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MINISTRY OF AGRICULTURE

Assessment of Landscape Transformation and Its Implication in Benishangul Gumuz Region

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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ACCRONYM

ANN	Artificial Neural Network
CART	Classification and Regression Trees
CSA	Central Statistical Agency
CHIRPS	Climate Hazards Group InfraRed Precipitation with Station Data
EAILAA	Ethiopian Agricultural Investment Land Administration Agency
EVI	Enhanced Vegetation Index
ETM+	Enhanced Thematic Mapper Plus
FGD	Focus Group Discussion
FNF	Forest Non-Forest
FAO	Food and Agricultural Organisation
FERLA	Forest Environment Rural Land Administration
GEE	Google Earth Engine
HWM	Household Welfare Monitoring
GIS	Geographic Information System
GTP	Growth and Transformation Plan

GDP	Gross Domestic Product
KII	Key Informant Interview
MSS	Multi-Spectral Scanner
MODIS	Moderate Resolution Imaging Spectroradiometer
NDVI	Normalized Difference Vegetation Index
IPCC	Inter-governmental panel for climate change
IDPs	Internal displaced people
HCE	Household Consumption Expenditure
HDDS	Household Dietary Diversity Scores
LEDAPS	Ecosystem Disturbance Adaptive Processing System
LSAI	Large-scale Agricultural Investment
LULC	Land Use and Landcover
M&E	Monitoring and Evaluation
MEFCC	Ministry of Environment Forest and Climate Change
OLI	Operational Land Image
SDPRP	Development and Poverty Reduction Program
SVM	Support Vector Machine
TM	Thematic Mapper
WMS	Welfer Monitoring System
6S	Second Simulation of a Satellite Signal in the Solar Spectrum

Executive Summary

The Growth and Transformation Plan (GTP) targeted achieving food security and middle-income level country by 2025. Encouraging private investment in the agricultural sector is one of the strategies towards achieving such ambitious goals. In this regard, the government is leasing agricultural lands to domestic and international investors in different parts of the country where ample arable lands are available, including Benishangul-Gumuz region.

This assessment aimed at generating geospatial and socioeconomic information required to support responsible agricultural investment in the region. Specifically, the assessment focused on landscape transformation and its implication with particular emphasis on large scale agricultural investment (LSAI).

The landscape transformations examined using satellite images acquired in the region since the 1980's. Images acquired by using sensors aboard satellites such as Landsat, MODIS, Sentinel 1, 2, ALOS-PALSAR 2 were processed to derive information such as land use/land cover conditions, changes over time and hotspot areas; where major landscape transformation took place. On the other hand, the implication of landscape transformation was addressed by the socioeconomic survey conducted in four sample woredas distributed across three administrative zones of the region. The major findings include the following:

- Over the past three decades (1986-2017), forest and woodlands diminished in the region at the rate of 23,389 hectare/year. While croplands increased by 23,309 hectare/year since 1986. Croplands increased at increasing rate and forests and woodlands decreased at an increasing rate during the 2010-2017 trajectories.

- Until 2017, about 223,766 hectares of land were given out to investors, but these lands remain largely underutilized. Only 55% of them were under cropland use type in 2017.

- Hotspot areas of landscape transformation in the 2010-2017-time trajectory were concentrated in the peripheral parts; where the region bordered with other neighbouring regions. In addition to LSAI expansion in those parts, it appears that these areas were subjected to high population pressure due to the influx of people from the neighbouring

regions and the subsequent increment of demands for agricultural lands; leading to conversion of forests and woodlands into cropland. Vast hotspot areas of transformation were also observed during the 2000-2010-time trajectory. However, small parts of these areas were associated with LSAI. Flowering of lowland bamboo and the subsequent death of the species observed in many parts of the region during this trajectory appears the likely causes, though other factors such as selective logging and bush/forest fires can induces such hotspots.

- ☐ Rainfall and temperature generally showed an increasing trend in the region. The combined effect of these changes is an increased photosynthetic activity and increased in gross primary productivity (GPP). Both rainfall and temperature also projected to increase in the region. As rainfall is the most important factor controlling vegetation growth and productivity in tropical region, such natural factors can make the region more attractive for agricultural investment if the potential side effects are managed properly.

- ☐ The expansion of LSAI, the construction of the Great Ethiopia Renaissance Dam (GERD), mining activities, urban expansion and flourishing of new settlements, and expansion of small-scale agricultural activities were the major drivers of the landscape transformation in the region.

- ☐ The study area is highly prone to deforestation, crime and diffusion of culture due to large scale farming, immigrant workers, and expansion of commercial sex worker. The main livelihood of the local people is agriculture with limited off-farm job opportunities.

- ☐ The average land holding of the target study population was 10 - 12 hectares. Most of them owning the land traditionally/customary with no title deed for the land they have been using but by paying annual tax.

- ☐ There is no community consultation, discussions and sense of ownership creation program during land transfer process. There were grievance complains and conflict during and after the land is transferred. The local community was not happy when land is transferred. Thus, the community didn't feel sense of ownership on investors and on large scale farms.

- The community is not happy by the investors as the government took their land with out consultation. Because priority for the farmlands are not given to local people, the persistent conflict that arise with workers/ laborers, deforestation of the area and the culture and tradition of the local people is seriously affected. Most of the community responded that the large-scale famer fails to meet the expected result in production as well as benefiting the local people.

- In general, in Ethiopia and in particular in the target area health infrastructure is improving and extension services are available. However due to limited availability of health professionals to work at kebele level and high staff turnover, the health service is poor. Even if the health posts and health centers are built, they don't have the necessary professional and facilities to provide service. Health problems related to children are caused by food shortage and lack of hygiene and sanitation.

- The agricultural practice is traditional and limited to rain season production. The consulting team has learnt that there is very minimum practice of irrigation even though there are some opportunities and resources. Maize, wheat and haricot bean are the most common products of the target area

- The use of improved varieties of seeds is limited because of the poor qualities of improved seeds; discouraging many farmers from using them. Investors are reluctant to distribute improved seed and fertilizer to the local community. Most of the farmers apply natural fertilizer to keep their minimum production. There are farmers who used traditional means of compost application (which just throwing animal dung on the farm land) in their back yard.

1 Introduction

Agriculture is the primary economic activity in Ethiopia, where about 84 percent of the country's population generates its income for household consumption to sustain its livelihood. Moreover, the country generates the lion share of its foreign currency earnings from the sales/export of agricultural commodities abroad and currently the sector contributes about 42 percent to the country's GDP (CSA, 2015). Above all, the sector is believed to be the main source of capital to be accumulated for the process of establishing the future industrialized Ethiopia, which again shows the determinant role played by the sector to bring about sustainable economic development for the country in the years to come.

Ethiopian agriculture has suffered for years from the use of traditional farm implements and subsistence farming system as well as limited use of modern farm inputs that resulted to the Sector's poor performance (i.e. low productivity of the sector). Bringing improvement on the overall performance of the agricultural sector as a whole could only be successful, if and only if policies, strategies, implementation plans, and programs and related efforts are geared towards addressing the problems identified in the two agricultural sub- sectors. The two major agricultural sub sectors are:

a) Private agricultural holding: This sub-sector includes rural-urban small and fragmented privately owned agricultural holdings on which all types of agricultural activities such as crop production, livestock rearing etc, are performed by the operator/holders to obtain agricultural produce for self/family consumption and sometimes for sell. However, over 95 % of the annual gross total agricultural output of the country is said to be generated from this sub-sector,
b) Commercial Farms: This sub-sector refers to the farms that include state and private commercial farms mainly established for the purpose of profit making by selling agricultural products at local market and/or abroad. These farms are commonly owned and operated by government, private companies and non-governmental institutions, such as private individual investors, shareholders, religious and non-

religious institutions etc. The sub-sector is mainly characterized by the use of relatively capital intensive, mechanized and market-oriented farming system, with increased use of modern farm management practices and inputs such as, use of high tech-farm machineries and implements, irrigation scheme, use of chemical fertilizers, pesticides and improved seeds. Even if a lot effort is exerted to invest on commercial farm, due to various reasons, commercial farms are not effective and productive as expected and as a result of which the contribution of these farms to the country's gross total agricultural output is limited only to about 5 percent.

1.1 Background Context

Ethiopia has progressed a lot in increasing food production, reducing hunger and malnutrition over the past two decades. However, the country faces significant food deficit each year and still remained food insecure.

The Government has been making a big stride to improve the agricultural sector, with the aim of reducing poverty, improving food security and boosting economic growth. Among others, the GTP of the country targeted food security and middle-income level country by 2025. This target entails increasing the output of major crops from 19 to 27 million during the period of the plan. This requires rapid transformation of the agricultural sector to increase production, productivity, market and employment by small holders in the highlands and large-scale commercial farming in spatially large lowland regions with comparatively low population densities and high arable area potential. Attracting and encouraging private investors in the agricultural sector is also part of the strategy to ensure food security and generate foreign currency.

In an effort towards increasing private investment in large scale agriculture, 3.6 million hectors of land have been identified in different regions to be allotted to investors by the federal land bank. Until 2014, the government leased out 2.4 million hectares and this includes approximately 0.5 million hectares from the federal land bank, managed by Ethiopian Agriculture Investment and Land Administration Agency (EAILAA), and 1.7 million hectares by regional governments. EAILAA was established in 2013 to guide and administer

large scale commercial farming. It is responsible for facilitating agricultural investments as well as land administration and transfer processes.

The expected advantages of large-scale agricultural investment (LSAI) such as job creation, technology transfer, infrastructure development and source of foreign currency can only be realized with proper design and implementation. The progress towards achieving these objectives however has been very limited so far. Out of the 2.4 million hectares of land transferred to about 6,000 private investors, only about one-third have been developed up to 2014.

However, there is a lack of an overall consistent and transparent frameworks and sever human and institutional capacity constraints for managing large-scale land based agricultural investments. Such constraints affect all stages of the process of land management and implementing large scale agricultural investments, from identification, demarcation and transfer of the land up to implementation and monitoring of the investments.

The Benishangul-Gumuz region, on which this study focuses, is one of the nine administrative regions of Ethiopia. This region, which is one of the areas where much of the current land acquisitions is focused, is located in the western part of the country, sharing an international border with Sudan in the west. In a national setting, the region shares borders with the Amhara, Oromiya, and Gambella regional states. It occupies an estimated total area with 50,380 km^2 and has a total population of 1,066,001 (CSA 2017 Population projection). The population consists of indigenous ethnic minority groups of Berta, Gumuz, Shinasha, Mao and Komo. It is also inhabited by settlers with a diverse ethnic background from other regions. The region is perceived to have extensive and untapped land resources with a great potential for agricultural development and has vast vegetation cover of natural forests, bushes and shrubs.

1.2 Purpose and scope

Benishangul-Gumuz Regional State is one of the regions in the country where large tracts of agricultural lands are leased out to private investors. As a result of this, there is an

expected large-scale landscape transformation in the region and mounting qualitative evidence of increase land use pressure in Benishangul-Gumuz are available even though spatially explicit information at adequate spatial and temporal scale are missing. It is also believed that the region holds huge biodiversity and wetlands which are under heavy threat and have been cleared already in the past for agricultural investments.

Thus, the extent and nature of changes involved is so far not quantified. This study is conducted with the main objective to identify the type, extent, intensity and direction of landscape level changes happened for the last three and half decades in Benishangul-Gumuz. Hence, the present study gave insights and fills the knowledge gap about the ongoing landscape change, its driving forces and impacts on the overall environment of the study region.

The general objective of the project is to quantify the extent and nature of land use/Landover change in Benishangul-Gumuz regional state over the last three and half decades. The survey is divided in two parts: Landscape transformation assessment and Socio-economic survey. The specific objectives include:

1. To produce a pixel Level Land use/Landcover (LULC) maps for periods (1986, 2000, 2010 and 2017) and database of the Benishangul-Gumuz Regional State.

2. To estimate Landscape change at landscape level for three periods (1986-2000, 2000-2010, 2010-2017).

3. To identify and map hotspots of landscape transformation in the region, with a specific focus on the areas where most land has been given out to investors.

4. To identify the drivers, causes and impacts of the change on selected and major hotspot areas of the region and suggest mitigation measures.

2 Description of the region

2.1 Location

Benishangul-Gumuz is located in the western parts of the country and lies between 34.10-36.69 longitude and 8.97-12.05 latitude (Figure 1). The total area is estimated to be about 5,129,569 hectares (raster representation). It borders with Amhara, Oromiya and Gambella regions and also to Sudan and South Sudan in the West. The total population estimated to be about 1,066,001 (CSA 2017 Population projection). The regional capital, Assosa, is about 679 kms west of Addis Ababa. The population of the region consists of diverse ethnic groups, five of which are indigenous to the region namely: Berta, Gumuz, Shinasha, Mao and Komo. The region is a home of huge tracts of forest, agricultural land and water. The region is also known for its rich gold and marble resources. In addition, the bamboo forest in the region account for 67 percent of Africa's bamboo forests. The Grand Ethiopian Renaissance Dam project is also situated in the region.

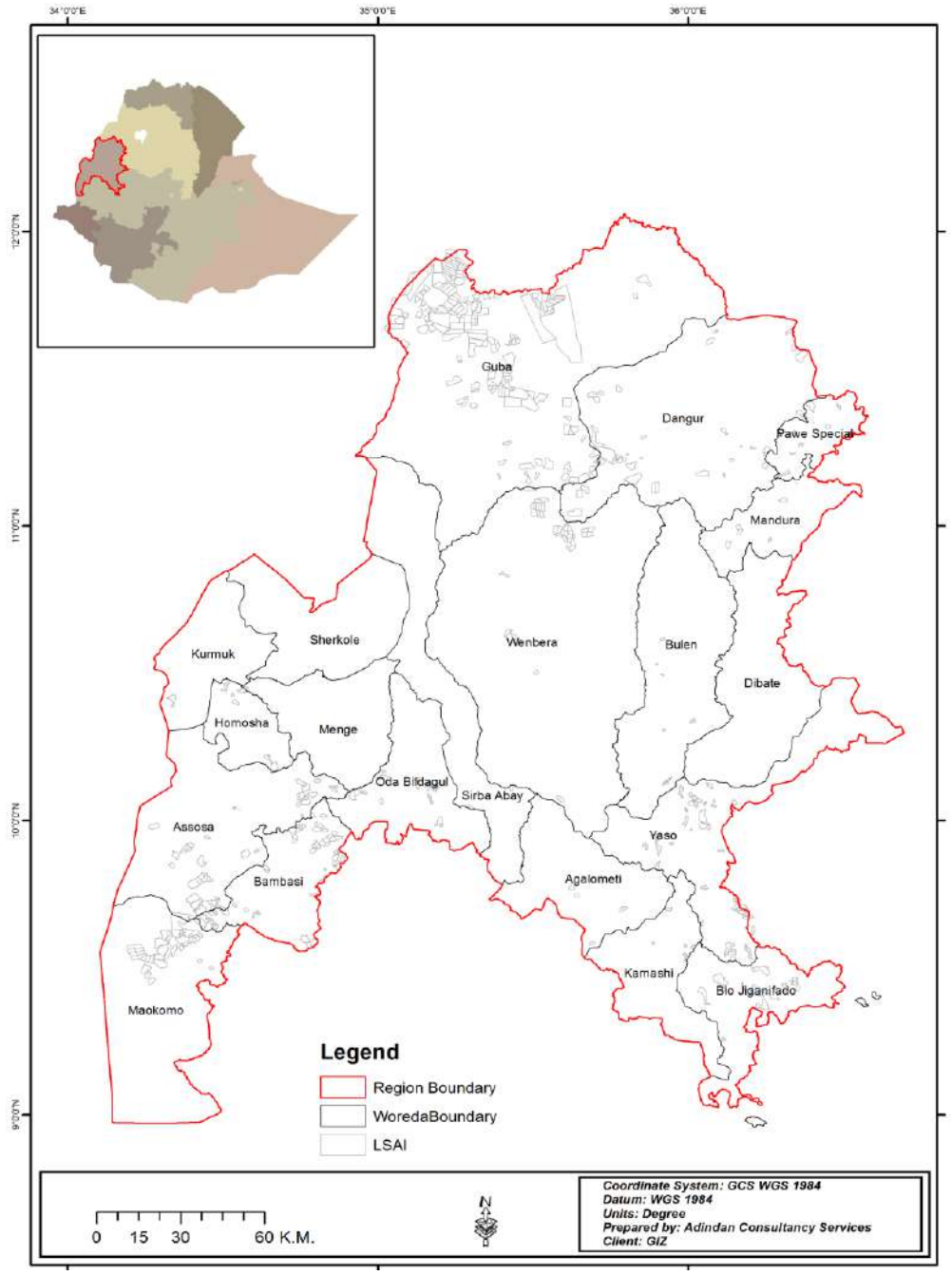


Figure 1: Location map of the region.

2.2 Topography

The elevation ranges from 488 - 2752m.a.sl and the maximum slope steepness reaches about 74^0.The region is generally lowland and dominated by flat terrain (Figure 1). Some higher elevations and steeper slope areas are apparent in the mid-East and North-East parts of the region.

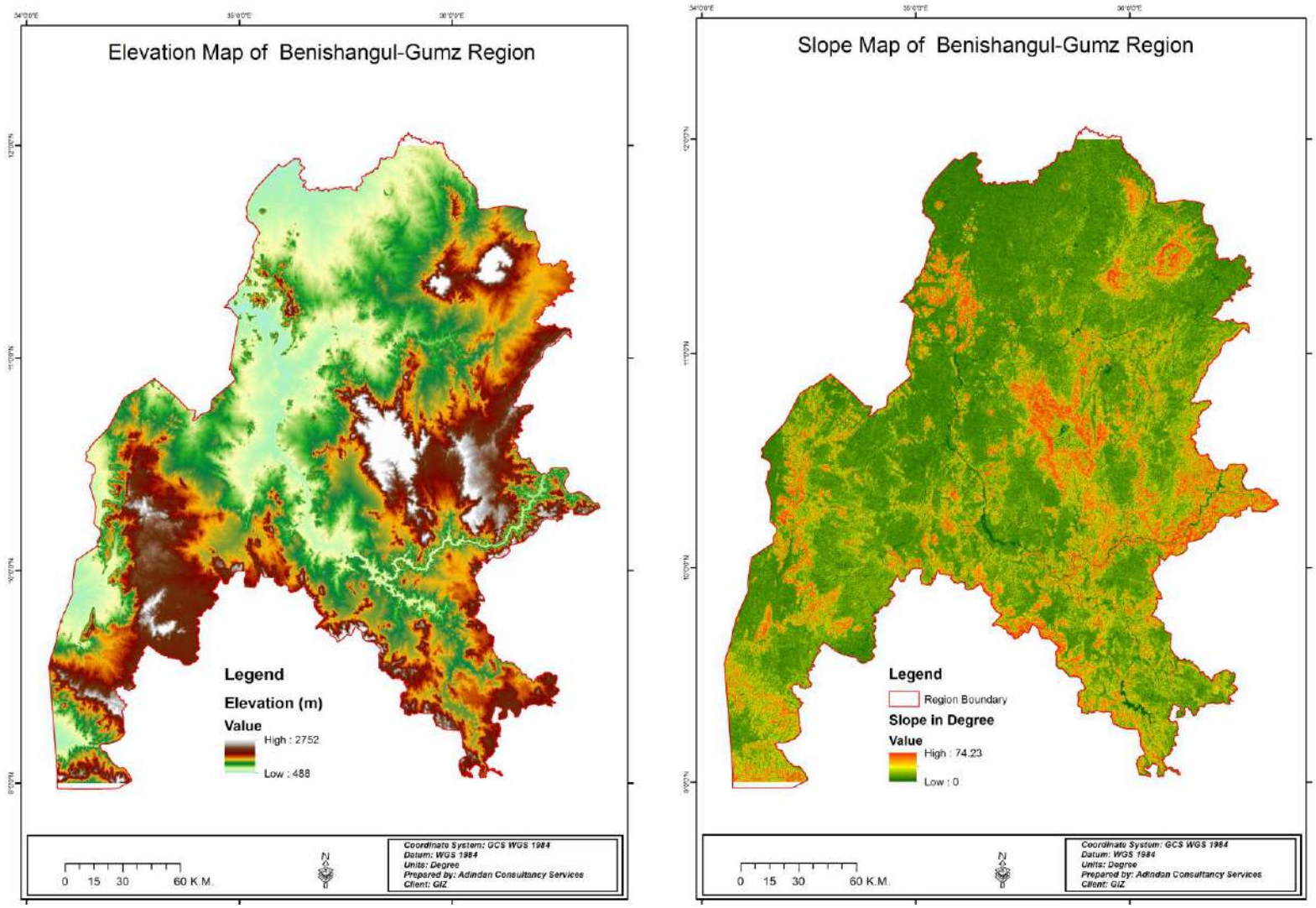


Figure 2: Elevation (m) (left) and Slope (degree) map of the region (right).

2.3 Climate

According to the Koppen-Geiger climate classification, the region lies under the AW climate class which is Tropical savanna climate type. The tropical savanna climate has alternating dry and wet seasons. It shares some similar characteristics with the tropical monsoon climate, but it receives less annual rainfall as compared to the tropical monsoon climate (http://koeppen-geiger.vu-wien.ac.at).

The mean monthly surface temperature and rainfall of the region in 2017 was between 28-31^{o}C and between 75-192 mm, respectively (Figure 3). The temperature relatively gets cooler as we move into hilly and mountains areas of the region. The mean monthly rainfall increases towards the east of the region. The prevailing winds in the region are easterlies trade winds, blowing from east to west. This wind has enormous impact on the rainfall amount, and usually decreases from east to west (www.worldatlas.com).

