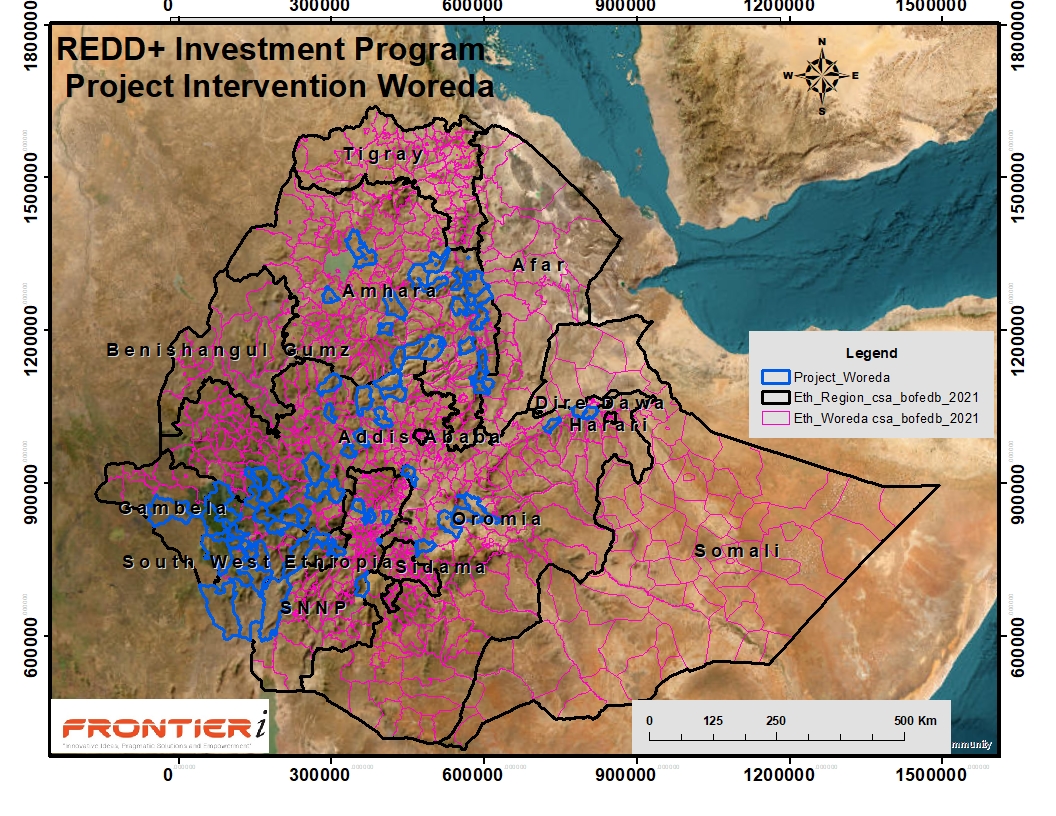


Figure 1: The location map of the identified project *woreda*s.

# **TECHNICAL APPROACH AND METHODOLOGY**

## Technical Approach

This section presents the technical approach that the Frontieri team will follow to provide GIS training, data collection, and geospatial database development for the REDD+ project. The overall technical approach to this is presented in Figure 2 below.

Unified geodatabase development that can serve to accept, store and compile the spatial and non-spatial data for the REDD+ Investment Program (RIP) sites

Geodatabase development

After an intensive training, the 119 forestry experts will be required to collect data from their respective districts (ANR, AR and PFM sites in the RIP intervention area)

**The four GIS trainers, four assistant GIS trainers, and the central data manager will closely follow up the maintaining of the minimum acceptable standard of quality for the data collected**

Compiled unified spatial and non-spatial data for knowledge management will be generated.

Training on GIS for 119 forestry experts that will come from different regions The training is organized in four centers (Hawassa, Adama, Jimma and Bahir Dar)

Train forestry experts

Data collection

Follow-up

Outcomes: 1) unified geospatial database, 2) capable trained forester staff, 3) knowledge management platform for RIP developed

Figure 2: Overall technical approach for the GIS training and geodatabase development for REDD+ and investment program

## Methodological Approach

### *Geodatabase*

The Frontier*i* team will design and develop a geospatial database that can accept, store and manage the RIP field/forest geospatial/non-spatial and related datasets using QGIS. Here are some of the points to consider. [QGIS is an open-source Geographic Information System (GIS) software that offers a wide range of features, including vector and raster analysis, geoprocessing, geocoding, georeferencing, online mapping, and 3D visualization](https://docs.qgis.org/latest/en/docs/user_manual/preamble/features.html). [QGIS supports many data formats and standards such as Shapefile, GeoTIFF, GeoJSON, WMS, WFS, and PostGIS1](https://docs.qgis.org/latest/en/docs/user_manual/preamble/features.html). [Its interface is more modular and flexible, allowing one to add or remove toolbars, panels, menus, and windows based on one’s preferences and needs](https://docs.qgis.org/latest/en/docs/user_manual/preamble/features.html).