2.4 Vegetation

The natural vegetation of tropical savanna regions mainly consists of tall grass and short deciduous trees. Trees such as acacias shed their leaves during the dry period of the year to avoid excessive loss of water to the environment through transpiration. They also tend to have broad trunks which store water to help them survive periods of prolonged drought. Tropical grasslands are moderately green during the rainy seasons, but the grass turns yellow and eventually dies down during dry periods (www.worldatlas.com).

2.5 Animals

Tropical grasslands are home to thousands of animal species. The African savanna has the greatest diversity of hoofed mammals including giraffes, deer, and hippos which inhabit marshy areas in the grasslands. The ecosystem of tropical savannas consists of two broad categories of animals, herbivores, and carnivores (www.worldatlas.com).

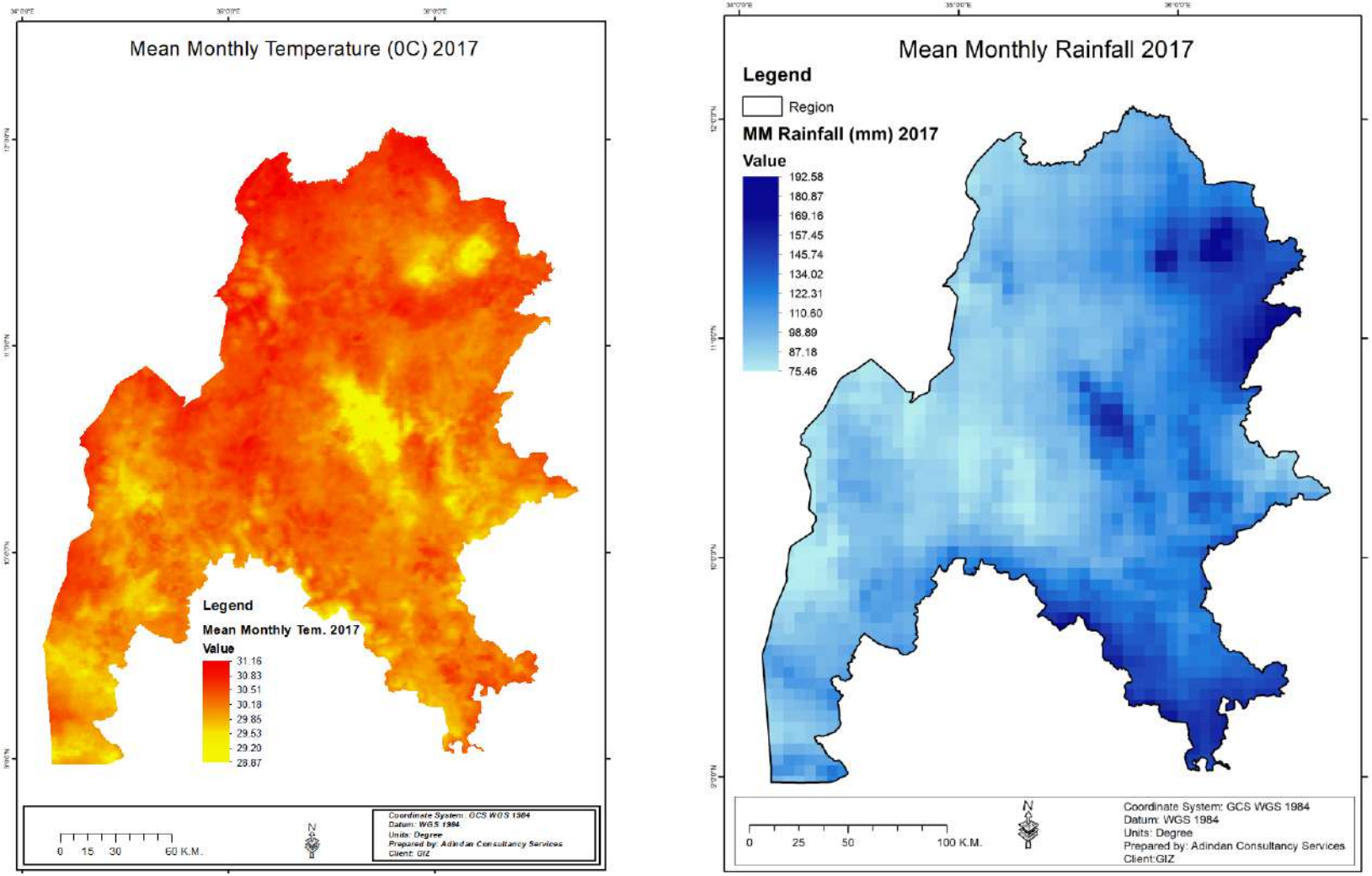


Figure 3: Mean monthly temperature of the region in 2017 (^{0}C) based on the MODIS LST (left) and Mean monthly Rainfall based on CHIRPS data (right) in 2017 (mm).

3 Methodology

Broadly two separate methods were employed to address the specific objectives of the assessment of landscape transformation and its implications in Benishangul-Gumuz region. The first part focuses on the assessment of the landscape transformation in the region. It mainly involves analysis of varies satellite images and gridded data with the purpose of generating land use/land cover conditions, change detection, and hotspot area identification with a specific focus on the large-scale agricultural investments (LSAI). The second part of the methodology was designed to assess the implication of LSAI in the environment and the local people. The two methodologies are discussed one after the other.

3.1 Data sources for assessment of landscape transformation

The assessment of landscape transformation was made using time series satellite images and other gridded data. The data and software used with their respective purposes are presented in Table 1. The datasets can be available from different platforms, but Level 1 C Sentinel 2 images were downloaded from European Space Agency (ESA) data hub (https://scihub.copernicus.eu/) for its convenience, though the same dataset is available in the GEE platform. PALSAR-2/PALSAR/JERS-1 derived forest/Non-Forest map (FNF) was downloaded at:www.eorc.jaxa.jp, but all other datasets were available in the GEE platform after ingested from different sources.

The FNF maps are 25m spatial resolution, global and free datasets generated by applying JAXA's powerful processing and sophisticated analysis method to images obtained with Japanese L-band Synthetic Aperture Radars (PALSAR and PALSAR-2) on Advanced Land Observing Satellite (ALOS) and Advanced Land Observing Satellite-2 (ALOS-2). L-band Synthetic Aperture Radars (SAR) on ALOS and ALOS-2 can observe the land surface even under clouds, and therefore the L-band SAR data have been providing useful information about forest changes in tropical region. Since the L-band has canopy penetrating capacity, it is highly useful to differentiate forest and non-forest areas. The FNF data of the study area representing 2010 and 2017 reference years were separately downloaded, mosaic, and resample to 30m spatial resolution. These datasets

were used to improve the land use/land cover classification results obtained from Landsat 5 TM and Sentinel 2 classifications.

MODIS EVI product is the other important data source used to identify hotspot areas of landscape transformation. MODIS aboard Terra satellite is a course spatial and high temporal resolutions sensor. It revisits the same area more often than sensors aboard Landsat satellites (16 days temporal resolution). Due to such high temporal resolutions of MODIS, it is more convenient to track subtle changes in the landscape and to form a cloud free scene covering large geographic areas than Landsat satellite sensors.

Apart from the FNF product, two synthetic aperture radar (SAR) data was used to complement the classifications made on the optical sensors' images, i.e., Sentinel -2 and Landsat 5 TM images. The first SAR image is the ALOS-PALSAR-2 annual composite for the period of 2017 and 2010. The Advanced Land Observing Satellite was successfully launched on January 24, 2006 from Tanegashima Space Center, Japan, and it is continuously working very well. ALOS has an L-band Synthetic Aperture Radar (SAR) called PALSAR. PALSAR stands for the Phased Array type L-band Synthetic Aperture Radar which can be observed the Earth surface with high spatial resolution and multi polarizations even cloud cover conditions (Tadono, 2008).

ALOS-PALSAR has been widely used to distinguish different land use and land cover condition due to the sensitivity of backscatters to different surface materials and conditions. The low vegetation typical for agricultural crops is largely transparent at the L-band wavelength, signified by low HV backscatter. Vegetated areas generally characterized by medium to high HV and HH back scatter with variation depending on tree height, structure and stem density. Water bodies on the other hand appear black as a result of limited backscatter off water bodies (CEOS, 2016). The annual HV polarisation composites ALOS-PALSAR 2 images of the region was classified based on threshold method to distinguish mainly agricultural, water bodies and forests and woodlands. Figure 4 is the annual ALOS-PALSAR-2 HV polarisation composites of Benishangul-Gumuz region in 2017 and 2010.

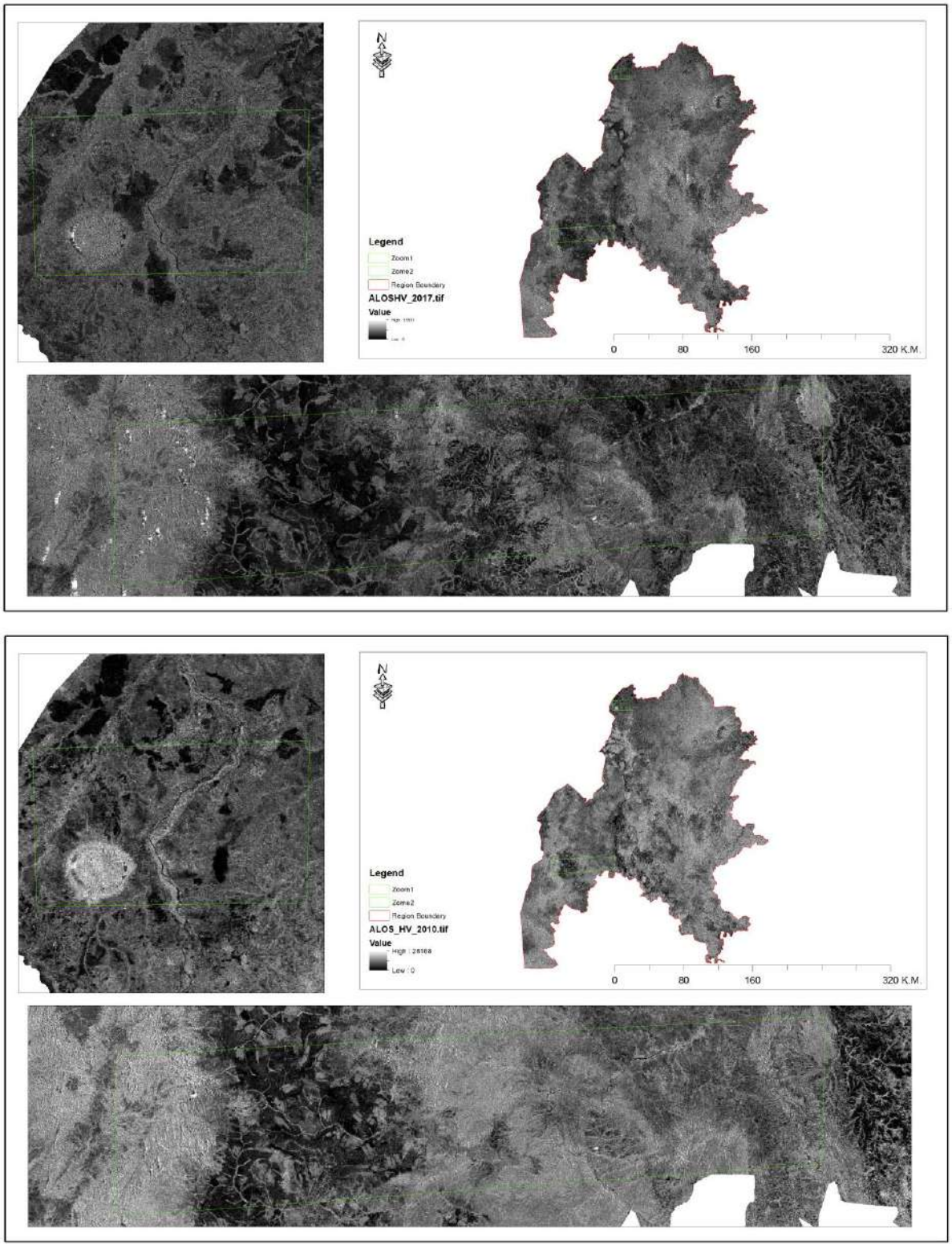


Figure 4: ALOS-PALSAR 2 HV polarisation data of Benishangul Gumz region 2017 (top) and 2010 (bottom)

Sentinel 1 is also a C band SAR data with dual polarisation (VV and VH). The VV polarisation data of the region during the August 2017 was used to complement the water body extent distinguished by the optical images. VV back scatter is sensitive to water bodies and attenuates the backscattering signal. As a result, water bodies appear dark on the image. Figure 5 show the Sentinel-1 VV polarisation look of the region.

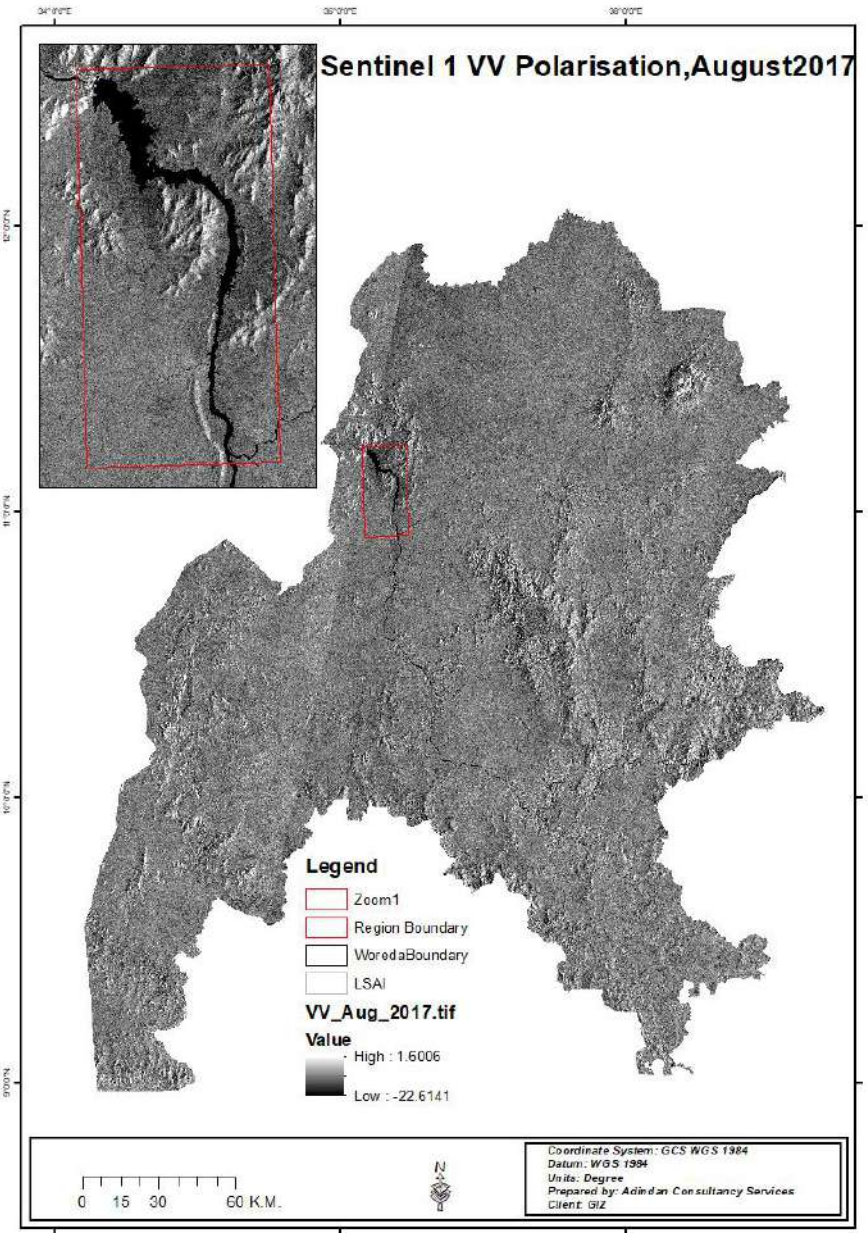


Figure 5: Sentinel 1 VV polarisation composite of the region

Agricultural lands appear dark in the Sentinel 1 VH polarisation in response to the soil moisture attenuation of the backscatter signal. Since the croplands are usually ploughed in the early growing seasons as part of field preparation, croplands appear dark though cropping with minimum tillage are also common practices in the region. Thus, the sentinel 1 VH polarisation image composite acquired during the period between 15 May-15 June 2017 was investigated further to improve the cropland classification. Figure 6 indicates the VH polarisation image composites of the region in between 15 May-17 June.

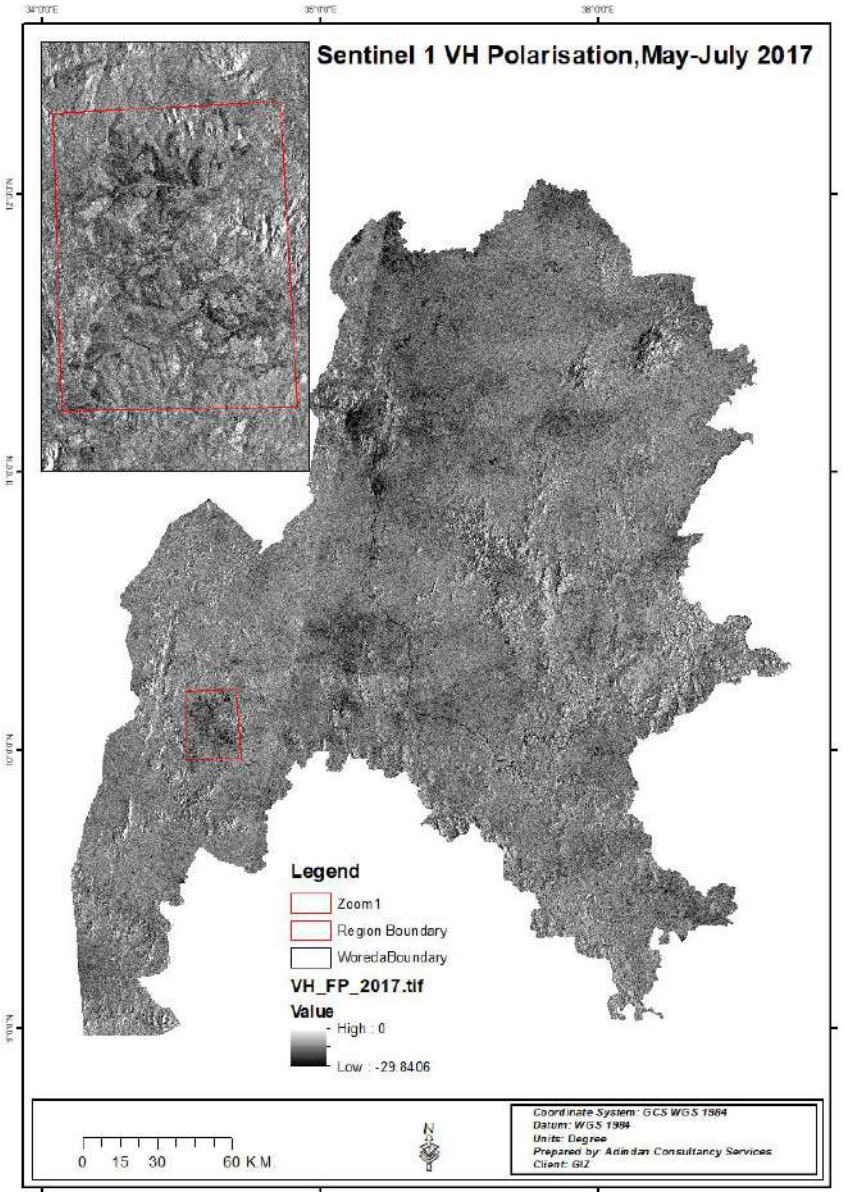


Figure 6: VH polarisation image composites of Benishangul-Gumuz Region in between 15 May-17 June.

Table 1: Data and software

Sn	Data and Software	Year	Processing level	Spatial Resolution	Purpose
1	Land sat 5	1986,2000,2010	Surface reflectance	30m	Landscape transformation assessment (Land use/Landcover)
2	Sentinel 2	2017	Top of atmospheric reflectance	10m (used for the analysis)	Landscape transformation assessment (Land use/Landcover)
3	MODIS Terra EVI	2000-2017	Derived from surface reflectance data	250m	Hotspot area identification of landscape transformation of time series EVI.
4	MODIS LSR	2000-2017	>>	250	Temperature trend analysis
5	CHIRPS) pentad (version 2.0 final)	1981-2017		0.05 degree	Rainfall trend analysis
6	JAXA FNF map	2010 and 2017		25m	Refining forest area classifications (used to supplement the land use landcover classification)
7	ASTER DEM			30m	Topography condition (Elevation, Slope, Stream networks etc)

8	Sentinel-1 C band VV polarisation	2017	10m	To improve land cover classifications
9	ALOS-PALSAR-2 L bans (HV) annual composite	2010 & 2017	25	To improve land cover classification
10	GEE			Access and processing of satellite images (classification and accuracy assessment) and other spatial data
11	SNAP(Sen2Cor)			Atmospheric correction of Sentinel -2 images
12	ENVI 5.3			Land use/Landcover change detection analysis and co-registration
13	ArcGIS 10.2			Rainfall and temperature trend classification and map production

3.2 Landscape transformation Assessment

Remote sensing approaches are the most cost-effective means of quantifying landscape transformation over large areas at unprecedented spatial and temporal details. Remotely sensed datasets have become increasingly available to the public at no cost. MSS, TM, ETM^{+}, & OLI sensors aboard Landsat satellites are the most notable instruments that has been operational in acquiring image data of the globe in a time series basis since the 1970's. More recently, improved in its spatial, spectral and temporal resolutions, sentinel 2 images added up to existing public domain satellites and acquire images of the earth surface in three spatial resolutions (10m, 20m & 60m) and with 5 days temporal resolution. Microwave radar data such as Sentinel 1 and ALOS PALSAR data are also becoming increasingly useful for land cover mapping. The proliferation of remotely sensed datasets from different sources are creating big data challenges causing parallel computing facilities such as Google earth engine cloud computing facility to emerge. In addition to this, more robust classification algorithms are being developed. In this regard, pattern recognition machine learning algorithms are the most notable. All these developments combined are creating better opportunities for monitoring landscape transformations at broader spatial scales. The following section describes the methods used to quantify the landscape transformation in the region using land use/land cover as a proxy.

The analyses used Landsat and sentinel 2 images of the region acquired in four-time references (1986, 2000, 2010 & 2017). The reference from 1986-2010 were represented by landsat 5 TM image composites while the 2017 reference were represented by Sentinel-2 images. The classification by these optical images was also supported by SAR data acquired from ALOS-PALSAR-2 and Sentinel-1. The analysis was conducted using Google Earth Engine platform but additional software's such as ENVI 5.3, SNAP/Sen2Cor and ArcGIS10.2 were used at different stages of the analysis. GEE is an infrastructure as a service (IaaS) and provides powerful parallel processing facilities and earth observation data access. Such central facilities allow users to bring algorithms to the large data sets while minimizing duplication of storage and processing

efforts (Welder and Coops, 2015). The target land cover classes were customized from the definitions by MEFCC (MEFCC, 2016) and include seven classes, i.e., Forest & Dense Woodland, Cropland, Open Woodland, Grassland, Shrub land, Wetland, Bare lands and Built-up areas. The definition of each class is described in Table 2.

Table 2: Class definitions (MEFCC, 2016)

Sn	Classes	Description
1	Open woodland	Land covered by natural growth of graminea and herbaceous vegetation, with some scattered trees (tree canopy covers less than 3%. it is composed of a canopy of grass wooded ecosystem of Combretum-Terminalia and Accacia-Comiphora that can both tolerate burning and temporary flooding with the tall grass stratums, in case of the former one.
2	Forest & Dense Woodland	A continuous stand of trees with a crown density of between 20 - 80%. Mature trees are usually single storied, although there may be layered under-stories of immature trees, and of bushes, shrubs and grasses/forbs. Maximum height of the canopy is generally not more than 20 meters, although emergent may exceed this. Dense woodland has more than 400 stems per hectare. A relatively continuous cover of trees, which are evergreen or semi-deciduous, only being leafless for a short period, and then not simultaneously for all species. The canopy should preferably have more than one story." Three categories of high forest are recognized: Closed: crown cover of the upper stratum exceeds 80 percent; Dense: crown cover of the upper strata is between 50 to 80 percent; and Open: crown cover of the upper stratum is

		between 20 to 50 percent.
3	Cropland/agriculture	Arable and fallow land that grow annual crops (wheat, maize, sorghum, teff, Cotton etc) or perennial crops (sugar cane, coffee and permanent fruit trees) on the small scale or commercial level by rain fed or irrigation schemes.
4	Grassland	Land covered with the natural growth of graminea and herbaceous vegetation or a land sown with introduced grass and leguminous for the grazing of livestock.
5	Water body/Wetland	Wetlands are those areas dominated by wetland herbaceous vegetation or are non-vegetate where the water table is at, near, or above the land surface for a significant part of most years. These wetlands include, brackish and salt marshes and non-vegetated flats as well as freshwater meadows, wet prairies, and open bogs. Area occupied by major rivers of perennial or intermittent (width ≥ 15m), lakes, ponds and reservoirs.
6	Bare land and	It is land of limited ability to support life and in which less than one-third of the area covered by vegetation or other cover. It may be constituted by bare exposed rock, Strip mines, quarries and gravel pits. In general, it is an area of thin soil, sand, or rocks. Vegetation, if present, is more widely spaced and scrubby than that in the Shrub and Brush category. Unusual conditions, such as a heavy rainfall, occasionally result in growth of a short- lived, more luxuriant plant cover. Wet, non-vegetated barren lands are included in the Non-forested Wetland category.

	Built-up	Urban or Built-up Land is comprised of areas of intensive use with much of the land covered by structures. Included in this category are cities, towns, villages, strip developments along highways, transportation, power, and communications facilities, and areas such as those occupied by mills, shopping centers, industrial and commercial complexes, and institutions that may, in some instances, be isolated from urban areas.
	Shrub land	Vegetation types where the dominant woody elements are shrubs with more than 50 cm and less than 5 meters height on maturity.

The methodology followed can be summarized into three major activities, i.e., pre-processing, processing and post-processing.

3.2.1 Pre-processing

3.2.1.1 Atmospheric correction

Except sentinel 2- images, atmospherically corrected Landsat image products are available in the GEE platform. As a result, surface reflectance Landsat 5 TM images were directly used as an input for classification without any atmospheric correction for the 1986, 2000 & 2010-time references.

Landsat 5 TM images were in the form of atmospherically corrected surface reflectance. These images contain 4 visible and near-infrared (VNIR) bands and 2 short-wave infrared (SWIR) bands processed to orthorectified surface reflectance, and one thermal infrared (TIR) band processed to orthorectified brightness temperature. The VNIR and SWIR bands have a resolution of 30m / pixel. The TIR band, while originally collected with a resolution of 120m / pixel (60m / pixel for Landsat 7) has been resampled using cubic convolution to 30m.

The surface reflectance data product is generated from specialized software called Landsat Ecosystem Disturbance Adaptive Processing System (LEDAPS). LEDAPS was originally developed through a National Aeronautics and Space Administration (NASA) Making Earth System Data Records for Use in Research Environments (MEaSUREs) grant by NASA Goddard Space Flight Centre (GSFC) and the University of Maryland (Masek et al., 2006). LEDAPS applies atmospheric correction routines to Level-1 Landsat Thematic Mapper (TM) or Enhanced Thematic Mapper Plus (ETM+) data, similar to routines derived from Moderate Resolution Imaging Spectroradiometer (MODIS). Water vapor, ozone, geopotential height, aerosol optical thickness, and digital elevation are input with Landsat data to Second Simulation of a Satellite Signal in the Solar Spectrum (6S) radiative transfer models to generate Top of Atmosphere (TOA) Reflectance, Surface Reflectance, TOA Brightness Temperature, and masks for clouds, cloud shadows, adjacent clouds, land, and water. The result is delivered as the Landsat Surface Reflectance data product (USGS, 2018).

Sentinel-2 images which were used to represent the 2017-time reference contains 13 bands provided as top of atmospheric reflectance (TOR) and available both in the GEE platform and European space agency (ESA) hub. One of the improvements of Sentinel 2 images in addition to the temporal and spatial resolution is the acquisition of information in additional bands in the red-edge regions, which is highly sensitive to leaf and canopy level chlorophyll contents. To convert TOR to surface reflectance, atmospheric correction is required. Atmospheric correction modules for Sentinel-2 images were not available in the JavaScript application program interface (API) of GEE platform. In the Python script API of the same platform, 6s methods of atmospheric corrections are available but require lengthy installation of new features, Jupiter notebook and a fee for cloud. To overcome this challenge, cloud free Sentine-2 images covering the region in 3 seasons (winter, spring, autumn) were downloaded from the ESA hub and each image scene were under gone to atmospheric correction using Sen2cor atmospheric correction module in SNAP software. Sen2Cor is a Level-2A (L2A) processor which main purpose is to correct single-date Sentinel-2 Level-1C products from the effects of the atmosphere in order to deliver a Level-2A surface reflectance product. Level-2A processing is applied to granules of

Top-Of-Atmosphere (TOA) Level-1C ortho-image reflectance products. The processing starts with the Cloud Detection and Scene Classification followed by the retrieval of the Aerosol Optical Thickness (AOT) and the Water Vapour (WV) content from the L1C image. The final step is the TOA to Bottom-Of Atmosphere (BOA) conversion. Sen2Cor also includes several options that can be activated like cirrus correction, terrain correction, adjacency correction and empirical BRDF-corrections (Louis et al., 2016).

The summer season (rainy season) images were excluded from atmospheric correction as they were contaminated with clouds and it was difficult to get image scenes that can form cloud free image composites representing the region. Image scene at 10m spatial resolution (bands: B2, B3, B4, B8) representing each season were mosaic together to convert them into one image file resulting a file size of about 10 GB. For classification, these images need to be ingested as an asset into the GEE platform. However, GEE allows a maximum of 10 GB image to be ingested as an asset for free. An additional file size requires purchasing a cloud space on Google, which was not feasible to us. As a result of this, only the winter season surface reflectance image composite was ingested as an asset into the GEE platform for further processing/ image classification. We also run a classification using a composite of top of atmospheric reflectance of sentinel 2 images. We eventually used the result with better classification accuracy.

3.2.1.2 Image compositing

Landsat 5 TM has a temporal resolution of 16 days and as a result acquires images of the same area in 16 days interval. While Sentinel -2 has 5 days temporal resolution. To cover the whole region a few images scenes are required. Given its temporal resolution, about 23 and 73 image scenes from Landsat 5 TM and Sentinel 2 can be acquired for the same area in a year, respectively. All these datasets are not always available to the users for download and processing and as a result creates uneven distribution of image availability. In addition to this, the cloud distribution and the spectral properties vary greatly across seasons. These factors cause challenges in creating comparable image composite for each of the reference years considered. To create an image composite, we used median reducer of image scenes over

images available in the platform in three seasons (autumn, winter & spring). However, it is important to acknowledge that the unevenness in the distribution of the image scenes can be one source of classification errors.

3.2.2 Processing

The processing phase of the landscape transformation analysis involved three major activities. These include, ground truth sampling used for training a classifier and for accuracy assessment purposes, image classification, and accuracy assessment.

3.2.2.1 Sampling ground truths

The ground truths have to be representative of the land use/land cover heterogeneity for a reliable classification and accuracy assessments. To distribute sample ground truths, we generate 15 strata based on unsupervised classification using the annual images composites for 2017 and 2010 reference years. The ground truth samples should be a minimum of at the least 20 to 100 samples per strata (Congalton and Green, 2008). We suggest allocating 50 samples in each stratum and this formed a total of 750 ground truths. The 750 ground truths were allocated randomly using stratified sampling technique. The stratification for 2017 is depicted in Figure 7. The respective land use and land cover conditions on these points were collected in Collect Earth. Collect Earth is a Google Earth plug-in for visual land assessment through freely available satellite imagery that was developed by the Food and Agriculture Organization of the United Nations (FAO) under the Open Foris Initiative (FAO, 2016). To determine the respective land use/land cover types, visual assessment, spectral values and phenology were considered. These sample ground points were further refined based on our level of certainty in determining the land use and land cover conditions on each point. Comments were taken with respect to the level of certainty when the land use and land cover conditions were determined in the collect earth platform at each sample ground truth points.

However, since very high-resolution satellite images were not available in the 1986 and 2000 reference years, collection of sample ground truths were made in the GEE platform through digitizing from image composites displayed in three seasons (Autumn (ፀደይ), Winter(ክረምት) and

Spring (በልግ). Winter is the main rainy season in Ethiopia and it makes difficult to get a cloud free image scene in this season. The ground truths were conducted in three steps, a) image composites of the region was created and displayed with False Colour Composite (FCC) in the GEE platform in the three seasons, b) The target Land use/Land cover classes were defined, c) Distributed sample ground truths (Land use/land cover conditions) were determined and collected by looking at a point in three seasons. The visual separability of land use and land cover conditions increases as the same area is seen at different seasons. For example, croplands appear spectrally similar in winter with that of grasslands, but croplands are ploughed usually in spring and as a result appears spectrally unique than other land use and land cover classes.

Out of these samples, we use 80% for training a classifier and the remaining for accuracy assessment. Figure 7 indicates unsupervised classification (KMean-classifier) classes and stratification of ground truth samples conducted on the 2017 sentinel 2 image composite of the region.

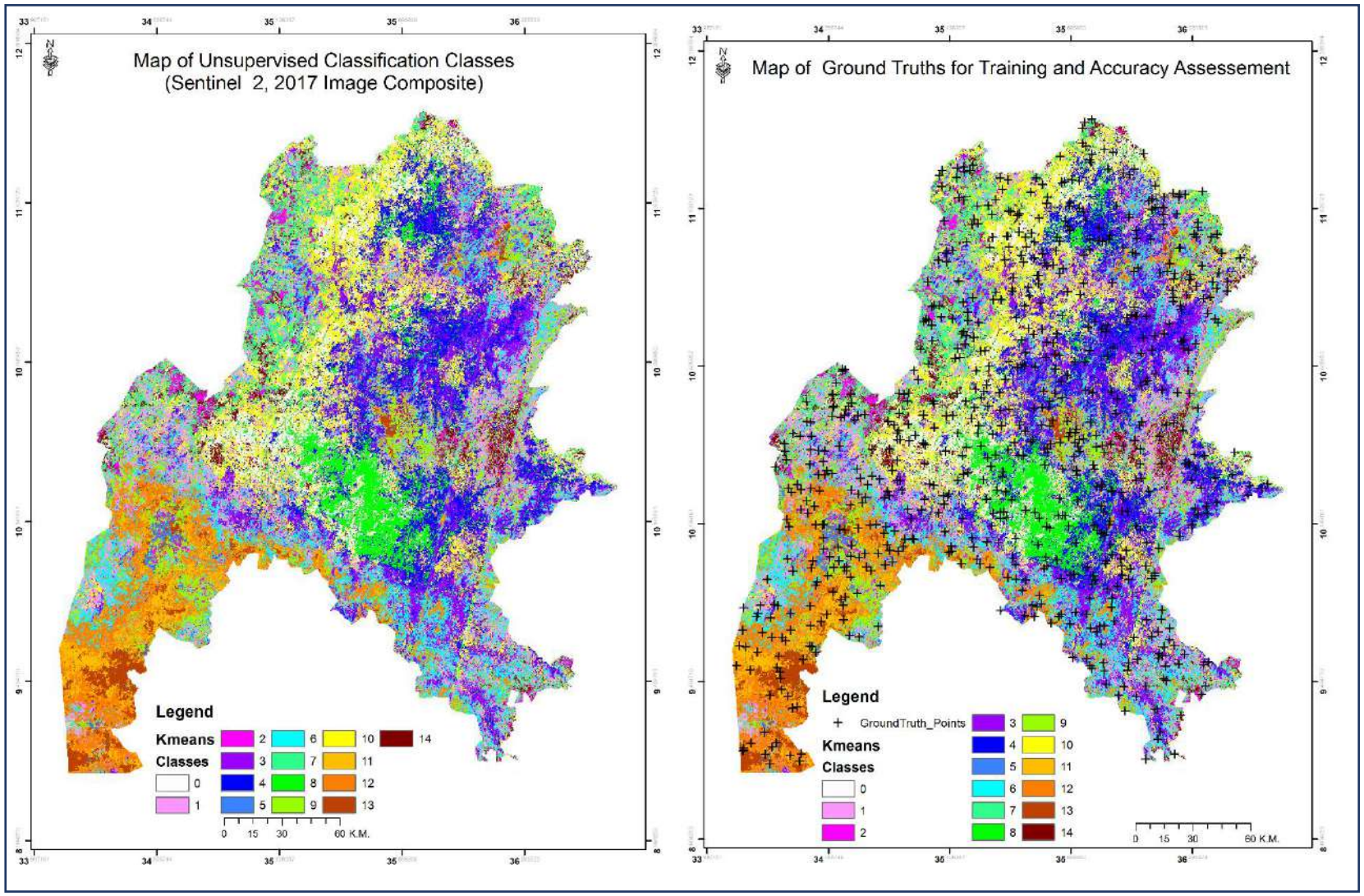


Figure 7: Image strata created through unsupervised classification (Left) and sampling ground truths (Right).

3.2.2.2 Image classification

The sample ground truths were split into two as training (80%) and validation (20%); both of which were coded and uploaded into the GEE platform as fusion tables. Three machine learning classification algorithms, namely, Support Vector Machine (SVM), Random Forest (RF) and Classification and Regression Trees (CART) were trained using the training datasets one after the other. This was followed by assessing the respective accuracy using the validation data. The algorithm that yielded better classification accuracy was considered optimal.

3.2.3 Post processing

The post processing phases include five major activities, i.e., resampling, image to image registration, smoothing, accuracy assessment, and LULC change detections.

The resampling of the LULC maps was done to create a common spatial resolution having comparable pixel sizes and it was done using nearest neighbour resampling technique. Since the time series image composites were based on different sensors, geometrical mismatch between image scenes are expected. Therefore, the image to image registration was done using clearly identifiable features on the LULC maps such as river meanders. The smoothing on the other hand was made to generalize smaller LULC pixels and it was done by passing the time series LULC maps into a 3X3 low pass filter window.

The accuracy assessment was conducted to quantify the level of accuracy of the classification. A matrix was generated in the GEE platform using reference datasets, which was 20% of the sample ground truths, and their respective LULC classes on the map. Accuracy measures such as overall accuracy was computed.

This was followed by time series land use/land cover change detections and hotspot area identification. The hot-spot area identification was supported by time series MODIS enhanced vegetation index (EVI) products. EVI is calculated similarly to NDVI, but it corrects for some distortions in the reflected light caused by the particles in the air as well as the ground cover below the vegetation. The EVI data product also does not become saturated as easily as the NDVI when viewing rainforests and other areas of the Earth with large amounts of chlorophyll. The 16-day composite VI is generated using the two 8-day

composite Surface Reflectance granules (MxD09A1) in the 16-day period. This Surface Reflectance Input is based on the Minimum Blue compositing approach used to generate the 8-day Surface Reflectance product (Didan, 2015). This approach was used as a complement to the land use/land cover change detection approach for hotspot area identification from 2000-2010 and 2010-2017. The overall methodological approach followed is summarized in Figure 8.

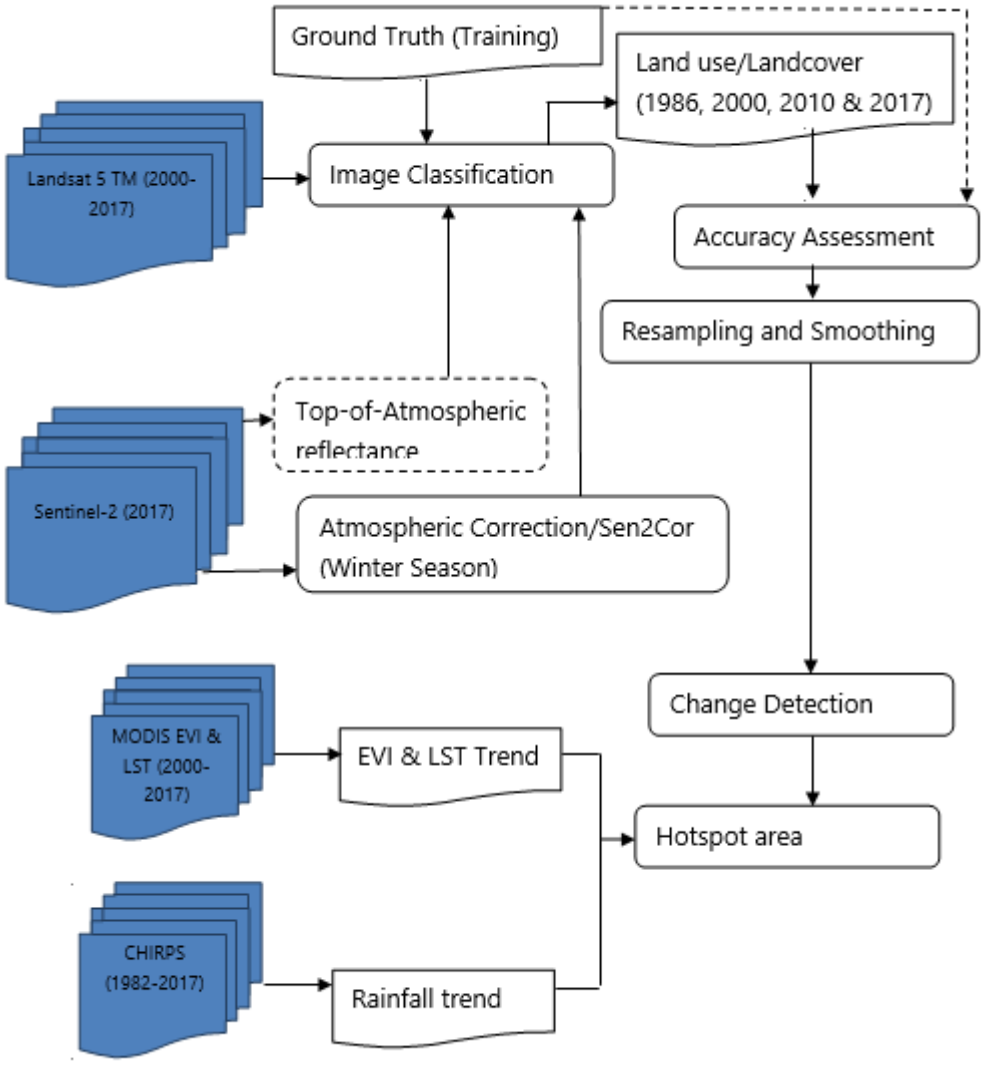


Figure 8: Summary of workflows in for landscape transformation assessment

3.3 Socio-economic Survey

3.3.1 Data Collection Methods

The study bases on qualitative and quantitative approach and generated both primary and secondary data. Detail questions were prepared for household survey in the form of questionnaires and quantitative data were collected using FGDs and Key informants' interview (KII) guides to better understand and capture the overall picture of the socioeconomic situation of the study population. Detail explanation of each of the data collection instruments and their specific purposes is presented in the following sub-sections.