Moreover, in QGIS, the file geodatabase format has emerged as a very common format for storing and exchanging spatial data, particularly considering that it allows for the storage of multiple data layers and data layers that exceed the limits of other specifications.

In the current REDD+ Investment Program (RIP) Project Intervention Areas database, all the activities will be entered in this QGIS project so that all stakeholders at all levels will have the same information about the status of the implementation of activities at the same time.

Data collection templates will be developed for all activities under each project. It is in these templates that all project activity data will be compiled. Their Spatial Reference System (SRS) has been proposed to be defined as **WGS\_1984 UTM Zone 37N**. These templates are empty shapefiles having attributes built into their corresponding Attribute Table. As SRS has already been defined for each empty shapefile, data collectors should use copies of those shapefiles whenever activities data are captured and attributes constructed. The empty shape files are organized by polygon feature types.

The geodatabase will include four major components as shown in Table 1 below. Under these activity types there are a number of attributes that will be incorporated in the QGIS project and their description is found in the operational manual. Data collectors are advised to read and understand what the truncated words stand for in the attribute description tables of the operational manual.

Table 1: Components of the Project Intervention of REDD+ Investment Program (RIP)

|  |  |  |  |
| --- | --- | --- | --- |
| **S/N** | **Intervention Type** | **Code** | **Feature Type** |
| 1 | Plantation Site (AR) | 01 | Polygon |
| 2 | Restoration Site (ANR) | 02 | Polygon |
| 3 | Participatory Forest Management Site (PFM) | 03 | Polygon |
| 4 | Project Nurseries | 04 | Polygon |

In addition to developing the database, trainees will get to learn QGIS architecture, skills to create tables and several other database objects including views, functions and sequences. The designed, developed and deployed unified geospatial database will then store, manage and display data/information from either newly collected data, secondary data or already existing spatial data, and it will have quality assurance mechanisms. Moreover, metadata for each of the collected datasets/shapefiles will be created.

A QFieldCloud-based mobile/tablet data collection will be employed for real-time synchronization and merging of the collected data from each duty station (Addis Ababa, Adama, Hawassa, Jimma, Bahir Dar, and project districts). During the training, each team will be capable of developing its own QGIS geodatabase and QFieldCloud.

A pre-testingexercise will be done by the Frontier*i* staffs first and later after the training there will be a pilot-testingof the data collection during the training session, syncing as well as managing the database. The Frontier*i* team will improve the database and data collection app if there are requirements for adjustments. Th Frontier*i* team will design and establish a geodatabase (including metadata) and train project staffs on running and maintaining the database that serve as knowledge management platform for REDD+ Investment Program (RIP).

The training will include a data quality assurance module to check for errors in the datasets, even when they appear accurate. Data quality assessment and control are primary tasks in data management for producing good end products, and they are a part of the training for data collectors. The quality assurance mechanisms for this assignment will include:

* Applying topology checker and rule and editing topological errors
* Checking for errors in an existing Shapefile

### *Provision Of Training*

**Target trainees and stakeholders**

A total of **119 forestry/project staff/experts** from **120 *woreda*s** will be trained. The training will be conducted in **53 *woreda*s** from RIP-AR, **60 *woreda*s** from RIP-DD, and **6 *woreda*s** from FSTU (listed in the ToR). For the Dejen and Werejarso projects, one team will manage the training, and hence only **six trainees** from **seven *woreda*s** of FSTU project districts will participate.

**Location and venue of the training**

The forestry experts will be trained in four clusters: Adama, Hawassa, Bahir Dar, and Jimma. The RIP AR, in collaboration with the two components, will assign the trainees to the identified clusters. The class size will range from **25 to 35 individuals per classroom**. The trainers will be assigned to the nearest training town based on geographic proximity. To provide hands-on GIS software training, Frontier*i* will use well-established GIS computer laboratories from universities in the training towns through partnership agreements to have spacious enough rooms for the trainees. The trainers will move around easily to supervise and provide support for the trainees. The training room should have proper ventilation. The total lecture day will not be more than one day out of the 10 days. [A course outline containing course schedule and learning objectives and outcomes will be provided to the trainees](http://mrv.hu.edu.et/). A course outline containing course schedule and learning objectives and outcomes will be provided to the trainees.