1. Document Review: Relevant project documents, basic documentation on large-scale farming, investment, government land and lease related police and regulation. National and regional policy documents, as well as research reports produced so far regarding large scale investments were reviewed.
2. Key Informant Interviews (KIIs): In-depth interviews were conducted. Representatives from *woreda* and *kebele* Agriculture Bureaus, investment office, and Women and Children Affairs Office were interviewed to create the balance on the information.
3. Focus Group Discussion (FGDs): Focus group discussion was one of the data collection instruments used to collect qualitative data with selected community representatives, youth women and men group in four selected woredas. A group of 8 -12 FGD discussants drawn for one session of FGD. The focus areas of the discussion were prepared beforehand to guide the FGD in a structured manner and to enable the data collectors better analyze the data obtained. Each key informant interview and focus group discussion is conducted by a team of two trained qualitative data collectors with prior experiences in qualitative data collection. One of the team members is facilitated discussions and forward interview questions while the second team member takes notes. Household Surveys: A household surveys is conducted to collect quantitative data. Data is collected through face to face interviews with head of the household (spouse and husband) in the age range of 18 to 60.

4. Observation: Observation guild is prepared to observe the existing large-scale farms and the key socioeconomic progress of the local community.

3.3.2 Study Settings

As it is clearly indicated in the inception report, the study was conducted in the four woredas of the region and out of which two *kebeles* (a total of 8 kebeles) were selected for the survey with the following purposive sampling technique.

These sample areas in the region include, Guba-Woreda and Dangur-Woreda from Metekel Zone, Asossa-Woreda from Asosas Zone and Belojegonfoy Woreda from Kemashi- zone are selected Figure 9. The woredas are selected based on the large-scale agriculture land use coverage and population density of the woredas. The total population of these woredas is estimated to be about 27, 9033(CSA, 2017 projection) Table 3. The study kebeles from the woreda is selected purposely based on land use coverage changes.

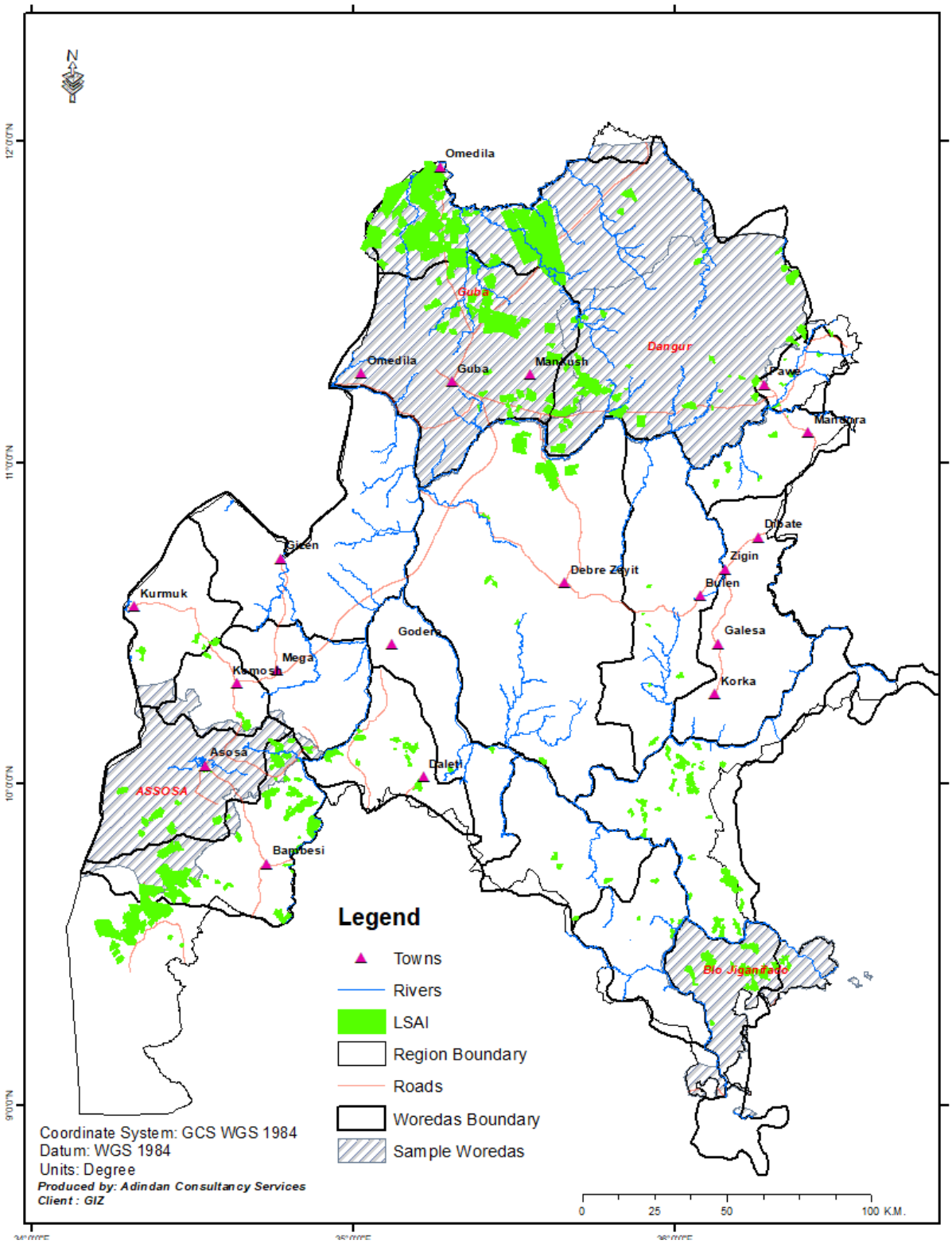


Figure 9: Map of sample woredas for socioeconomic survey

Table 3*: BENISHANGUL-GUMUZ Region Population projection values of 2017 at zonal and Woreda levels by urban and rural residence and by sex*

Region, zone and woreda	Total population			Urban			Rural		
	Male	Female	Total	Female	Male	Total `	Male	Male	Total
Region total	541,002	524,999	1,066,001	117,000	113,000	230,000	424,000	412,000	836,000
Metekel Zone	188,700	187,190	375,890	40,612	41,065	81,677	148,087	146,126	294,213
Guba-Woreda	10,383	10,184	20,567	2,719	2,360	5,079	7,664	7,824	15,488
Dangur woreda	33,730	33,926	67,656	8,702	9,434	18,136	25,028	24,492	49,520
Asossa-Zone	214,941	205,595	420,536	44,933	41,824	86,757	170,007	163,771	333,778
Asossa-Woreda	76,844	74,231	151,075	27,019	25,556	52,575	49,825	48,675	98,500
Kemashi Zone	71,648	67,463	139,111	16,951	15,387	32,338	54,696	52,077	106,773
Belojegonfoy	21,041	18,694	39,735	3,191	2,806	5,997	17,850	15,888	33,738

Source: CSA, census 2017 projection

The target populations are predominantly dependent on subsistence farming and animal husbandry for their livelihood. The socioeconomic and livelihoods of the target community is changed with the expansion of LSAI in the region.

3.3.3 Study Design

A cross-sectional survey design is employed to study socioeconomic of the local community affected and benefited in the large-scale farming expansion. Quantitative data is generated through household survey from sampled household. Qualitative data is collected through key informant interviews and focus group discussions. Facility an assessment is also be conducted to explore availability of relevant services.

3.3.3.1 Target Population

The target population for this study is selected household head (spouse or husband) affected/ benefited by the explanation of large-scale farming areas.

3.3.3.2 Study Population

The study population includes samples of household, key stakeholders, youth and community leaders. Quantitative data is collected among household heads. Qualitative data is collected from key informants involved in provision of relevant services and informed members of communities including community leaders, youth, concerned government offices and other likeminded stakeholders. All permanent resides of the household head; spouse and wife in the age group 18-60 are eligible for quantitative surveys. Individuals who have stayed for less than three months in temporary settlement sites for IDPs and those who lived for less than six months in a kebele is excluded from the surveys among IDPs and kebeles, respectively.

3.3.3.3 Sample Size Determination and Sampling Strategy

In order to meet the data needs of the WMS, the CSA has been conducting the two surveys that provide poverty related data: the HICE (Currently HCE) and the HWM surveys since 1995/96. The HCE and the HWM surveys provide fundamental information for the designing and M&E of the country's poverty reduction strategy, Sustainable Development and Poverty Reduction Program (SDPRP), various socioeconomic policies and programs and hence monitor the progress towards meeting the MDGs as well as SDG. The HCE survey basically

provides data on consumption and expenditure of households that reflect the income dimension of poverty while HWM survey aims at providing socioeconomic data that reflect the non-income dimension of poverty. The HCE survey provides statistics on consumption and expenditure of households and HWM survey provides basic indicators on the various socioeconomic areas including health, education, nutrition, access to and utilization and satisfaction of basic facilities/services and related non-income aspects of poverty. Thu, this study uses different scenario “p” from HCE and HWM study.

The study variable for socio-economic survey is assessed on a sample of HH. Therefore, sample size should be first calculated to determine the number of HH who have to be included in the study. Sample size calculation formula for determination of single population proportion is used to determine the number of that have to be included in the study.

$$n = \left(\frac{Z_{\alpha/2}}{E} \right)^2 p\, q$$

Parameters and assumption:

Z = 1.96 for 95% level of confidence

P, the population distribution of variables of interest, was estimated by using findings from Ethiopian Central statistics authority consummation and expenditure survey and household welfare monitoring survey on relevant variables including HH expenditure and capability of copping shocks. Findings on these variables were 27.3% and 25.0%, 25 respectively.

Q = 1 – P

E, the level of precision, corresponding to each of the variables listed above

Sample size was calculated for multiple scenarios (Table4).

Table 4*: Sample size for socio economic survey, different scenarios*

Variable	HCE 2016	P	Q	Z	E	n
HH expenditure	27.3%	0.273	0.727	1.96	0.05	305
Capacity of raising 200 birrs within a week	25%	0.25	0.75	1.96	0.05	288
From general study	50%	0.5	0.5	1.96	0.05	384

The use of HH expenditure as the population proportion of the variable of interest yielded the maximum sample size of 384. By taking 5 % clustering effect and non-respondent rate, the sample size will be 400. The calculated sample sizes will be allocated proportionally to the four woredas in the region based on the concentration of large-scale farming and population density.

3.3.3.4 Study Variables

This study will assess the overall socioeconomic aspect in relation to income, expenditure, production, household food security, social bondage, livelihood in large-scale farming woredas including internal displacement of these people caused by LSAI. It will also explore the drivers and causes of the landscape transformation. The key variables for the socio-economic survey are listed here under.

- Basic demography (age, sex, education marital status)
- Assess the level, extent and distribution of income dimension of poverty;
- Distribution and pattern of household expenditure and income
- Basis of HH Livelihood and Productivity
- Land use and land cover change
- Infrastructure and technology transfer
- Employment status (self and employed)
- Basic services, health, food security, education
- Burden of social and economic discrimination including Violence and criminals

3.3.4 Survey Administration

The consultant team undertakes the assignment in close consultation and full involvement of the staff assigned by the client. The consultant deployed five highly experienced consultants, having different roles in the assignment. One consultant was assigned in each of the four woreda of region and collected the data at field level. The Consulting firm monitored the team through continuous physical as well as telephone reporting. Potential respondents were arranged by woreda stakeholders' representatives in consultation with the team leader of the consultants.

3.3.5 Data Analysis

Analysis is disaggregated based on demographic factors as well as key socio-economic variables of the study population. Furthermore, the data were analysed by using SPSS 22 version. Following data collection, the FGDs and KII interview notes were analysis with open code qualitative data analyses software. To facilitate later analysis, the field notes were organized under the main themes of the semi-structured interview guides. The data from both focus group discussions and key informant in-depth interviews were analysed.

4 Results and Discussion

4.1 Pixel based analysis of Land use /Landcover condition in Benishangul-Gumz region in four reference years (2017, 2010, 2000 & 1986)

4.1.1 Land use/landcover in 2017

As explained in the methodology part, a composite of 10-meter Sentinel 2 images, JAXA Forest-non-Forest (FNF) map, Sentinel 1 dual polarisation data (VV &VH), and ALOS-PALSAR-2 HV were used to quantify the land use/Land cover condition of the region. The classification with the optical images in the GEE platform was done with 74% overall classification accuracy. The maximum classification accuracy was obtained using the random forest (RF) classification algorithm for all the reference years. The winter season surface reflectance yielded very low overall accuracy (40%) using the same classification algorithm and validation data. RF is a classification and regression algorithm originally designed for the machine learning community. This algorithm is increasingly being applied to satellite and aerial image classification. It has several advantages when compared with other image classification methods because it is non-parametric, capable of using continuous and categorical data sets, easy to parameterize, not sensitive to over-fitting, and good at dealing with outliers in training data (Horning, 2010). The link of the JavaScript codes for classification and accuracy assessment are available at:

https://code.earthengine.google.com/71d5aaddbf205c25ad208d6d3c288dc1.

It requires trusted GEE tester account to open the link.

During this period, the region was dominantly covered by forest and woodlands. Both cover types combined constitute about 66% of the region while croplands account for about 38%. Among croplands, only about 6.3% are developed by private LSAI. This indicates that small scale agriculture is the dominant activities forming the major parts of croplands in the region. The remaining parts of the region were covered by other covers types (Bareland, wetlands, shrubs and grasslands) (Table 7). The spatial distribution of the different cover types is depicted in Figure 10. The croplands are dominant in the North-East, North West, South West and the Mid-South West parts of the region.

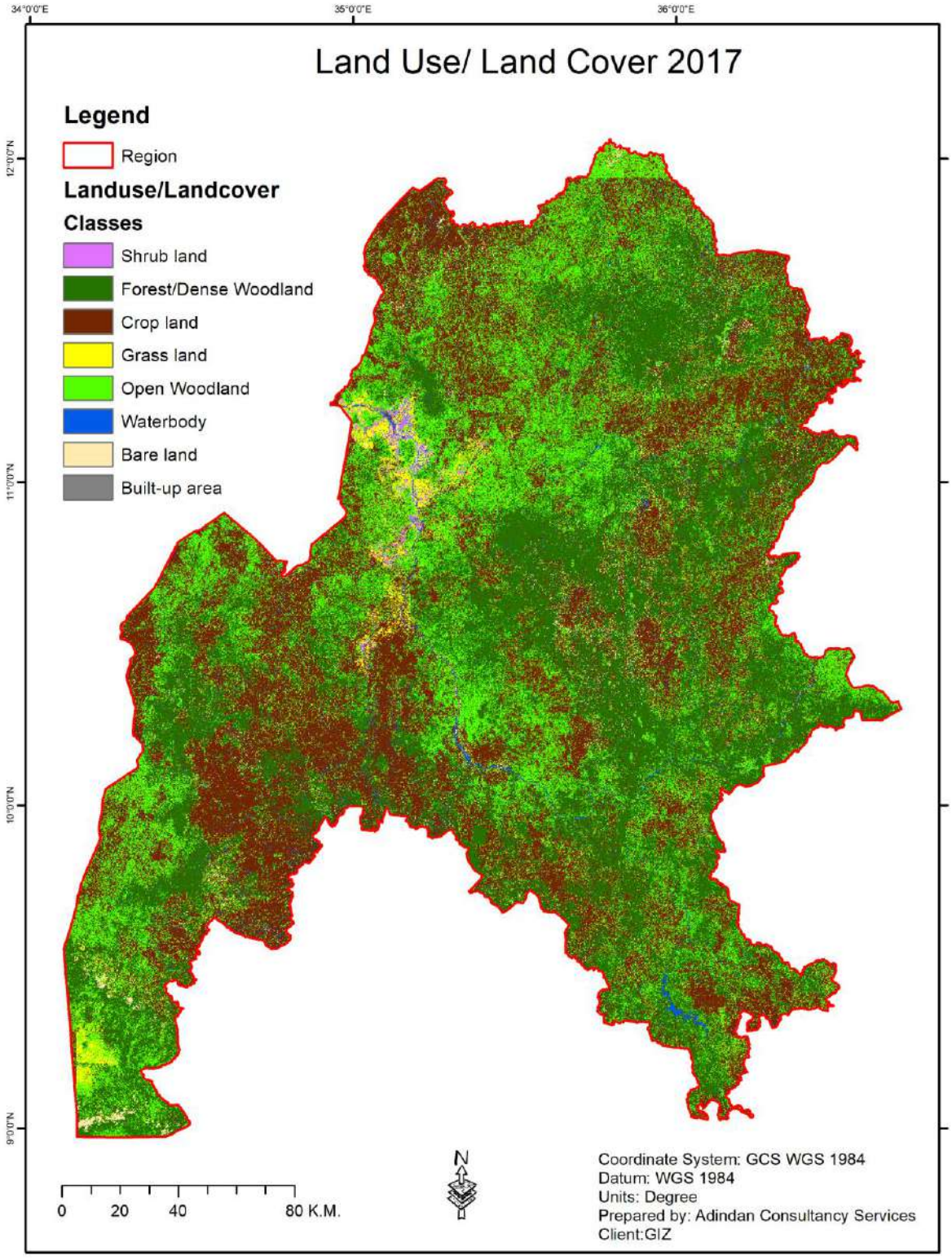


Figure 10: Land use / Land cover of the region in 2017.

About 55% of the LSAI areas were under crop/agricultural land uses. Forest and woodland cover combined account for 40% of the LSAI areas. The remaining land cover combined

represented the remaining 5% of the LSAI area (Table 5). This indicates that, agricultural lands given out for investors are still underutilized. As most of the agricultural investments are related to crop production of a certain type, almost all the LSAI areas should have been under crop/agricultural land uses. This can be due one or the combined effect of the following conditions.

a) The investors are utilizing only parts of their lands for agricultural productions. Such cases were evident during FGD, KII and observation of the large-scale farms. Factors such as shortages of agricultural inputs, machinery, infrastructures and capital are responsible for the underutilization of the land. This is also an indication that the lands given out to investors are not proportional to their capacity in utilizing the land for the respective purposes.

b) Some lands given out to investors are not utilized for the respective purpose at all. As pointed out by the FGD participants during the socioeconomic survey, this kind of investors acquire the land for the sake of getting loan from banks on the name of agricultural investment. The impacts of this kind of investors can be many folds as they bring nothing to the local people and also keep the land under their ownership for some time which otherwise can be used by the local people or some other investors. Since the government provide the loan to encourage private involvement in the sector, diverting the loan for some other purposes by the investor is wastage of the limited financial resources of the government.

Table 5: Land use/land cover condition of LSAI areas in 2017

Land use/land cover	Area (Ha)	%
Shrub land	8.84	0.00
Forest	27,944.40	12.56
Croplands	122,803.12	55.20
Grass	1,017.26	0.46
Open woodland	62,025.95	27.88
Wetland	6,182.52	2.78
Bare land	2,499.07	1.12
Total	222,481.15	100.00

4.1.2 Land use/Landcover in 2010

Landsat 5 satellite images were used to generate the land use/land cover map of the region for the 2010, 2000 and 1986 reference yeas. The 2010 image composite was classified with an overall accuracy of 60%. The JavaScript can be accessed at: https://code.earthengine.google.com/71d5aaddbf205c25ad208d6d3c288dc1 with a trusted tester login.

The distributions of image archives in this year were uneven across seasons and it was difficult to achieve better classification accuracy by creating an image composite that enhance separability of Land use/Land cover classes. In this reference year, forest and woodlands combined was the dominant Land use/Land cover and account for about 73% of the region. While the croplands account for about 23% and other Land use/Land covers constitute about the remaining 4% of the region (Table 7). The spatial distribution of the land cover follows the same pattern with the 2017 reference year (Figure 11).

About 38% of areas designated as LSAI were under cropland use condition while the majority (about 47%) was covered by open woodlands table 6.