**Training Contents**

The training will include the following components with hands-on-practice sections.

1. Basics of GIS & QGIS Concepts

1.1 Basics of GIS concepts

1.2 Why QGIS?

2. Creating and Exploring a Basic Map

2.1. An Overview of the Interface

.2. Adding your first layers

2.3. Navigating the Map Canvas

2.4. Symbology

3. Classifying Vector Data

3.1. Vector Attribute Data

3.2. Labels

3.3. Classification

4. Coordinate Reference System (CRS)

4.1 Overview of Projection Support

4.2 Layer Coordinate Reference Systems

4.3 UTM coordinate zones of Ethiopia

5. Creating Vector Data

5.1 Creating a New Vector Dataset

5.2 Feature Topology

6. Georeferencing a Map

7. Quality Assurance and Control

7.1 Applying Topology Checker and Rule and Edit Topological Error

7.2 Check for Errors in an Existing Shapefile

8. Digitize RIP Project Implementation Sites into a QGIS Project

9. QField and QFieldCloud

Training packages (Training manual, lecture material, exercises, software/packages/extensions, videos, references) will be available to the trainees.

The trainees may have differences in skills, and they will be assessed with pre- and post-training exams. Low-performing field staff will receive additional coaching during training, as well as frequent supervision during field data collection. This information will be reported to the client. Additionally, some of the locations that we foresee (5% checks) could be these sites. To improve communication among data collectors, Frontier*i* plans to create a group account for exchanging information. To facilitate this, it is important that the data collectors have mobile phones. In case they do not, they can use Frontier*i*’s tablets to communicate with other teams when a Wi-Fi connection is available. The communication can be one-to-one or for common issues with the group account.

The training program will require trainees to work on their project site during the training. Trainees will be required to prepare a base-map (google earth) and create different thematic layers that will assist them during field work. At the end of their training, they will be required to work on their project site and handover a small project report. High resolution GeoTiff layers will be created for their project sites after they create the general boundary of their project site. If the client provides specific project site boundaries, it would be helpful to inform trainees prior to their training. This will enable them to create a basemap that will be useful for their field work.

### *Data Collection*

The data to be collected and the method by which the data will be collected are outlined as follows.

1. Input data to be used

* Google Satellite Hybrid imagery
* Administrative Boundary Shape file
* Agroecological map (MoA, 2007 map)
* Biophysical data (Climate, soil, topography, other land characteristics)

1. Attribute data to be collected

|  |  |  |  |
| --- | --- | --- | --- |
| S/N | **Activity Attribute Lists** | S/N | **Activity Attribute Lists** |
| 1 | Identification Number | 29 | silvicultural practices (species site matching, method of planting, preferred spacing, mulching, pruning, thinning, harvesting) |
| 2 | Region Name | 30 | logged area |
| 3 | Zone Name | 31 | Altitude |
| 4 | Woreda Name | 32 | aspect North-east, South-east, North-west, South-east) |
| 5 | Kebele Name | 33 | Presence of natural Regeneration (Yes, No) |
| 6 | Intervention year | 34 | Forest expansion (% of Area, % of species per area) |
| 7 | Mode of Intervention (A/R, ANR, PFM) | 35 | Management plan and planning (Yes, No) |
| 8 | Existing Plant Species in the intervention area | 36 | Fire protection (Yes, No) |
| 9 | Annual Survival Rate of Seedlings | 37 | Community involvement (Number of community members) |
| 10 | List of Constructed Soil and Water Conservation Structures | 38 | Year of the PFM site |
| 11 | Post planting Management Activities | 39 | Invasive species |
| 12 | Ownership | 40 | Artificial surfaces (Number of homestead/ha.) |
| 13 | Data Collector | 41 | Artificial surfaces (No. of boreholes/ha.) |
| 14 | Date of Data Collection | 42 | Name of PFM site |
| 15 | 01= Plantation Site 02= Restoration Site 03=Participatory Forest Management Site 04 = Project Nurseries | 43 | Membership requirement (Yes, No) |
| 16 | Name of the restoration site | 44 | Income generated (Yes, No), If yes, how much/annum) |
| 17 | Agro Climatic Condition | 45 | , how much income /annum |
| 18 | Annual mean temperature in 0C | 46 | Number of members |
| 19 | Annual mean rainfall | 47 | Permitted products for collection (Yes, No) |
| 20 | Soil Type | 48 | Security Involved in forest protection/ guarding – Yes/No), If yes, how many guard hours/annum? |
| 21 | Land Form Type (Plain, Mountain, Plateau, Hills, Ridge and escarpment) | 49 | how many guard hours/annum? |
| 22 | Slope Class in Percent (0-2, 2-5, 5-8, 8-15, 15-30, 30-60, >60) | 50 | Capacity (Number of seedlings per/annum) |
| 23 | area/size of the Plantation/restoration/PFM/Project Nursey site in Ha | 51 | Facility (Yes, No) If yes, areas compost production, water availability, Availability of pots, Presence of shades) |
| 24 | Restoration type | 52 | Yes/ No: Level of community engagement and participation |
| 25 | purpose of the plantation | 53 | Challenges faced during implementation (seed availability; seedling availability; availability of appropriate tools) |
| 26 | management unit | 54 | The proposed solutions (Availability of NGO support, Government support, training support etc.) |
| 27 | Roads | 55 | Attached Photograph |
| 28 | The health of the plantation |  |  |