Table 6: Land use/land cover condition of LSAI areas in 2010

Land use/Land cover	Area (Ha)	%
Shrub land	78.33	0.04
Forest	33935.06	15.25
Croplands	83990.50	37.75
Grass	264.74	0.12
Open woodland	104117.12	46.80
Wetland	20.81	0.01
Bare land	75.65	0.03
Total	222482.22	100.00

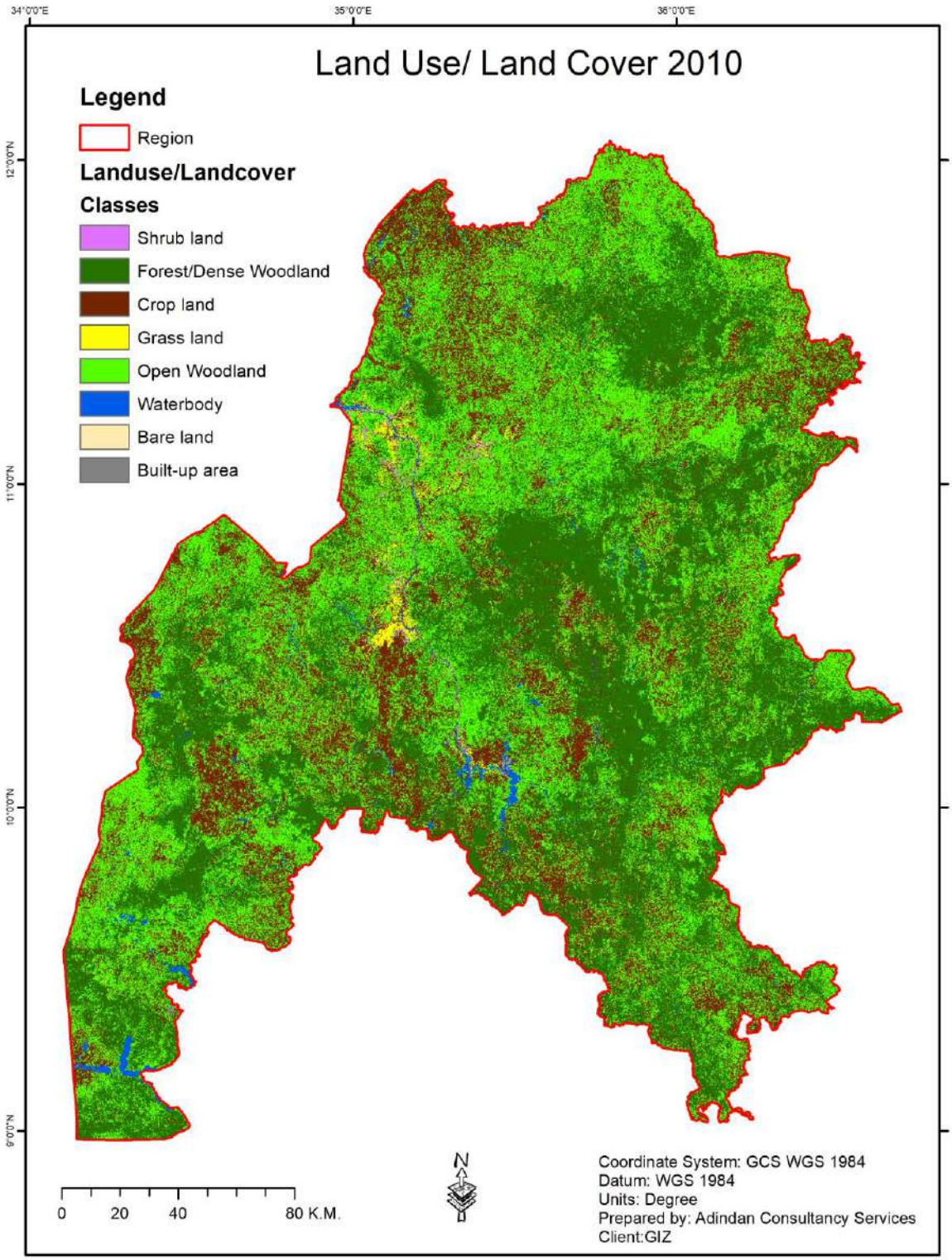


Figure 11: Land use / Land cover of the region in 2010.

4.1.3 Land use/Landcover in 2000

The highest classification accuracy was obtained in this reference year, which was about 87% overall accuracy. The image classification code is available at:

https://code.earthengine.google.com/71d5aaddbf205c25ad208d6d3c288dc1. Unlike the previous two-time references, SAR data was not available during this period to complement the classification with.

During 2000, more than 84% of the region was covered by forest and woodlands. The remaining notable area was covered by croplands, which was about 12% of the region. Other land use/land cover types account only about 4% (Figure 12). The homogeneity of the land covers in this year can be one of the factors for achieving highest classification accuracy.

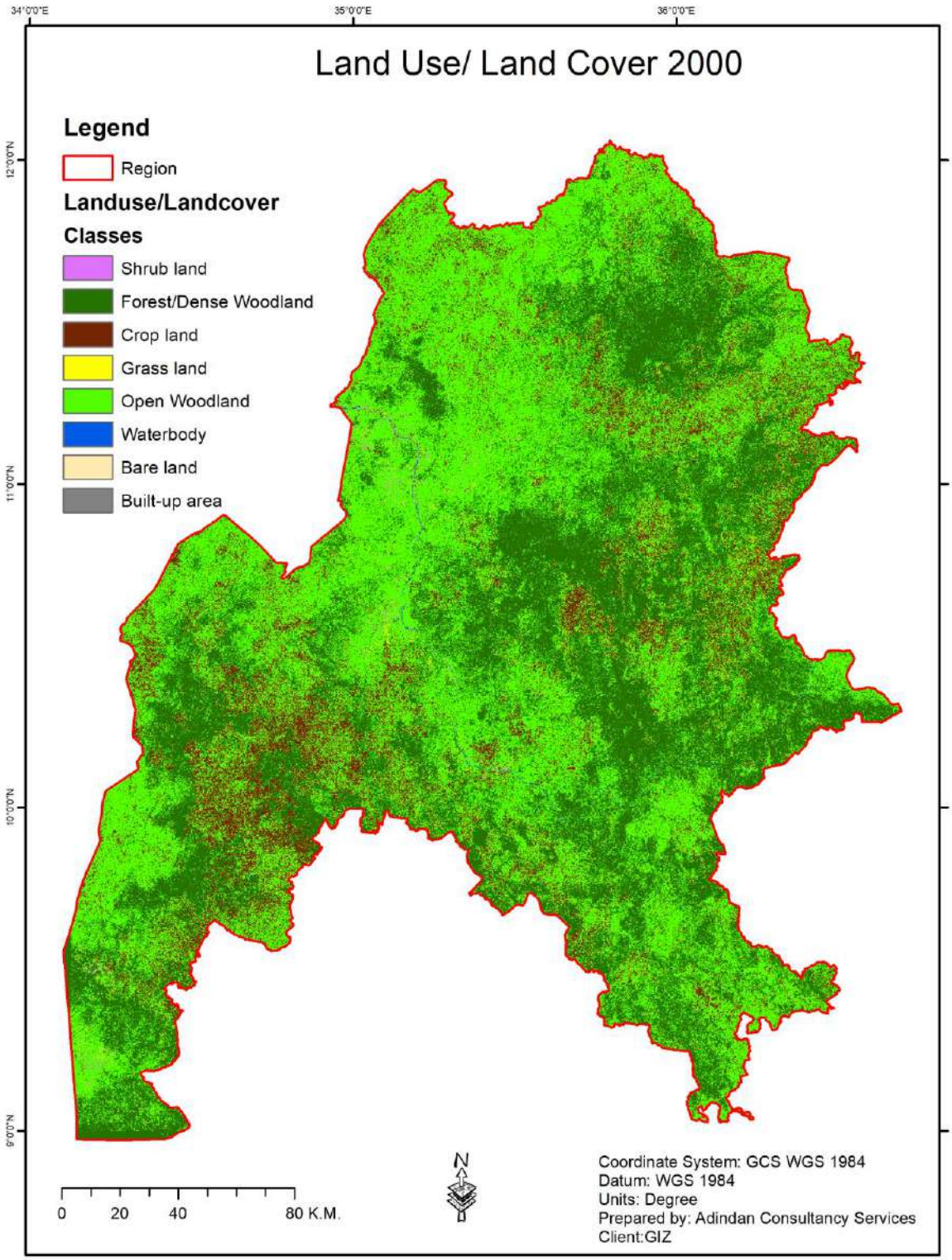


Figure 12: Land use / Land cover of the region in 2000.

4.1.4 Land use/Landcover in 1986

The Java Scripts for classifications are available at:

https://code.earthengine.google.com/71d5aaddbf205c25ad208d6d3c288dc1.

The image composite representing the 1986 reference year was classified with an overall accuracy of 85%. The proportion of forests and woodlands combined account for 88% of the region while croplands were covering about 10% of the region (Table 7). The croplands used to be dominating in the mid-South Western part of the region though some agricultural practices were evident in the Eastern and North-Western parts (Figure 13).

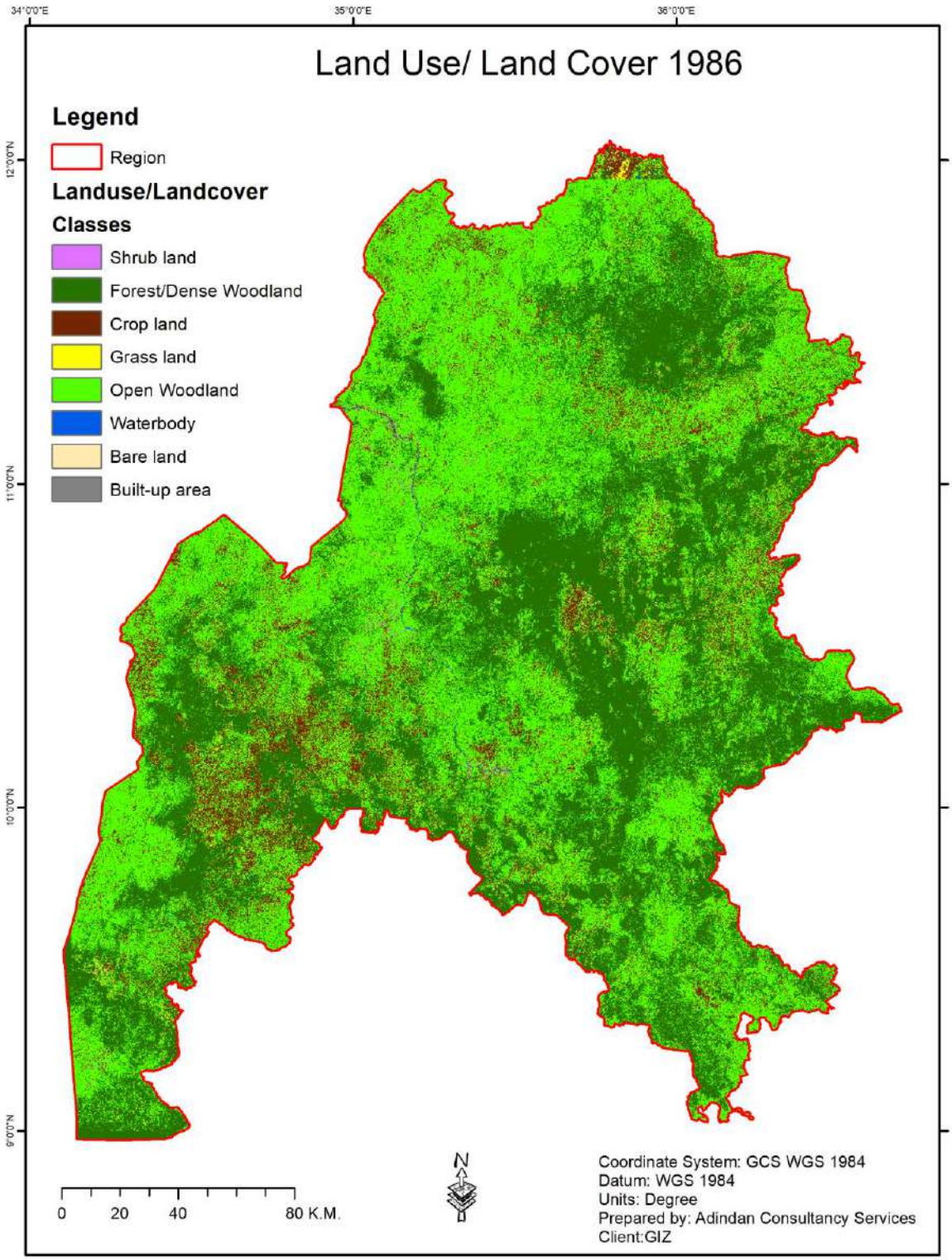


Figure 13: Land use/Land covers 1986

Table 7: Land use/Land cover Statistics 2017

Land use/Land cover	2017		2010		2000		1986	
	Area (Ha)	Percent (%)	Area (Ha)	Percent (%)	Area (Ha)	Percent (%)	Area (Ha)	Percent (%)
Shrub land	17,568.74	0.34	13,730.95	0.27	10,104.45	0.20	7,243.80	0.14
Forest/Dense Woodland	1,582,345.87	30.84	1,778,298.75	34.65	1,972,294.21	38.43	2,018,688.57	39.33
Cropland	1,944,292.57	37.89	1,308,005.76	25.49	651,976.42	12.70	585,407.49	11.41
Grassland	81,714.77	1.59	33,027.86	0.64	23,501.49	0.46	40,723.37	0.79
Open Woodland	1,289,051.34	25.12	1,989,368.53	38.77	2,463,945.20	48.01	2,463,945.11	48.01
Wetland	131,994.98	2.57	5,203.72	0.10	7,661.46	0.15	8,649.59	0.17
Bare land	81601.62	1.59	2881.46	0.06	2627.08	0.05	7215.30	0.14
Built-up area	2948.86	0.06	1020.41	0.02	79.21	0.00	316.11	0.01
Total	5,131,518.76	100.00	5,131,537.44	100.00	5,132,189.53	100.00	5,132,189.34	100.00

4.2 Landscape change at landscape level for three periods (1986-2000, 2000-2010, 2010-2017)

The region underwent dramatic landscape transformations over the past three decades. The region was dominantly covered by forest and woodlands (dense and open) in all the reference years and continues to diminish since 1986. In 1986, forests and woodlands account about 87% of the region. These dominant covers slightly reduced by about 1% in 2000 and by about 14% in 2010 from their respective previous reference years. Rapid changes of forest and woodland covers were evident after 2010. In 2017, both covers combined reduced by more than 17% from the 2010 reference year (Table 7). Croplands steadily increased since 2000 at the expenses of forests and woodlands. In between each time trajectory the croplands increased on average by about 9%. However, the rate of increment per year was higher in the 2010-2017 trajectories when the cropland increases by about 1.77 % per year, while 1.22 and 0.09% increments per year were observed in the 2000-2010 and 1986-2000 trajectories, respectively. The extent of wetlands slightly increased in 2017 and this can be attributable to the great Ethiopian renaissance dam (GERD). The dam already started holding water in 2017.

In the same fashion, increment of bare land covers, including built up environments showed abrupt increment in 2017 than the previous years' which are attributable to expansion of towns, flourishing of new settlements, mining activities and construction projects such as GERD. Grasslands are highly misclassified in all reference years and difficult to generalise their cover changes over time. Grasslands are spectrally similar with that of post-harvest croplands as seen from space. Even during the rainy seasons, they start greening up similarly with crops.

4.3 Landscape transformation hotspot areas

Hotspots are areas where major landscape transformation took place over the analysis period i.e., 1986-2000, 2000-2010 & 2010-2017. The hotspot area identification was made using two major approaches; Land use/land cover change detection and trend analysis of 16-day MODIS EVI products (2000-2010 & 2010-2017). Both methods are complementary to each other and supposed to indicate hotspot areas of transformation except the fact that classification errors can sometimes detect false hotspots in case of Land use/Land cover change detection approach. The second approach on the other hand, uses time series EVI as a proxy indicator for changes in the landscape. A trend line was fitted to EVI observations (every 16 days composites) from 2000-2010 & 2010-2017. The slope of the trend line indicates whether the EVI is increasing or decreasing over the analysis period. Since EVI are sensitive to land cover changes and canopy greenness, the changes of the slope of the trend line readily detect if the landscape underwent transformation. This method is relatively robust in accurately detecting the hotspot areas than the previous method. The results from both approaches are discussed in the following section.

4.3.1 Hot-spot areas and LSAI: 2010-2017

The landscape transformation can be induced by direct anthropogenic land use /land cover conversions as well as due to climate change factors. From 2010-2017, hotspot areas were evident in different parts of the region. These hotspot areas include areas given out for large scale agricultural investment, small scale agriculture expansion, and other areas (e.g the GERD area). For the purpose of differentiating other areas form the LSAI, the agricultural investment areas are overlaid over the EVI trend slope map in Figure 14. As can be seen from Figure 11, most of the region (~ 98%) shows an increasing trend while 1% a decreasing trend and 1% of the region in a constant trend. The hotspot areas form good association with the spatial distribution of LSAI areas.

LSAIs are causing landscape transformations as the slope of the trend line shows a decreasing trend in these areas. In the North-Western, North-Eastern, South-Eastern, South-Western part of the region, major areas of transformation due to agricultural investments are evident. The GERD is also among the hotspot areas clearly identified by this approach. Contrary to this, there are areas given out for LSAI but showed a constant trend (0 slopes)

indicating that the land remains without major changes. Out of the LSAI areas, about 4% showed a decreasing trend while about 92% an increasing trend and the remaining areas are constant (close to 0 slope). Most of the region experienced increment of rainfall over the past three and half decades (Figure 16 right) and increment of temperature over the past 17years (Figure 16 left). The combined effect of rainfall and temperature increment is enhanced photosynthetic activity leading to an increment of ecosystem productivity. As EVI is directly proportional to ecosystem productivity, an increasing trend in EVI is attributable largely to increment of ecosystem productivity without major landscape transformations unless afforestation or conversion of bare lands into croplands are apparent, which is not a common phenomenon in the region. Minor disturbances might be in the constant trend regions, but the changes are offset to each other. The decreasing trends however are due to major anthropogenic land cover conversions.

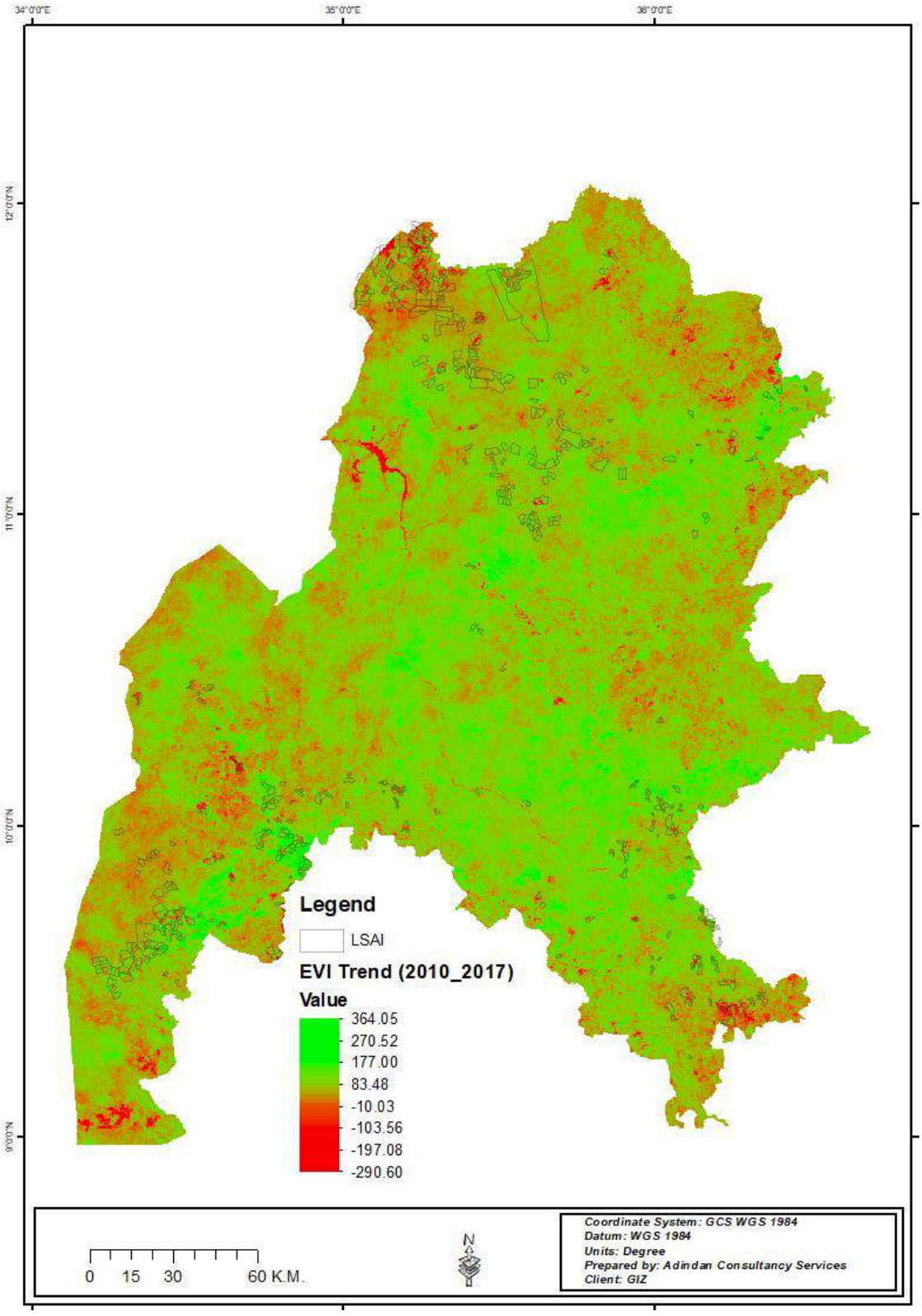


Figure 14: EVI trend 2010-2017. The map shows the slope of the trend line; +ve slopes indicate increasing trend while the –ve slopes indicate the decreasing trend.

Landscape transformation was also evident based on the land use/land cover change detection approach from 2010-2017 (Table 8). LSAIs are partly responsible for the forest and woodland losses in the region as more than 5% of the LSAI areas transformed into croplands between 2010 and 2017. About 75% showed no change in terms of land use/land cover from the previous reference year. It is also important to note that hotspot areas vary over space and time. In the 2010- 2017 trajectory, the hotspot areas induced by the LSAI tend to concentrate in the North-Western part of the region, which are in Guba Woreda where concentrations of LSAIs are evident.