1. Data Collection Methods

Depending on the requirement, different data collection methods can be used. For example:

1. Exploratory Field survey

* Collect relevant secondary information from existing geoportal or from project office
* Field validation of actual sample points using GPS
* Obtaining the existing shapefile and GPS location of the A/R, ANR, and PFM sites from each selected project woreda (120 woredas);
* location accuracy of each dataset will be examined by overlaying them on top of reliable topo-maps from official data source such as Ethiopian Mapping Agency.

1. Actual field survey

* Measurement and observation (biophysical factors, georeferenced data using GPS/Tablet)
* Measurement of site information, boundary delineation

## Field Operation and Quality Assurance Mechanisms

### *Field operation*

Frontier*i* believes that careful management of fieldwork activities is essential to complete the data collection in time, within the scope of the available budget and with high data quality that meets client’s expectation. For the current field data collection, Frontier*i* is strongly committed to ensuring that the field data collection activities are conducted following acceptable ethical procedures that involve several activities, such as training of field staff, logistics arrangement, pre-testing and pilot testing of instruments, organizing debriefing sessions (before and after data collection), deployment of field staff, field monitoring, reporting, and communication with the UNDP project team at regular intervals.

### *Resources*

Frontier*i* has a well-established Human Resources and Logistics Division responsible to provide all relevant and required resources during filed staff training as well as during the fieldwork. In this regard, Frontier*i* will arrange the following logistics for the survey.

* **Training Hall**: Frontieri will arrange well-furnished training halls equipped with all relevant training facilities in those universities that have GIS laboratories around the training towns. Each hall would accommodate up to 35 participants. In addition to the GIS software, relevant training facilities, including projectors, high-speed broadband internet, a home theatre audio system, and refreshments will be readily available.
* **Electronic Devices:** Frontier*i* has more than 400 Samsung TAB-A Tablets with features of 8 inches (20.32 cm) touch screen for daily use, 5000 Am battery with long life after charging, and a 4 GB RAM with 32 GB storage capacity. Moreover, we also provide power banks, charging-doc, and other relevant data collection materials. For this assignment, Frontier*i* will provide 119+ tablets for field data collection. The field data collectors will sign an agreement form to return the tablets after the end of the survey. However, if the tablets are already available at the project or with the field staff, we will use them instead.
* **Vehicles:** Frontier*i’s* Logistics Division will provide field vehicles for the fieldwork in collaboration with its sister company.
* **Health Equipment:** Considering the prevailing COVID-19 pandemic and other safety precautions, Frontier*i* will provide relevant health and safety equipment, such as face masks, sanitizers, and other relevant emergency first-aid kits, to field staff as well as respondents.

### *Quality Assurance*

Monitoring quality during data collection is one of Frontier*i*’s key strategies to ensure high-quality data. During the pre-data collection and while-field data collection, our data management team will monitor and ensure data quality using the following techniques:

1. **Pre-testing and standardization of the tool:** Once the field data collection tool is developed, contextualized and programmed, we will perform office-based pre-testing to standardize the data collection instrument. During the pre-testing, we will check the logical flow of questions, typological issues, language issues, inconsistencies, etc. This will be shared to the client for comment.
2. **Pilot survey**: After completing the field staffs training, a pilot survey will be carried out prior to the beginning of the actual survey on the forest area near the training sites. The pilot testing site should resemble the actual surveying site as much as possible. The field team will not be informed that it is a pilot survey. Every input data that is included in the final survey will be piloted prior to launching. Since this data collection is undertaken using digital technology, the pilot survey is intended to help field testing of both the survey program and devices. Based on the piloting feedback, corrections will be made to the final tool and programming.
3. **Pilot test supervision and team debriefs**: During the pilot survey, a team from Frontier*i* will accompany the field staff to guide the pilot testing and tool administration. Supervisions will be made with the field staffs to review any challenges faced, allow for questions and clarifications, and provide feedback to the wider group. These are especially important at the early stage of the data collection activity to ensure that proper data collection habits are formed.
4. **Accompaniment and supervisor checks:** The Frontier team (GIS and assistant trainee) will strictly follow the data collection procedures introduced at the training and directly observe those who need support. Moreover, Frontieri will ensure that at least 5% of the study sites (This will be discussed and agreed upon with the client) are directly observed by a Frontieri supervisor or field coordinators. Office level supervisors will check the data collectors synced data before they are archived in the unified database.
5. **GIS for data quality control:** All data collected from the field will be accessed from the main server by the office level supervisors. This data will be overlaid on to a high-resolution Airbus image to conduct daily checks. Erroneous shapefiles or input datasets will be notified back to the field data collector for correction. Most errors could emanate such as from improper use of projection, loss of GPS signals, negligence, lack of understanding, improper naming, and complexity of the survey area. This will be identified and immediately communicated to the field staffs/data collectors.
6. **Implementation and action on High Frequency Checks (HFC)**: The HFCs involve office level monitoring of synchronized data quality. High frequency checks provide insight into ongoing field team and data quality concerns before they become too entrenched or too late to manage. HFCs are meant to provide the evidence needed to successfully guide and manage a field team daily. If the quality of the data collected is found below the expected standard, it will be rejected and returned to the field data collectors for correction. Three different types of HFCs will be employed for this assignment: response quality, programming, and enumerator checks, as described below.

* **Input quality checks:** The team will perform routine checks on the quality of inputs of the synchronized data while the data collection is in progress. Moreover, we will carry out test for reasonable ranges of inputs to identify the extreme values and outliers (even though this will be capped in the program considering the range of values).
* **Programming checks:** Though we will perform rigorous check on programmed questionnaire before field deployment, there could be instances in which some minor program errors arise during the data collection period. To mitigate this, it is important for the team to frequently check if there are programming errors that need a quick fix. A newer version of the fix will be made available on their tablets from remote.
* **Enumerators checks:** Our data managers/GIS trainee expert will track the performance of the data collectors by running daily checks. We will check if the data recorded by individual data collectors are different from those of other enumerators from similar or nearby locations, or if they are different from what is expected. Any discrepancies will be communicated soon.

Moreover, as part of the high frequency data check, we will undertake the following: (a) check for duplicates (of instruments) and remove them; (b) check if there are empty records and verify that all study areas (project area) are covered, and (c) use GPS collected daily field data that will allow the data managers/ GIS trainee expert to identify the locations of the data collector where errors are reported as well as evaluate the performance of the data collectors coverage every day and assess quality.

Data quality assurance mechanisms will be done in two steps: 1) In person field checks and supervisions to some selected locations and 2) Office-level assignment of a supervisor (GIS trainee expert) to undertake spot-checks and discussion with the data collector to check that the quality of data is to the required standard, (3) Use of high-resolution datasets to check that field forms are complete and valid as per the instruction given (field implementation manual and guideline). On the other hand, data managers at the office level will continuously conduct checks, and reject/delete measurements with any error by indicating the overserved errors for re-correction. For this, the Frontieri team will:

* Prepare a checklist for assessing quality;
* Conduct testing and validation through ground trothing;
* Generate and use random data;
* Cross-check with other sources;
* Collect data along the trainees for consistency and accuracy of later quality evaluation\
* Compare raw data with modeled data

The schematic workflow of activities for the general process and specifically the data quality control and assurance are shown in Figure 4.