Table 8: Land cover changes in LSAI areas (2010-2017)

Changes	Area (Ha)	%
No change	167549.31	75.31
Forest/Dense Woodland to Cropland	5387.30	2.42
Forest to Other	2070.16	0.93
Open woodland to cropland	36505.76	16.41
Open woodland to others	7285.70	3.27
Other changes	3682.73	1.66

4.3.2 Hotspot areas and LSAI: 2000-2010

In the 2000-2010-time trajectories, large areas of the region underwent major transformations. About 70% of the region showed an increasing EVI trend. While constant and decreasing trends account for about 19.79 and 10.4%, respectively. Hotspot areas in this trajectory are depicted in Figure 15. As can be seen from the figure, most of the hotspot areas are concentrated in the Western and Eastern part of the region. The change detection reveals flourishing of LSAIs in this time trajectory. Hotspot area associated with the LSAI, were located in the South-Western and South-Eastern parts of the region. In this time trajectory as well, both temperature and rainfall showed an increasing trend. Most of the hotspot areas concentrated in the mid-Western part of the region are also under open woodland cover condition, both in 2010 (Figure 11) and in 2000 (Figure 12). Despite all these conditions, the hotspot areas can be due selective logging, dieback of trees and bushfires. The region is home of lowland bamboo with its specific botanical name called

Oxytenanthera abyssinica (A.Rich) Munro. This species of bamboo is widely grown in the region in such local areas as Assosa, Bambesi, Begi, Demi, Guba, Dibate, Kamashi and Pawe. During our field visit period we have learned that, in between 2004-2007 flowering of bamboo followed by die back was took place in many parts of the region and this can be the major factors for the decreasing trends of EVI during this trajectory in parts of the region. There are evidences that though *O. abyssinica,* differs widely, it is widely held that the species flowers gregariously at intervals of about 30 years. It may well be the case that the species exhibits both cyclical gregarious flowering patterns as well as unpredictable sporadic flowering, which is followed by the death of the plant (UNIDO, 2009).

Other hotspot areas in the mid-Western parts of the region are dominantly under cropland land use conditions which continuously expanded since 2000 as a result of expansion of small-scale agricultural activities. The hotspot areas are also partly associated with LSAI, particularly in the South Western parts of the region.

In this time trajectory about 30% of the LSAI are transformed into croplands. This indicates that the LSAI started flourishing since 2010 Table 9.

Table 9: Land cover changes in LSAI areas (2000-2010)

Changes	Area (Ha)	%
No change	131194.68	58.97
Forest/Dense Woodland to Cropland	3552.146156	1.60
Forest to Other	2448.604056	1.10
Open Woodland to cropland	64455.34396	28.97
Open Woodland to others	2227.895636	1.00
Other changes	18603.54933	8.36

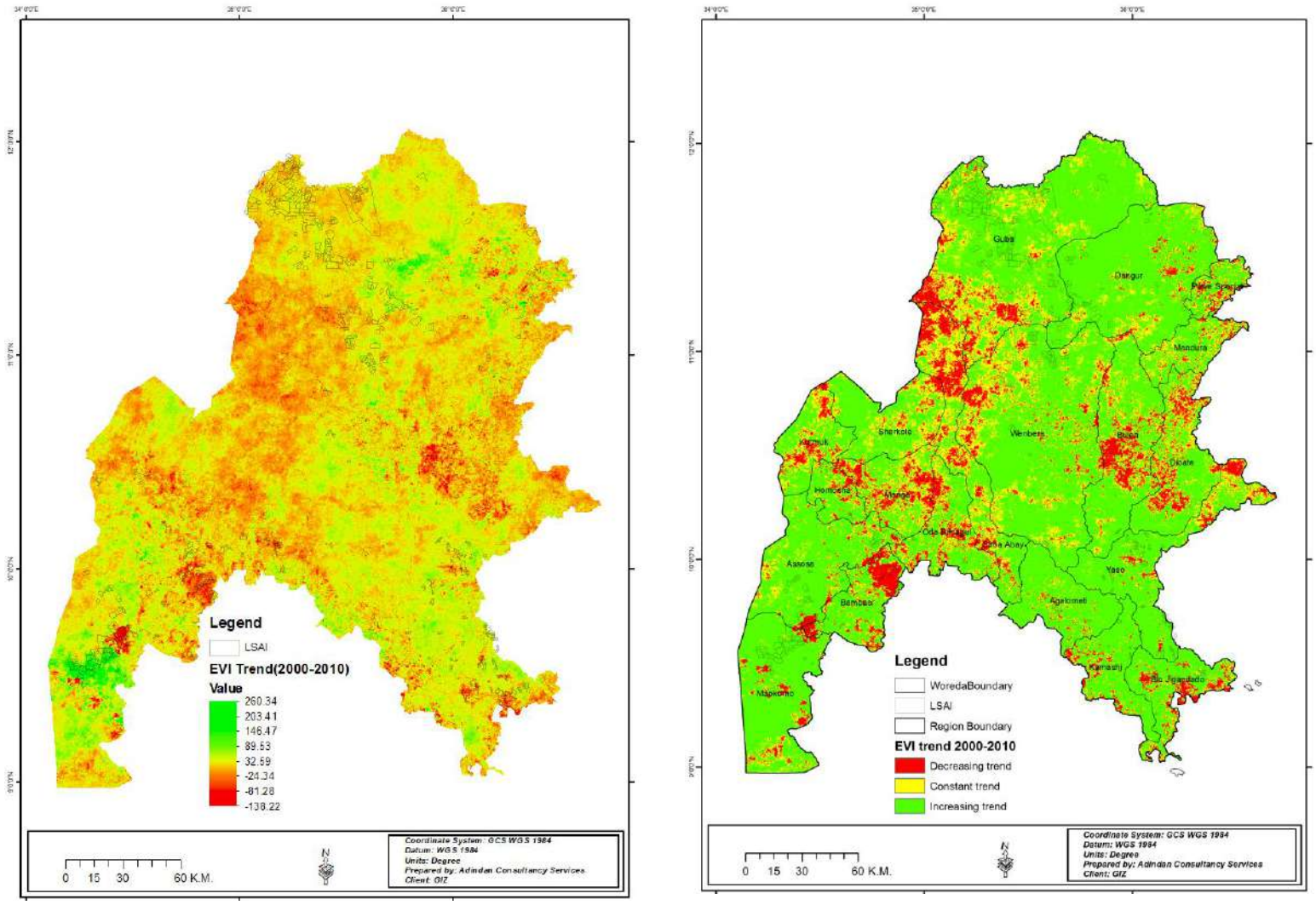


Figure 15: EVI trend 2000-2010 (continuous class) (Left) The map in the left shows the slope of the trend line; +ve slopes indicate increasing trend while the –ve slopes indicate the decreasing trend and categorized class (right).

In areas currently designated as LSIA, about 98% of the areas experience no changes from 2000 to 2010 (Table 8). Only about 1% of the areas converted into croplands leading to limited areas of hotspot formation in the investment areas.

4.3.3 Hotspot areas and LSAI: 1986-2000

Private LSAIs are a recent phenomenon and such kinds of investments are almost non-existent in this trajectory. Despite this, the government owned large-scale agricultural practice was apparent in the region since 1985. The most notable of this is the PAWI agricultural centre which was established in 1985 with the aim of producing food crops to people relocated under the villagization program in the Derg regime. Despite this, on areas currently designated as LSAIs, less than 1% of the areas were transformed to croplands. This however might not be due to LSAIs; rather small-scale agricultural practice might be there that later given out to LSAI. Table 10 summarises the changes.

Table 10: Land cover changes in LSAI areas (1986-2000)

Changes	Area (Ha)	%
No change	218,744.28	98.31
Forest/Dense Woodland to Cropland	1,823.90	0.82
Forest to Other	107.09	0.05
Open Woodland to cropland	222.50	0.10
Open Woodland to others	667.50	0.30
Other changes	934.50	0.42

4.4 Climate change/variability in the region

In between the 1960 and 2006, temperature has increased by about 1.3 ^{O}C and strong variability's in precipitation were observed in Ethiopia (USAID, 2012). Despite discrepancies among climate models, the majority of these models projected temperature to increase by 1.1 to 3.1 by 2060 in the country. Annual rainfall is also projected to increase all over the country with high seasonal variability (Irish Aid, 2017).

Climate variables; temperature and rainfall as obtained from remotely sensed datasets were analysed in terms of their changes/variability over time and space in the region. In line with

the national trend, both land surface temperature (2000-2017) and rainfall (1982-2017) have increasing trends (Figure 16). Except South Western parts of the region which gets cooler over the past 15 years, most parts of the region are getting much hotter. Though the rainfall generally trends up, the rate of increment is higher in the western parts of the region. On the other hand, the mean annual rainfall is higher in the eastern parts of the region as seen from the 2017 mean annual rainfall (mm). This appears that the drier region tends to experience more rainfall than the wetter parts.

Rainfall is the most determinant factors controlling vegetation growth and productivity in tropical regions. The combined effect of both temperature and rainfall increment is usually an enhanced photosynthesis activity. However, tropical regions are characterised by high temperature conditions year-round. As a result, the minimum temperature in all seasons is large enough to meet the thermal needs of vegetation for photosynthetic activities. The overall effect of increasing temperature is an increase in evapotranspiration and leads vegetation to dry up than enhancing photosynthesis. Therefore, in dry seasons the temperature increment increases the moisture demand of vegetation rather than enhancing photosynthesis and greening up.

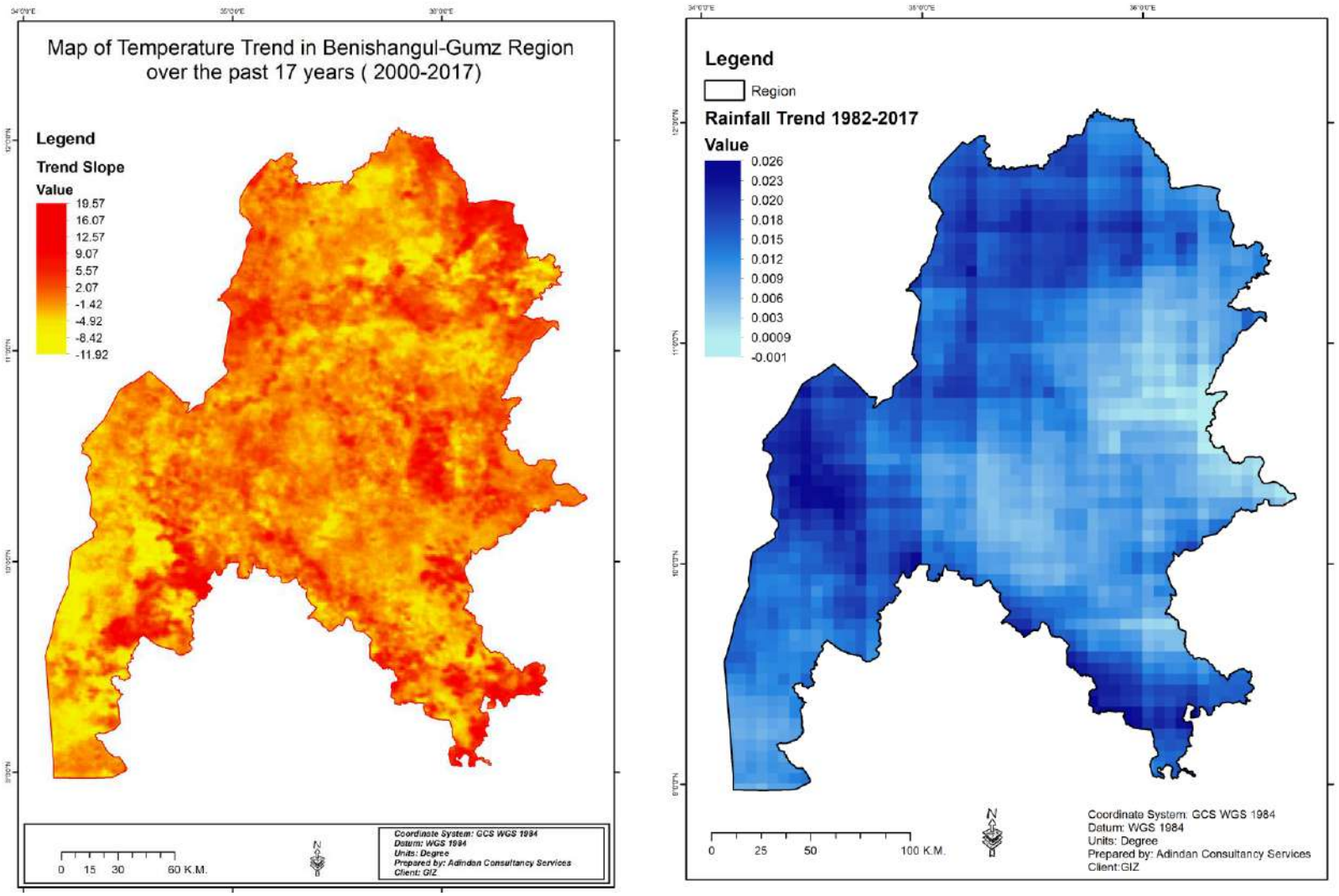


Figure 16: The slope of a linear fit to time series temperature from MODIS LST 2000-2017 (left) and pentad time series rainfall from CHIRPS data1982-2017 (right).

4.5 Implication of the landscape transformation on the environment

Landscape transformation in the region is evident as shown in the land use/land cover change detection and hotspot area identification. Among others, the transformation of forest and woodlands into crop/agricultural lands are striking. Such changes are induced by both large-scale agricultural investments that emerge over the past decade and small scale agricultural activities in the region. Such changes are causing deforestation and degradation leading to diminishing of wild animals (through migration and extinction), increased CO_2 emission due to forest fires and charcoal productions, increased use of pest-sides etc.

Due to deforestation alone, the region lost about 58 million, 43 million and 3 million tons of above ground biomass carbon (AGB C) from 2010-2017, 2000-2010 & 1986-200, respectively. This is assuming the average carbon stock of high forests, woodlands and lowland bamboo (65.64 tonnes AGBC/Ha) (Yietebitu et al., 2010).

Pesticide uses by LSAI are increasing in the region. The term pesticide covers a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, plant growth regulators and others. Beyond the immediate benefit of controlling the targeted insects and weeds, pesticides can have detrimental impact on the environment and human health. Pesticides can contaminate soil, water, turf, and other vegetation. They can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants. Insecticides are generally the most acutely toxic class of pesticides, but herbicides can also pose risks to non-target organisms (Wasim et al., 2009).

In association with LSAI, influxes of labourers from other parts of the country are observed which are partly responsible for occurrences of bush and forest fires that are very common in the region. Among other factors, labourers set fires for different purposes including during alighting cigarettes, cooking, and illegally harvesting wild honey. The resultant fire is usually not put out unless residential areas are endangered. This is in addition to what the local people induce to clear weeds and agricultural lands. Fire always affects the environment in which it burns and may alter the ecosystem, which may have both negative and positive impacts on the land. The negative environmental impact of forest fires is caused by the release of carbon dioxide and the consumption of atmospheric oxygen, the

disruption of energy flow and the cycling of nutrients upsetting the ecosystem functions and, the pollution of the atmosphere and water bodies contributing to the impaired health of organisms. Furthermore, forest fires affect soils physically, biologically and chemically. Because they have such a comprehensive impact on soils, fires may radically change the environment, which significantly affects an ecosystem's biodiversity.

5 Impact of Large Scale Farming in Benishangul-Gumuz Region basedon Socio-economic survey

5.1 Coverage of the Study and Response Rate

In terms of representativeness, the survey has cover four woredas of the Benishangul-Gumuz region i.e., Guba-Woreda and Dangur from Metekel Zone, Asossa-Woreda from Asossa-zone, Belojegonfoy-Woreda from Kemashi Zone of the region. As shown in *Table 11* below, quantitative data was collected from 400 heads of households (spouse or husband) who are in the age group of 18 - 60 living in the sample woredas. Equal percentage of the survey data, which accounts 100 (25%), was collected from the four woredas.

Table 11*: Sample size and regional coverage of the study*

Methodology	Guba-Woreda	Dangur Woreda	Asossa-Woreda	Belojegonfoy Woreda	Total
HH survey coverage	100(25%)	100(25%)	100 (25%)	100 (25%)	400(100%)
KII	3	1	2	2	8
FGD	4	4	4	4	16

Source: Survey data, April 2018

5.2 Socio- Demographic Characteristics of the Sample Households

As shown in the *Table 12* below, out of the total survey respondents, 11.8% were female and the rest 88.2% were male. Looking at the type of households, 322(84.1%) of the respondents are living in male headed households, while 44(11.5%) live in female headed households and the rest 17(4.4%) of the respondents live in polygamous households.

When we see the variation by woreda, the highest proportion of female headed respondents who are in polygamy family is 9% in Asossa *woreda* followed by 8.2% in Dangur

woredas. There is no polygamy respondent in the other two woredas. In Belojiga Woreda there was little number of female headed households (6.7%).

Regarding the religion of the respondents, the majority of the study population is Muslims 218(54.5%) followed by Orthodox Christianity followers that accounted 108(27.1%) of the survey respondents and 71(17.8%) of the respondents were Protestant. The remaining 3(0.8%) respondents were Catholic and others.

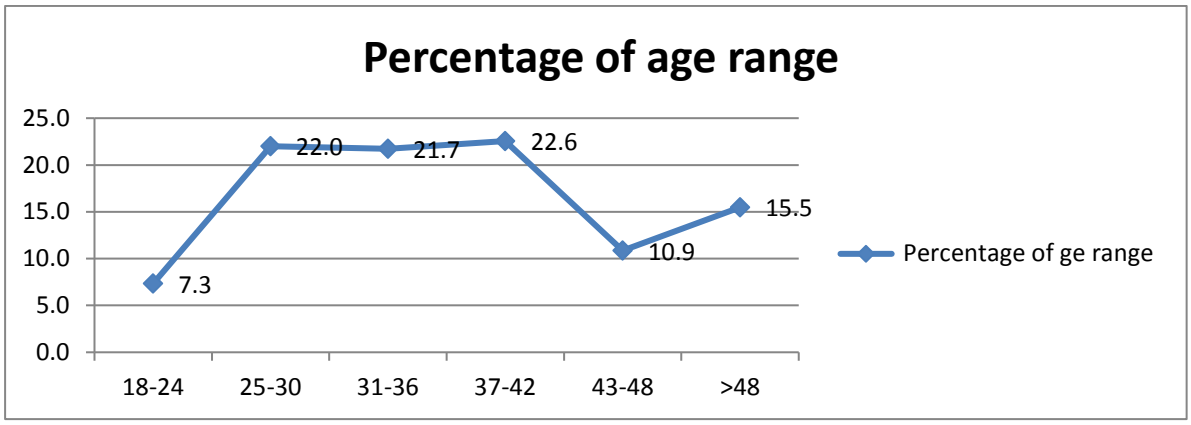
Table 12*: Household Characteristics of the Respondents*

		Household Characteristics of Respondents				
		Asossa	Belojigan	Guba	Dangur	Total
		Column N %	Column N %	Column N %	Column N %	
Gender	Male	82.00%	93.00%	91.00%	87.00%	353(88.3)
	Female	18.00%	7.00%	9.00%	13.00%	47(11.8)
Religion	Muslim	100.00%	2.00%	70.00%	46.00%	218(54.5)
	Orthodox	0.00%	28.00%	30.00%	50.00%	108(27)
	Protestant	0.00%	67.00%	0.00%	4.00%	71(17.8)
	Catholic	0.00%	2.00%	0.00%	0.00%	2(0.5)
	Other	0.00%	1.00%	0.00%	0.00%	1(0.3)
Head of HH	Male headed household	73.00%	93.40%	90.50%	80.40%	322(84.1)
	Female headed household	18.00%	6.60%	9.50%	11.30%	44(11.5)
	Women in polygamy	9.00%	0.00%	0.00%	8.20%	17(4.4)
	Resident	96.00%	72.00%	76.00%	81.00%	325(93.25)
	Displaced in host family	0.00%	7.00%	3.00%	7.00%	17(4.25)
	Displaced in settlement	0.00%	5.00%	0.00%	5.00%	10(2.5)
Relationship with head	Household head	94.90%	73.00%	58.30%	50.50%	270(69.6)
	Wife/husband	4.00%	26.00%	41.70%	48.40%	115(29.6)
	Other	0.80%	0.00%	0.00%	0.00%	3(0.8)

Source: Survey data, April 2018

With regard to age, as shown in Graph 1 about 65% of the respondents were within 25- 42 years old and the rest of the respondents were below 25 and above 43 years old.

Graph 1: Age distribution of the respondents



Source: Survey data, April 2018

5.2.1 Respondents Marital and Education

As shown in the *Table 13* below, the majority of the respondents 347 (87.8%) were married, 14 (3.5%) were widowed and the remaining 34 (8.6%) were divorced, separated and not married. More than 199 (53.6%) of the study population was illiterate followed by those who can read and write 126 (34%), while those who completed elementary education accounts to 20 (5.4%) of the total study population. The rest of the respondents who have completed secondary and above were only 7%.