Figure 4: Schematic workflow of activities

### *Data Cleaning and Auditing Phase*

Data cleaning and auditing is the final phase of the data quality assurance mechanism. It is a continuation of the data monitoring step and starts immediately when field data collection is completed. It enables the determination of inconsistent, inaccurate, incomplete, or unreasonable data by generating error-log sheets, and ensures the overall integrity of the data quality. Along with data cleaning, data auditing will be performed to ensure that the required features of the geodatabase from the respective study site are met to achieve the completeness dimension of data quality of the non-spatial data. For the spatial data, the boundary of the features and attributes will be checked to ensure they are properly captured, maps are overlapped, and portions of the feature are not included in the polygon. [All these and others will be covered during data monitoring and data cleaning stages.](https://www.tableau.com/learn/articles/what-is-data-cleaning) The cleaning process for the non-spatial data will include, but is not limited to:

* **Checking outliers:** Often any data point that is three standard deviations (3D) away from the mean of the same data point for all observations will be excluded from the cleaned data set. In this regard, we will discuss with the client (research team) as to which approach, we should use to clean the outliers;
* **Checking variable labels:** The cleaned data set will be checked for variable labels description;
* **Ensuring transparency:** We will carefully document each step and take measures to clean the data so that anybody could replicate the process at any time in the future;

## Data Usage

Frontier*i* Consult will adhere to all the data usage and contract requirements provided in the ToR. The major data usage and contract requirements are listed below.

1. Frontier*i* will comply with the fact that the completed datasets will be the property of the UNDP. Hence, Frontier*i* team will provide the compiled spatial and non-spatial cleaned datasets through the geodatabase for the client;
2. Frontier*i* will not use the data for its own research purposes, nor license the data to be used by others, without the written consent of the UNDP;
3. No data or other information from this survey will be released to third parties without the written approval of the UNDP;
4. Frontier*i* will comply with local laws on privacy protection for all data being collected during the survey.

# **OUR PROJECT IMPLEMENTATION STRATEGIES**

## Reporting Mechanism

For daily and weekly progress updates and reporting, the Frontieri team will use a dashboard in an Excel spreadsheet. A project coordinator will be assigned as a focal point to manage overall communication with the client. The central data manager, GIS trainers, and assistant trainers will be part of this reporting mechanism for successful implementation of the assignment. Accordingly, GIS trainers will report directly to the project manager, and the project manager will develop the daily report and submit it to the project coordinator. Finally, the project coordinator will update the progress directly to the UNDP focal person. The report mainly focuses on the training provision status, the data collection status, and the final unified database report. Finally, Frontieri will provide a compiled and comprehensive report for these three major milestones to the UNDP focal person.

## Ethics

Keeping the standard and scientific research ethics, confidentiality, privacy protocols and meeting compliances of the UN core values are at the very heart of the Frontieri undertakings. Professional ethics during training provision, quality data collection, database development and dependable report is guaranteed by the consulting the firm. Frontieri will be obliged to meet compliances of the UN core values including:

* Demonstration of integrity by modeling the UN’s values and ethical standards;
* Promoting the vision, mission, and strategic goals of UNDP;
* Displaying cultural, gender, religion, race, nationality and age sensitivity and adaptability
* Treating all people fairly without favoritism;
* Fulfilling all obligations to gender sensitivity and zero tolerance for sexual harassment.

## Risk Assessment and Anticipated Contingency Plans and Mitigation Strategies

Identifying potential risks that may have direct and indirect risks on the successful completion of this data collection process and training is essential as it would help us to design an appropriate solution to mitigate and avoid the risks and their effects on our data quality. Thus, we have identified expected (potential) risks and attempted to describe their probability, impact, and effect on the assignment, and suggested possible mitigation actions as presented in Table 2 below.

Table 2 Potential risks, their probability of occurrence and mitigation strategies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Potential risks assumed** | **Probability** | **Impact** | **Effect on the assignment** | **Mitigation actions** |
| Conflict/security risks in some of the study areas | High | High | Challenge on data collection process | Frontier*i* will plan to use field expert’s knowledge to fill missing gaps. If this is not possible it will consult the client for possible solutions. |
| Loss of power or internet connection at the field level | Medium | Low | Project timeline and quality, delay during syncing data | Provision of power bank to the field staff to recharge equipment at the field level.  The client may transport field staffs to nearby network location to sync data |
| Dense forest canopy location may have little GPS signal | low | high | Few spatial data collected | Use offline GeoTiff high resolution Aibus images to support data collection |
| Unstable COVID 19 situations | High | Low | Time-quality-cost and field staff safety | As much as possible, we will follow the notice from federal and regional government officials and strictly adhere to COVID-19 mitigation strategies to notify field data collectors. |

## Client Engagement and Communication

Frontier*i* Consult will actively engage the client team and other relevant stakeholders through the process of training material development, pre-testing of database, training, pilot testing, field data collection and database management as clearly indicated in the ToR. Frontieri’s project coordinator will update the research team/client about the progress of the work once a week.

Property rights: Frontieri respects the intellectual property right and understands that RIP (UNDP) shall, solely and exclusively, own all rights in and to any work created in connection with this agreement, including all information, data, documents, copyrights, or other proprietary rights in and to the work.

Delays: Due to unforeseen problems that may be encountered in the course of the assignment, some aspects of the project could be delayed beyond the timeline specified. In this regard, Frontier*i* will:

1. notify the client about the delay in writing with a plausible reason for the same at least 10 days ahead of the timeline due date; and
2. present ‘just-cause’ for the delay external to the performance of the study team.

Frontier*i* will work closely with FSTU, the national/regional RIP project coordinators, the national and regional RIP GIS Officers/experts to produce the operational manual and guidelines, to conduct the training and ensure the data is properly collected and processed.

* Frontier*i* will avail itself whenever UNDP/Ethiopian Forest Development (EFD) and partners require meetings or clarification questions. UNDP shall notify Frontier*i* through email and telephone whenever such meetings are required.
* Detailed and comprehensive site information will be provided by the EFD and this should be in place and communicated to Frontier*i* prior to commencing its consultancy services.
* EFD and UNDP ensure that Frontier*i* will have access to the working sites and provide supports as relevant.
* Both EFD and UNDP shall approve all deliverables.

## Deliverables and Workplan

### *Deliverables*

As part of the assignment, the Frontier*i* team will deliver the following.

1. Inception Report including database design and training and operation manual,
2. Training report, functioning geodatabase, operational manual and guideline,
3. Draft report and raw data that includes all spatial and non-spatial data,
4. Final report and final functional geodatabase that include all shapefiles and final operational manual and guideline.

### *Workplan*

For accomplishing all the activities of the REDD+ investment program assignment, 60 days were allocated. A brief summary of work plan is presented in following table (Table 3.2).

|  |  |  |  |
| --- | --- | --- | --- |
| **Major Activities** | **Individual/team responsibility** | **Due date** | |
| **start date** | **end date** |
| **Phase I: Inception Phase** |  |  |  |
| 1.1 Introductory kick-off meeting | UNDP team and Frontier*i* |  |  |
| 1.2 Submission of draft Inception Report (with Methods and GIS Database Design) and draft Training and Operational Manual) | Frontier*i* | 05 Jan. 24 | 05 Jan. 24 |
| 1.3. Presentation and discussion on draft inception report, database design and training and operation manual | Frontier*i* | 08 Jan. 24 | 08 Jan. 24 |
| 1.4. Feedback and comments on the draft inception report, database design and training and operation manual | Client team | 09 Jan. 24 | 10 Jan. 24 |
| 1.5 Revision of inception report, database design and training and operation manual | Frontier*i* | 11 Jan. 24 | 12 Jan. 24 |
| 1.6. Submission of revised inception report, database design and training and operation manual | Frontier*i* | 12 Jan. 24 | 12 Jan. 24 |
| 1.7 Approval of revised inception report, database design and training and operation manual | Client team | 13 Jan. 24 | 14 Jan. 24 |
| **Phase II: Training Phase** |  |  |  |
| 2.1 Arrangement of training venue, computers and Tablet/GPS | Frontier*i* | 14 Jan. 24 | 15 Jan. 24 |
| 2.2 Training at Awassa, Adama, Bahir Dar and Jimma | Frontier*i* | 16 Jan. 24 | 26 Jan. 24 |
| 2.3 Pilot testing at nearby training location and debriefing | Frontier*i* | 27 Jan 24 | 27 Jan 24 |
| 2.4 Debriefing | Frontier*i* | 28 Jan. 24 | 28 Jan. 24 |
| 2.5 Preparation of training report, geodatabase and operational manual and guideline | Frontier*i* | 29 Jan. 24 | 31 Jan. 24 |
| 2.6 Submission of training report, functioning geodatabase, operational manual and guideline | Frontier*i* | 31 Jan. 24 | 31 Jan. 24 |
| **Phase III: Field data collection and supervision** |  |  |  |
| 3.1 Deployment of project staffs for data collection | Frontier*i* | 29 Jan. 24 | 30 Jan. 24 |
| 3.2 Field data collection | Frontier*i* | 31 Jan. 24 | 15 Feb. 24 |
| 3.3 Supervision and monitoring of data quality | Frontier*i* | 31 Jan. 24 | 15 Feb. 24 |
| 3.4 Data auditing and cleaning of spatial and non-spatial data | Frontier*i* | 16 Feb. 24 | 21 Feb. 24 |
| 3.4 Preparation of draft report | Frontier*i* | 16 Feb. 24 | 22 Feb. 24 |
| **Phase IV: Geodatabase and Report Writing Phase** |  |  |  |
| 4.1 Data auditing and cleaning of spatial and non-spatial data | Frontier*i* | 16 Feb. 24 | 21 Feb. 24 |
| 4.1. Conducting primary data analysis and preparing draft report | Frontier*i* | 16 Feb. 24 | 21 Feb. 24 |
| 4.3 Submission of the draft report and collected spatial and non-spatial data | Frontier*i* | 21 Feb. 24 | 21 Feb. 24 |
| 4.4 Receiving feedback and comments on the draft report | Client team | 22 Feb. 24 | 23 Feb. 24 |
| 4.5 Revision of the draft report based on feedback and comments from the Client team | Frontier*i* team | 23 Feb. 24 | 26 Feb. 24 |
| 4.6 Compiling Geodatabase at national and *woreda* levels | Frontier*i* team | 22 Feb. 24 | 26 Feb. 24 |
| 4.7 Submission of final report and final functional geodatabase that include all shapefiles and final operational manual and guideline | Frontier*i* | 28 Feb. 24 | 28 Feb. 24 |