Table 13*: Marital and educational status of survey respondents*

Items	variables	Asossa	Belojiga	Guba	Dangur	Total
Marital status	Single	0.00%	2.00%	13.50%	2.10%	4.30%
	Married	86.00%	92.90%	80.20%	91.70%	87.80%
	Divorced	4.00%	0.00%	4.20%	5.20%	3.30%
	Widowed	7.00%	4.00%	2.10%	1.00%	3.50%
	Separated	3.00%	1.00%	0.00%	0.00%	1.00%

	I don't know	0.00%	0.00%	0.00%	0.00%	
Education	Can't read and write	76.00%	31.00%	67.00%	45.80%	223(55.5%)
	Read and write	17.30%	53.00%	20.00%	41.70%	131(32.8%)
	Elementary school	5.30%	8.00%	6.00%	2.10%	20(5%)
	Secondary school	1.30%	5.00%	3.00%	4.20%	13(3.3%)
	Above secondary	0.00%	3.00%	4.00%	6.30%	13(3.3%)

Source: Survey data, April 2018

5.2.2 History of Residence Intra-inter Migration

Among the study population 256 (64.2%) of the respondents were permanent residents in the targeted woredas whereas 143 (35.8%) of the respondents were migrated from other woreda and zone of the nearby regions of the country due to various reasons. As shown from *Graph 2* and *Table 14* below, more than 66% of the migrated people came to the study *woredas* looking for work, 19.2% of the respondents came for schooling of children, 4.6% of the respondents came to start new job, 3.3% of the respondents came to escape from draught and conflict and the rest 16.9% of the respondents came to the woredas for different reason.

Table 14*: History of residence place movement*

		woreda				
		Asossa	Belojiga	Guba	Dangur	Total
		Column N %	Column N %	Column N %	Column N %	
Lived in another place		9.0%	44.4%	24.0%	66.0%	143(35.8%)
Reason for moving to the study woredas	*Schooling of children*	0.0%	0.0%	10.5%	16.4%	12(9.2)
	Look for work	87.5%	50.0%	73.7%	72.1%	86(66.2)
	Start new job	0.0%	7.1%	10.5%	1.6%	6(4.6)
	To escape from the effect of drought/ famine	0.0%	0.0%	5.3%	0.0%	1(0.8)
	To escape from a family conflict	0.0%	4.8%	0.0%	1.6%	3(2.3)
	Other	12.5%	38.1%	0.0%	8.2%	22(16.9)
Had relatives, friends lived here before you came?		90.0%	43.2%	30.0%	54.5%	76(63.5)
Easy to settle		88.9%	44.4%	52.8%	78.8%	99(63.5)
Experience of difficulties when you came to the woreda		22.2%	21.3%	2.4%	19.4%	25(15.7)

Among the respondents who moved from other place to the woredas, 63.5% of them had relatives before they came to the woredas and it was easier to settle in the woreda and 15.7 % of them also experienced difficulty during their movement and settlement.

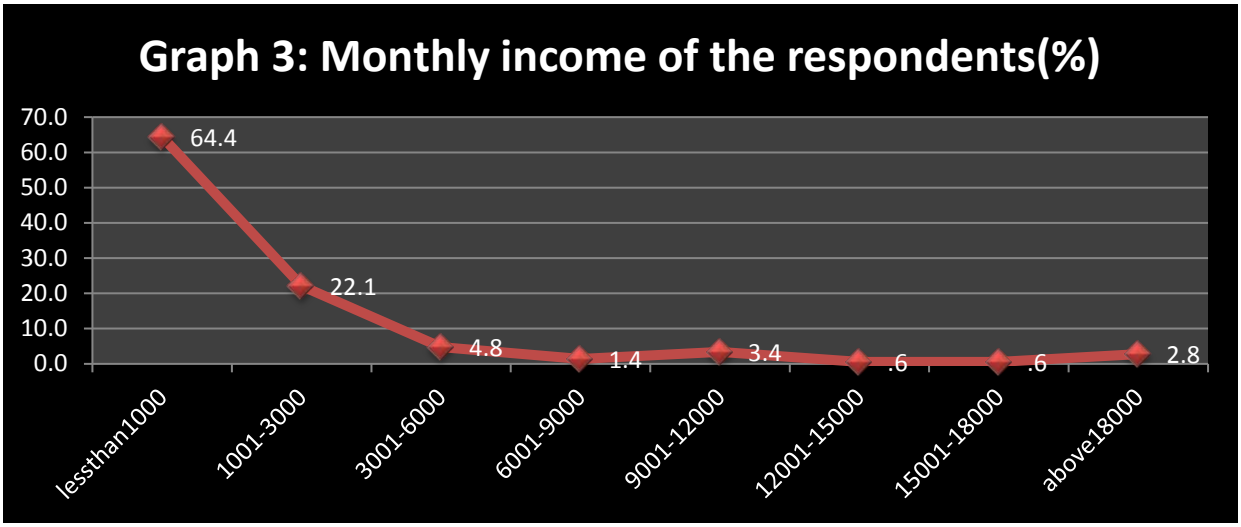
5.2.3 Income and livelihood

As per 2014 World Bank poverty assessment report, about 30% of Ethiopians live on less than US$1.25 a day (World Bank, 2014). Poverty can mean both absolute and relative poverty. Absolute poverty is defined as " *a situation in which the individual's basic needs are not covered, in other words, there is a lack of basic goods and services (normally related to food, housing and clothes)"* and where as "*a relative poverty considered when a person clearly in disadvantaged situation, either financially or socially, with regards other people in their environment*" (Alemayehu & Abebe, 2009).

As shown in *Graph 2* below, about 64.4% of the respondents have less than 1,000.00 Birr regular monthly family income and 22.1% of the participants have monthly income ranging from 1,000 to 3,000 Birr and 4.8% of the participants have monthly income ranging from 3001 to 6,000 birr 3.4% of the participants have monthly income ranging from 9,001 to 12,000 birr and 2.8% of the respondents monthly income is above 18,000 and the rest 1.2 % of the respondents have a monthly income that falls between 12,000 and 15,000 from their regular income sources. If we take the 2 dollars a day poverty line at 27.5 exchange rate of dollar to ETB, the monthly income of 1,650 birr is the expected threshold poverty line. Therefore, as the data indicated, more than 27.7% of the households are living below the poverty line.

As the data shows a greater number of respondents (92%) were able to estimate their annual incomes than those who were able to estimate their monthly incomes (59.1%). This is because agrarian communities are mostly dependent on incomes from the sales of crops and livestock which are mostly done once or twice a year and hence it is easier for them to estimate annual incomes. Therefore, the consulting team recommends taking the annual income. However, there is a huge variation among 75% of the respondent's birr/month who are under the poverty line and 25% of the respondents who has a better income. On average the annual income of 75% of respondent is 2,493.00 Birr whereas for the remaining 25% the respondents, the average annual income is 32,206.59 Birr (which can also be translated in to monthly income of 207.75 birr/month for lower income group and 2,683.88 birr/month for high income group as baseline figure for future comparisons).

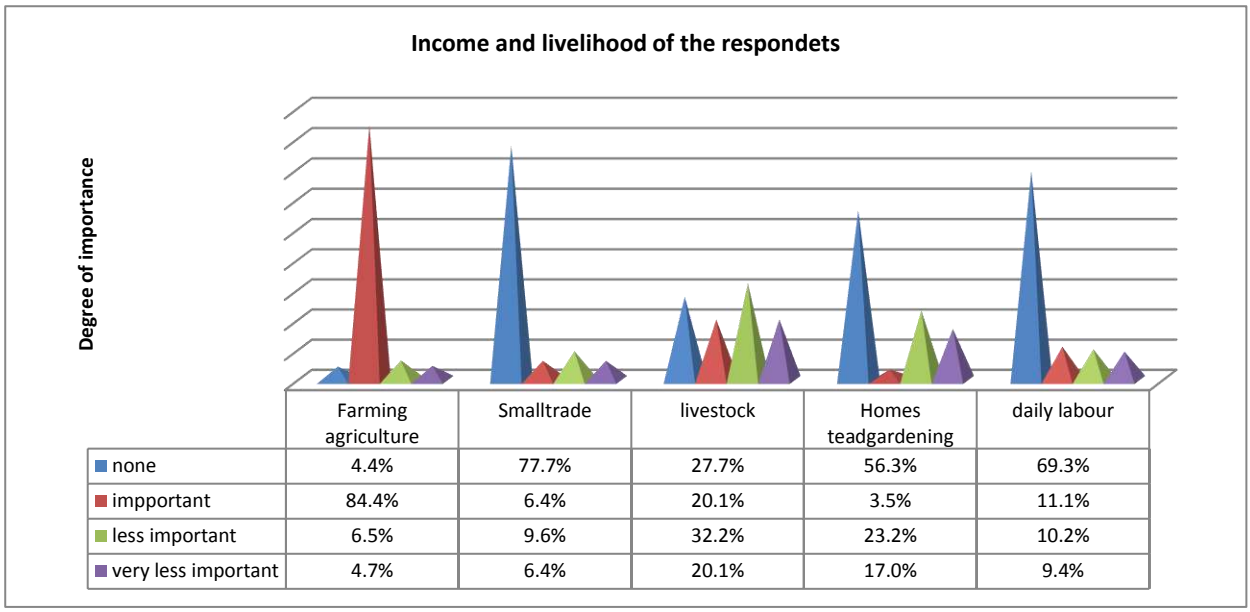
Graph 2: income of the respondents



Source: Survey data, April 2018

As can be seen in *Graph 3,* the respondents were asked the main source of income for their household. The result shows that the source of income is differ from household to household. By taking the local reference in their context, they were asked to list and rank their means of income by saying important, less important, and very less important and none. Since most communities relying on agriculture, they are mainly producing and selling agricultural products per year. As a result, farming and livestock rearing were the most widely practiced activities. Most of the respondents who reported to have 'no income' from small trade (77.7%), from daily laborer (69.3) and from homestead gardening (56.3%).

Graph 3: Income and livelihood of the respondents



	Farming agriculture	Smalltrade	livestock	Homes teadgardening	daily labour
none	4.4%	77.7%	27.7%	56.3%	69.3%
impportant	84.4%	6.4%	20.1%	3.5%	11.1%
less important	6.5%	9.6%	32.2%	23.2%	10.2%
very less important	4.7%	6.4%	20.1%	17.0%	9.4%

Source: Survey data, April 2018

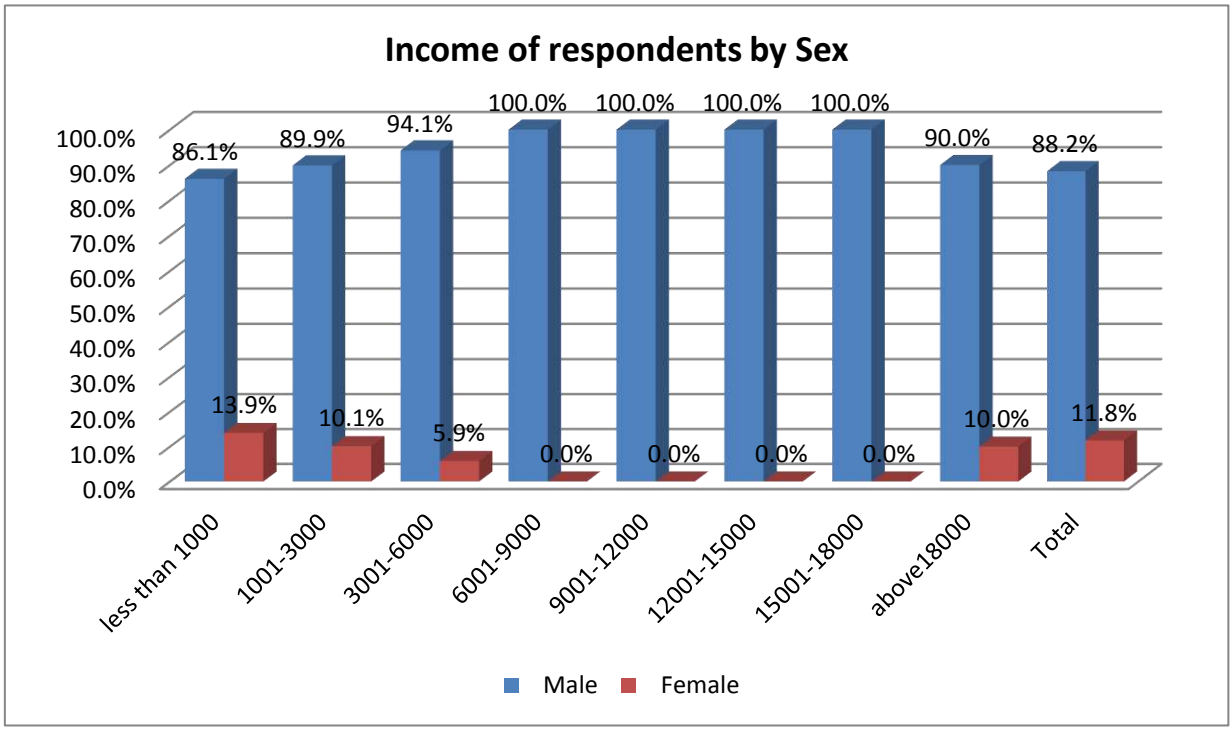
Analyzing the data on income sources by sex (See *Graph 4* below), there is huge difference in income source among women and men. 88.2% of the income generated by men. In all income level men can get more than 80% of the income than women. Relatively better numbers of women generate income from the lower income threshold which is less than 6,000.00 birr per month.

As per the FGDs with the respondents', women are responsible for domestic and reproductive activities and men are responsible for generating income. As Ethiopia is a male dominant society, most of the domestic activities (such as childcare, cooking, cleaning, collecting firewood and fetching water) are performed by women.

This finding is similar with many feminizations theorists that claimed high prevalence of poverty/vulnerability among women headed households. Feminization theorists explain that women are subjected to poverty because of social constructs. Feminization of poverty is used to explain three distinct things: that there is higher incidence of poverty among women than among men; that poverty among women is more severe than among men; and that the trend of poverty among women is greater, particularly because of the increasing proportion of Female Headed Households (Bridge, 2001).

Our findings from KII and FGD participants have also supported the quantitative survey findings. In the study Woredas of the region, women perform most of the domestic activities and men play only supportive roles. The role of men in domestic activities is highly limited in scope (i.e. number of household activities they can perform) and comprehensiveness (i.e. completing the assigned activity independently) as compared to women.

Graph 4: Income of the respondents by Sex



Source: Survey data, April 2018

5.2.4 Additional income: Humanitarian aid and supports from relatives

As per the findings of the survey about 8.3 % of the respondents have additional income (other than farming and livestock raring) from different sources. As can be seen from *Table 15* below, among respondents who have additional income, 80 % of them are men and 20 % are female. The sources of most of the additional income are support from relatives (10%), remittance/aid (5%) and from another source (75%).

Table 15*: Additional income of the respondents*

		Additional income of the respondents			Total
		Remittance	Support from relatives	other	
Male	count	1	1	14	16
	%age	6.3%	6.3%	87.5%	100.0%
	% of Total	5.0%	5.0%	70.0%	80.0%
Female	Count	0	1	3	4
	%age	0.0%	25.0%	75.0%	100.0%
	% of Total	0.0%	5.0%	15.0%	20.0%
Total	Count	1	2	17	20
	%age	5.0%	10.0%	85.0%	100.0%
	% of Total	5.0%	10.0%	85.0%	100.0%

Source: Survey data, April 2018

Estimation of income alone may be misleading as many people do not want to disclose their incomes for several reasons. Therefore, respondents were also asked to estimate their last month's and year's expenses for triangulating the information on income. Accordingly, the mean reported monthly expense is 2,341.90 birr which is greater than the reported total monthly average income of 821.9 birr. Therefore, there is some variation as the reported monthly expenditure is higher than the reported incomes.

5.2.5 Household Dietary Diversity Scores (HDDS)

The household dietary diversity score (HDDS) is meant to reflect, in a snapshot form, the economic ability of a household to access a variety of foods. The dietary diversity scores used in this survey consists of a simple count of food groups that a household or an individual has

consumed over the preceding 24 hours. The average score is calculated using the sum of those respondents that answer “yes” over the total respondents (Table 16).

Table 16*: Summary of HDDS*

Types of foods you eat in the last 24 hours	Yes	Total respondent	Baseline average HDDS	Average
Meat	77	400	0.1925	19.25
Milk	102	400	0.255	25.5
Fruit and Vegetable	129	400	0.3225	32.25
Total			0.77	

Source: Survey data, April 2018

The average HDD score is 0.77 out of three which is below the average score (and shows food intake diversity is very poor in survey population. As per FGDs, the consumption is high on cereals which the target community grows and use in different ways. Cereals include Teff, Maize and sorghum is most commonly used as Injera, bread and local beverages. The consumption of animal and animal products is low as 16 to 18%. Moreover, consumptions of fruits and green leafy vegetables which can be sources of many essential nutrients that are under consumed, including potassium, dietary fiber, vitamin C, and folate (folic acid) are not widely eaten.

5.3 Land Use and Agriculture

As per the EFDR Land Proclamation 2005 Article 40 land is belong to the state, the private ownership of land is prohibited to ensure equity of land use among citizens and between generations and the federal government determine the amount and type of land a citizen may hold in the country. However, the citizen has a right to use the land with different land use modality like in the form of state, private, or communal/group holdings.

For rural land holding both the Federal and Regional Constitutions as well as the land administration laws provide that peasants and pastoralists have the right to acquire use rights over rural land free of charge and without time limit including the protection against eviction

from their land except for public purposes subject to the payment of advance compensation commensurate to the value of the property. However, for any individual or private entity have the right to acquire land on the basis of payment and for a fixed period of time to be determined by regional laws.

This survey was asked the respondents whether they have land for use or not, the size of their own land and in what term they have been used the land. Among the study respondents 349 (87.3%) of the respondent households have agricultural land for farming, whereas the rest 51 (12.3 %) of the respondents don't have farming land. As it is indicated in *Table 17* below, most of the study population which is 12 (37.3%), have 1- 3 hectare of land, 86 (26.1%) of the population have 4-6 hectare of land, 45 (13.6%) of the population have 7- 9 hectare of the land the remaining 23% of the study population have more than 9 hectares of land. The community representatives confirmed this survey result. The local community owns a land whose size is not more than 10 hectares because the land-use regulation of the regional government prohibit household not to possess a land more than 10 hectare.

The respondents who have their own farm land were asked about the ownership of the land and the majority of the respondents (83.4%) confirmed that the land they cultivated are their own, 10.2% of the respondents own and cultivated some of land and rented additional land for cultivation from other individuals. 2.4% of the respondents use only rented lands and about 3% of the respondents, rented and use the land as a shareholder.

Table 17*: Land ownership status of the respondents*

Land ownership (in hectare)	Frequency	Percent
1-3	123	37.3
4-6	86	26.1
7-9	45	13.6
10-12	53	16.1
13-15	13	3.9
above 16	10	3.0
Ownership status		
I own and cultivated	311	83.4
I own but not cultivated	4	1.1
I rented this land from someone else	9	2.4
I rented out this land	5	1.3
I am a share holder	3	.8
I own and cultivated some of land and I rented some of the lard	38	10.2
other	3	.8

Source: Survey data, April 2018

5.4 Land Holding and Income

Land is a fundamental productive asset, especially for rural society who relies heavily on the agricultural sector which also contributes to nearly half of the GDP, 85% of exports and 85% of total employment (MoA, 2017). Agriculture in Ethiopia is dominated by small scale farmers who earn their livelihood primarily from subsistence rain fed agriculture with only limited use of

modern inputs. Thus, land holding is affecting the livelihood and the income of the individual as well as it determines the food security status of the household. The assessment tied to triangulate respondents' land holding with their annual income.

Table 18*: Land holding Vs income status of the respondents*

	land holding in hectare						
	1-3	4-6	7-9	10-12	13-15	above 16	Total
3001-6000	36.0%	21.6%	15.4%	34.8%	0.0%	0.0%	23.9%
6001-9000	31.5%	24.4%	19.2%	26.1%	0.0%	0.0%	26.1%
9001-12000	26.1%	28.8%	11.5%	8.7%	25.0%	30.0%	28.3%
12001-15000	5.4%	16.7%	26.9%	0.0%	25.0%	30.0%	18.9%
15001-18000	.9%	9.5%	26.9%	30.4%	50.0%	40.0%	2.8%

Source: Survey data, April 2018

As it is indicated in *Table 18* above, more than 66% of the respondent who have 1-3 ha of land got annual income of 3,001-9,000 and the largest percentage of population who have 4 - 6 ha of land got annual income ranging from 9,001-12,000 birr, more than 53 % of the respondents who have 7-9 ha of land got 12,001-18,000-birr income per year. This indicated that, the land holding status has a strong association with the individuals' annual income. When individual land holding increases, the amount of annual production and then their income also increased because production depends on the size of the land and even the household may have rented out the land for other individuals if they didn't use the land. Thus, the annual income of the large land holding family is increased directly or indirectly.