# **REFERENCES**

1. Abbadi Girmay Reda. 2022. Landscape Restoration in Tigrai: Challenges and experiences. Dryland restoration and dry forest management in Ethiopia (Eds. Mitiku Haile, J. Livingstone, Amsale Shibeshi, and Pasiecznik N), 160 pages, 2021. ISBN: 978-90-5113- 152-9, PENHA, Addis Ababa, Ethiopia, and Tropenbos International, The Netherlands.

2. Abbadi, Girmay Reda. 2016. Evidences of Spatiotemporal Climate Change and its Mitigation in Ethiopia. Hydrol Current Res 7: 220. doi:10.4172/2157-7587.1000220.

3. Abbadi G R. Framework for Carbon Sequestration and Accounting of SLM Practices for Climate Change Mitigation in Ethiopia. Int J Environ Sci Nat Res. 2017; 4(2): 555631. DOI: 10.19080/IJESNR.2017.04.555631 4. FDRE. 2012. National strategy and action plan for the implementation of the great green wall initiative in Ethiopia.

5. FDRE, MEFCC, 2016. National REDD+ Strategy (2016 - 2030).

6. Gebremedhin Gebremeskel, T.G. Gebremicael, Abbadi Girmay. 2017. Economic and environmental rehabilitation through soil and water conservation, the case of Tigray in northern Ethiopia. Journal of Arid Environments (2018), Volume 151, Pages 113-124, https://doi.org/10.1016/j.jaridenv.2017.12.002, Elsevier Publishers.

7. <https://www.worldfuturecouncil.org/p/2017-desertification/>

8. NMSA. 2008. Climate change adaptation taskforce and plans.

9. Girma, A., de Bie, C.A.J.M., Skidmore, A.K., Venus, V., & Bongers, F. (2015). Hypertemporal SPOT-NDVI dataset parameterization captures species distributions. International Journal of Geographical Information Science, 30, 89-107, 10.1080/13658816.2015.1082565

10. Girma, A., Skidmore, A.K., de Bie, C.A.J.M., Bongers, F., & Schlerf, M. (2013). Photosynthetic bark: Use of chlorophyll absorption continuum index to estimate Boswellia papyrifera bark chlorophyll content. International Journal of Applied Earth Observation and Geoinformation, 23, 71-80, 10.1016/j.jag.2012.10.013.

# **TEAM STRUCTURE**

**Client’s Counterpart team**

Lead trainers:

1. Abebe Ejigu
2. Afework Mekeberiaw
3. Berihu Alemayehu
4. Elias Cherenet

**Project Management Unit**

**Team Leader**

Mekbeb Eshetu (PhD.)

**Assisstant** trainers:

4 GIS experts and 4 computer lab assistants