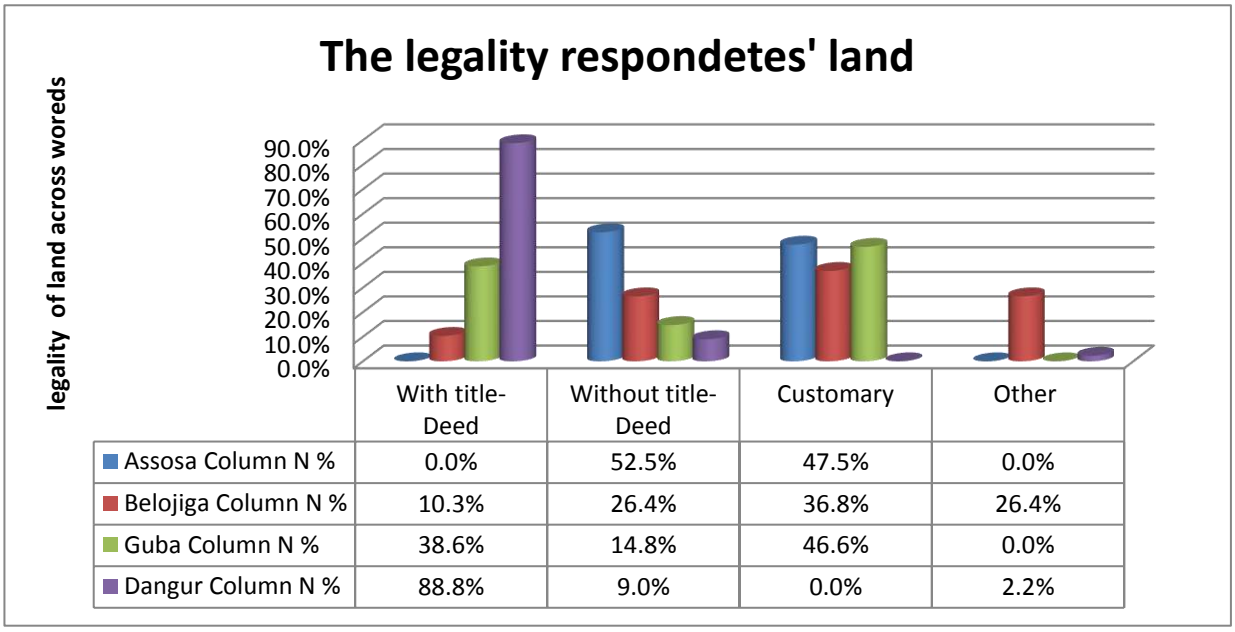
5.5 Legality of the Land

When we see the legality of the land owned by the study population, only 122 (33.6%) of the respondents' land are legal and 59.5% of respondent owned their land illegally. 26.4% owned the land without title and 33.1% of the respondents owned the land traditionally/ customarily.

As per CSA definition traditional/customary land ownership means "*it is a means of land acquisition strategies with habitual ways from their family and it is recognized by local people and the government, but it is not legal".*

As it is indicated in Graph *5*, when we see the land legality status of the respondents across the woredas, in Dangur 88.8% of the study population owned the land legally where as in Asossa the survey couldn't find a single respondent who has legal land ownership status. Most of the respondents in Asossa own the land without title (52.5) and customary (47.5%). In Belojiga only 10.3% of the respondents have legal land ownership status and the rest 89.7% of the respondents own the land without title (26.4%), customary (36.8%) and through other means of land acquisition (26.4). The majority of the respondents in Guba (46.6%) owned the land in a customary way, next to legally owned (38.8%); the rest 14.8% of the respondents in Guba owned the land without title.

Graph 5: Land's legality status of the respondents



	With title-Deed	Without title-Deed	Customary	Other
Assosa Column N %	0.0%	52.5%	47.5%	0.0%
Belojiga Column N %	10.3%	26.4%	36.8%	26.4%
Guba Column N %	38.6%	14.8%	46.6%	0.0%
Dangur Column N %	88.8%	9.0%	0.0%	2.2%

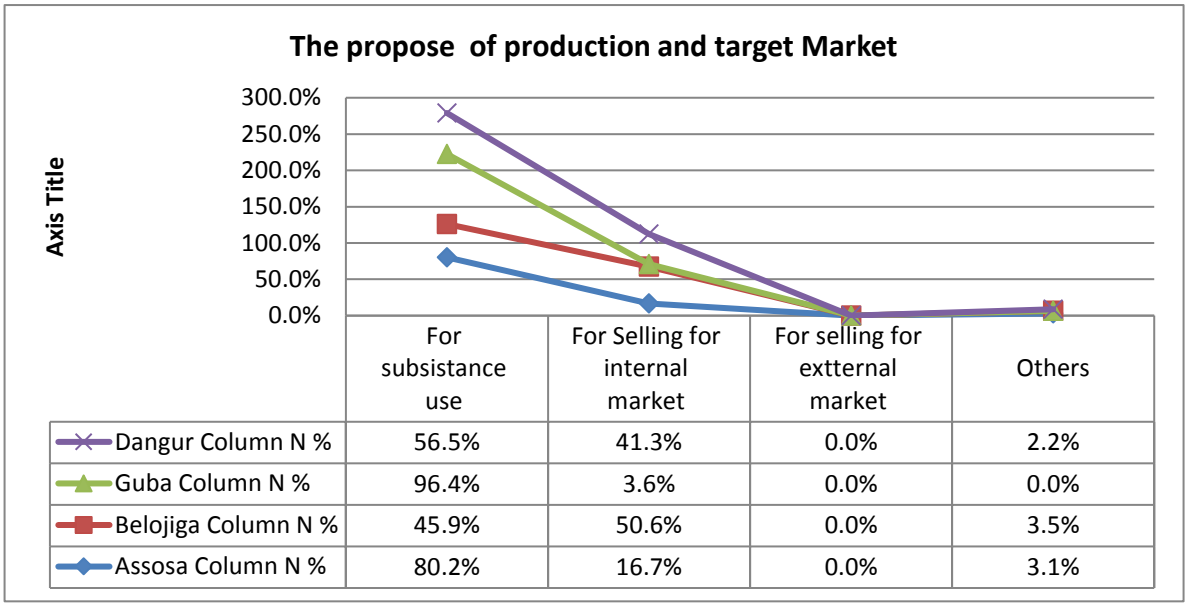
Source: Survey data, April 2018

As per the FGDs response, all the participants disclosed that the land they have been using for agricultural activity belongs to their own and for that they pay annual land utilization tax to the local governmental body. It was noted that all the participants have no title deed for the land they have been using.

5.5.1 Intended Purpose of the Production

The survey was further asked the respondents about what their intended purpose of the land and its outputs was. The result showed that majority of the respondents use their agricultural production for household consumptions only, but 28.1% of the respondents supplied their production to the local market and the rest 2% of the respondents use their production for other purpose. When we see the variation across the survey woredas, most of the respondents from Guba and Asossa (96.4% and 80.2% respectively) use their production for substance use and most of the respondents from Dangur and Belojiga use their production for selling in the local market.

Graph 6: Purpose of the Agricultural Production



	For subsistance use	For Selling for internal market	For selling for extternal market	Others
Dangur Column N %	56.5%	41.3%	0.0%	2.2%
Guba Column N %	96.4%	3.6%	0.0%	0.0%
Belojiga Column N %	45.9%	50.6%	0.0%	3.5%
Assosa Column N %	80.2%	16.7%	0.0%	3.1%

Source: Survey data, April 2018

5.6 Land Negotiations and Transfer

In Ethiopia, especially in emerging regions like Benshagul-Gumuz, interest in farmland from private local and foreign investors is increasing. Since 2006 the Ethiopian government is encouraging these investors (Ethiopian Regulation No. 396/2017). From investors side, they thought that while nearly no unused arable land is available in developed countries and despite that land in general is very expensive, land in developing countries, especially in Ethiopia is more affordable and accessible, labor costs are very cheap, and the government attempted different efforts to attract foreign investment and to support development *(EFDR Proclamation No. 916/2015).* Consequently, international large-scale land deals were expanded in the

country, which can be defined as purchases or long-term leases of land by foreign investors. This in mind the government use different strategies to arrange land to investors like transferring land from local people to investors and providing communal lands and state-owned lands are the two common strategies.

This survey was asked the study population whether they transferred their owned land to investors or not. 47 (11.9%) of the respondents transferred their agricultural land to government and investors for the purpose of large-scale farming for the last 5 years. 55.3% of the respondents who transferred their land for investment and explained that there were no negotiations between the government, investors and with them and rest 44.7% of the respondents confirmed that there were negotiations before the land transfer. Regarding the compensation, 80.4% of the respondents who transferred land for large scale farming didn't get any in-kind and cash compensation and only 19.5% of the respondents have got in-kind (15.2%) and cash (4.2%).

The assessment was further asked the respondents about their satisfaction and feeling about the benefits from the negotiation. The majority of the respondents (85%) were not happy by the compensation given to them. And as shown in *Table 19* below*,* the respondents who have got cash compensation, they couldn't buy a similar or better land like the transferred one. And only 16% of the respondents only bought better quality and/or bigger size or similar land with the compensation cash.

Table 19*: Land transfer and compensation*

Land transfer, Negotiations and Compensation		Count	N %
Did you transfer your agricultural land to government and investors	Yes	47	11.9%
	No	347	88.1%
If you transfer land, did you have negotiations during the transfer?	Yes	21	44.7%
	No	26	55.3%
If you transfer land, did you get in kind or	Yes, In kind	7	15.2%

cash compensation for your land	Yes, In Cash	2	4.3%
	No, I didn't get any	37	80.4%
Did you feel that you benefited from the offer during the negotiation	Yes	6	15.0%
	no	34	85.0%
If you get cash compensation, did you able to buy a parcel?	Yes, I bought a land which is better quality and/or bigger in size	1	4.0
	yes, I bought a land of similar size and quality	3	12.0
	Not, I didn't buy a similar/ better land	4	16.0
	the negotiation has completed	17	68.0
Did you have any grievances about the land acquisition?	yes	27	73%
	no	10	27%

Source: Survey data, April 2018

5.6.1 Conflict and Disagreement

In order to create sense of ownership and social standards for land deals that make a positive contribution to local development and local people it is necessary to respect the community, the existing land use rights of local people, transparency, good governance, and community consultation and participation. Article 92(3) of the constitution of Ethiopia states that local people have the right to be consulted fully and express their view in the planning and execution of policies, projects, and programs that affect them directly. With respect to the participation of indigenous communities, before land is supplied for commercial investors, there should be community level consultative discussions. There should be also a number of minutes and signed

documents in district offices showing the consents of local communities through their representatives.

However, as per the survey result, there is no community consultation, discussions and sense of ownership creation program during land transfer. Respondents who transferred their land were asked about whether there were any grievances during land transfer process and as its cause during and after the land transfer, 27(73%) of the respondents replayed that there were complaint and grievances on government and investors. As per the FGDs with community representative, the local community was not happy when land is transferred because there haven't been done community discussions before the land is transferred. Most of the community didn't get a compensation for their land and even some of the community member got compensation after 1-3 years delaines. Thus, the community didn't feel sense of ownership on investors and on large scale farms. As a result, grievances are happened frequently even during and after the land is transferred.

5.6.2 Reasons for Grievance

The assessment tried to analyze the reasons for the local people are not happy on the large-scale investments and the causes of disputes. As per the FGDs and KII response, the following major reasons were identified as a reason for disputes with the large-scale investment owners:

5.6.3 Land graving

Members of the community explained this as follows:

"Without any consultation and discussion, our farm land was handover to the investors. Most of the community didn't get any in-kind and in cash compensation. Our production decreased, and we are food insecure due to farm land is reduced and most of the fertile land is provided to investors. Thus, the local people have a fear and worried that one day our existing farmland may be taken by the current or new investors in the name of large-scale investment and we may in problem."

5.6.4 Lack of priority

Members of the community explained this as follows:

"As large-scale farming is labour intensive, job opportunities are created for large number of people however the job opportunity is given for migrant people, not for local people. The farms are not given priority for local people"

5.6.5 Conflict with worker/ Laborer

Members of the community explained this as follows:

"The workers/laborer's who came from other regions for looking job in the large-scale farming locally called Jango and Salug. They usually end up with a conflict with the local people and with each other and affect the peace of the locality. They kill to each other, they try to harass our women and girls, and steal our livestock (e.g., goats). Theft has increased in the community and trust has been lost in the community"

5.6.6 Deforestation

Members of the community explained this as follows:

"Deforestation has increased by forest cleaning for agricultural expansion and firewood by laborers and wild animals are disappearing. Wild animals such as elephant, wild Ibex, deer and the like are abundant in the neighborhood and now it is becoming history. Investors cause wild fire, it affects our crop and we couldn't also get honey from forest as past we did."

5.6.7 Progress of the farm

Members of the community explained this as follows:

"After the investors took our large size of land, most of the owner couldn't keep their promise in investing on the farm as well as in benefiting the people. Even they also rented out the land to others and they collect money. Rather benefiting the local people, sometimes expired inputs (seeds) are distributed to the local farmers as they imported in excess amount in the name of investment. There is no follow up and measure from government side too and the local people felt this and easily arise conflict with investors."

5.6.8 Public Services burden

Infrastructure development and community development works are expected from investor for local people however as per the response of FGDs response

"Most of the owners of the farm are not available in the farm, the farm whether operated by delegation or rented to other and the current operators of the farm may not worry about the infrastructure and public service of the woreda. Thus, rather the woreda getting infrastructure development like hospital, road, school, the laborer migrated from other region for farm job are using the public services such as health centers which was budgeted for local people only. This created extra burden on those service. For example, last year there were diarrhea incident in the community and there were unusually high number of patients, which was caused by the influx of high number of laborers associated with large scale farming."

5.6.9 Culture affected

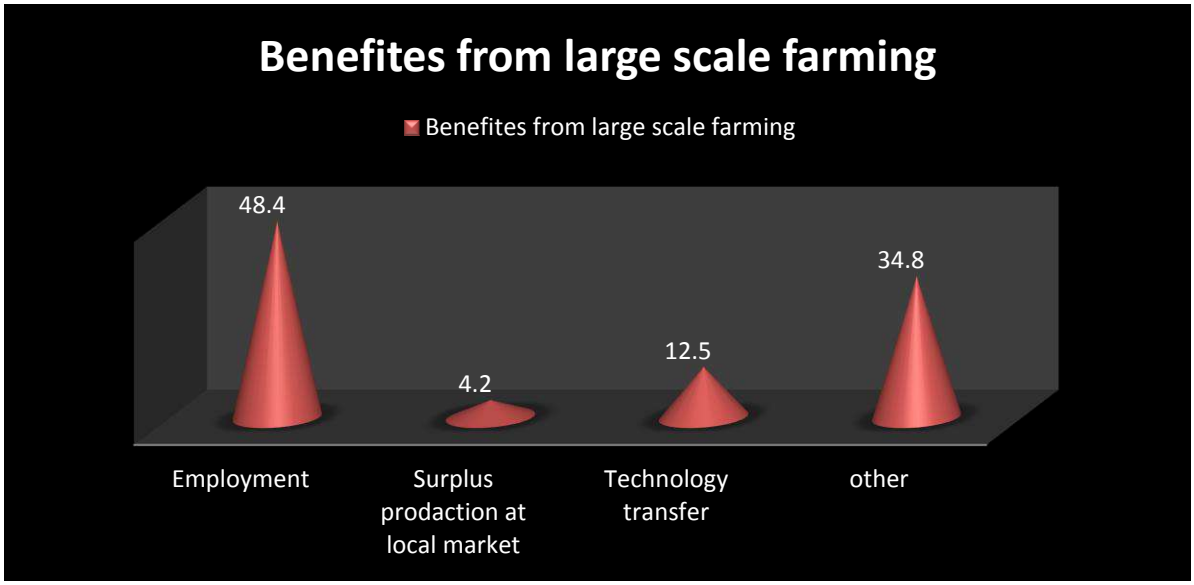
"The immigrant labor affects the culture and tradition of the local people, the number commercial workers in the woreda is also increased and the prevalence of HIV and other STDs is also increased. Rap is becoming a common practice which was not observed before in local culture. Killing to each other was not known to our culture but we are now observing such kind of incident often.

5.6.10 Benefits of large scale farming for community

Benefits of large-scale agricultural investment is inducing new technology, wage employment, increasing foreign direct investment (FDI) as well as for infrastructure development as intended by the Ethiopian government (MOARD 2009). As Ethiopia has Agricultural development lead industrialization policy (ADLI), new investments in agriculture sectors could facilitate the creation of Pre-conditions for sustainable development.

This survey tried to assess the benefit of large-scale farms for local community and the survey was asked the respondents to list out the benefits the existing large-scale arm in their woredas which, as you have seen in graph 7, 48.4% of the respondents' confirmed that the large-scale farms have some employment opportunities for community, especial they accommodate a huge number of laborers. 12.5% of the respondents' said that the large-scale farm has benefit for local people in transferring new technology which related to inputs, agricultural equipment's, information and early warning and readiness information for their productions. 4.2% of the respondents also said that the large-scale farms help the people to get surpluses of production at the local market and the rest 34.8% of the respondents' responses that the large-scale farms have other benefits.

Graph 7: Perceived benefits the existing large scale for local community



Source: Survey data, April 2018

After this assessment analyses, how the land is transferred from local people to investor, how the local people feel on investors and how they understood the farm benefits, the surveys were assessed the progress of agricultural production of the respondents for the last 5 years in order to evaluate the impact of large-scale farm on local people agricultural production.

As per the response of FGD participants response on the possible opportunities of large-scale farming for local community, almost all participates declared that no significant advantage has come in to the local communities from investors. This was evidenced that labour force has been brought from other areas, the investors are not willing to provide technical support like ploughing the local community farmlands by tractors and provision of best seeds nor does selling of grains and cereals for food consumption while asked. Rather the expansions of large-scale farming diffuse our culture and crime like drinking and sexual harassment, deliberate forest fire has been observed on their locality.

Table 20*: Respondents land Productivity and large scale*

Trend of productivity for the last 5 years	Due to think the productivity (increasing /decreasing) linked with Large scale farm	Reason for increasing/ decreasing productivity

Increased	Decreased	Yes	No	Usage quality of seeds got better	117(60%)
200(51.4%)		131(67.2%)	64(32.8%)		
				Usage of chemical fertilizers and pesticides have increased	35(17.9%)
				Usage of organic fertilizers have increased	25(12.8%)
				Irrigation has improved	3(1.5%)
				I bought agriculture vehicles	6(3.1%)
				other reason	9(4.6%)
	127(32.6%)	27(27.1)		Erosion	45(33.8%)
				Lack of agricultural vehicle	6(4.5%)
				Not using enough fertilizer (pesticide	32(24.1%)
				Lack of labor	16(12%)
				Other reason	34(25.6%)

Source: Survey data, April 2018

As per the assessment result the agricultural productivity of 200 (51.4%) of the respondents' production has increased for the last 5 years due to usage improved of seeds (60%), using chemical and organic fertilizer (30.7%) and using mechanizations, irrigation and other reasons

(9,3) (Table 20). The respondents were also asked to explain weather there were contribution of large scale farming which found in their woreda for their production increment, 131 (67.2%) of the respondents confirmed that the existence of large scale farms in our locality has a positive contribute for our agricultural production productivity and the rest 64 (32.8%) of the respondents responded that, our agricultural productivity increase didn't like with the existence of large scale farm, it is increased due to other reason like using fertilizer, improved seeds and using irrigation and farm machines as it is mentioned in the above.

On the other hand, 127 (32.6%) of the respondents' production is decreased for the last 5 years due to erosion (33.8), not using fertilizer (24.1%), lack of labor 12% and for other reasons (25.6%). Further study may be needed to explain why erosion is occurred for the last five years, and to link it deforestation with large scale farming.

As per the KII responses, land conversion from forests to "farm lands" has contributed to deforestation of the natural forest resource bases of the region as well. It is very common to observe huge woody masses in every commercial farm, and ongoing land-clearing and preparation (deforestation). Environmental damage associated with large-scale land investment might directly occur as a result of forest degradation.

5.7 Housing, Education and Health Status of the Community

5.7.1 Access to facilities: Housing, water, electricity and Transport

A majority of the respondents, which is 94.3% of the respondents, have their own house, 4% of the respondents live in the rented house and the rest 1.7% of the respondents live in other person's house free from rent. When we see the variation across the woreda, as it is indicated in the table 21 below, more than 90 % of the respondents live in their own house; even in Asossa all of the respondents have their own house. Among the study woredas, relatively Dangur is a woreda which relatively has small number of respondents in their own house, which is 90% of the respondents have own house and 7% of them live in rented house and 3% of the respondents live free of payment. The survey team tried to observe the main building material of the respondent's house, and more than 87% of the respondents' house build by wooden and soil and the rest 13% of the respondents' house built by other materials. The average of the number rooms of the respondents' house is 1.6 (from 1-3 room).

Table 21: *housing status of the respondents*

		Asossa	Belojiga	Guba	Dangur
		N %	N %	N %	N %
Owner ship status of your house	Own of the house	100.0%	95.0%	92.0%	90.0%
	Rent	0.0%	3.0%	6.0%	7.0%
	User not paying rent	0.0%	2.0%	2.0%	3.0%
	Other	0.0%	0.0%	0.0%	0.0%
Problems with water supply	Yes	49.0%	47.5%	35.8%	42.3%
	No	51.0%	52.5%	64.2%	57.7%
Electricity in your house	Yes	6.0%	9.0%	0.0%	0.0%
	No	94.0%	91.0%	100.0%	100.0%
Transportation access	Yes	91.2%	98.9%	7.3%	95.8%
	No	8.8%	1.1%	92.7%	4.2%

Source: Survey data, April 2018

When we see access to water supply, more than half of the respondents in all woredas don't have access to water supply. Especially in Guba more than 64% of the respondents don't have a water access next to Dangur woreda. The survey was further analysis the source of water supply of the respondents and 293(74.4%) of the respondents get water from water pump, 55(14%) of the respondents get water from village springs and the rest 45(11.7%) of the respondents get water from water well.

Surprisingly as it is indicated in the above table, more than 90 % of the respondents in all woreda don't have access to electricity especially in Guba, all respondents don't have electricity access.

Regarding to transportation access of the respondents to travel to the nearest woreda, 269(72.5%) of the respondents have a transportation access to travel to the nearest woreda. However, there is a big variation to access to transport among woredas, as it is shown in the table above respondents, more than 90% of the respondents from Asossa, Belojiga, Dangur woredas have access to transport to travel to the nearest woreda, whereas only 7.3 % of the respondents from Guba woreda have a transport access to travel to the nearest woreda, more than 92% of respondents in Guba don't have access to transport.

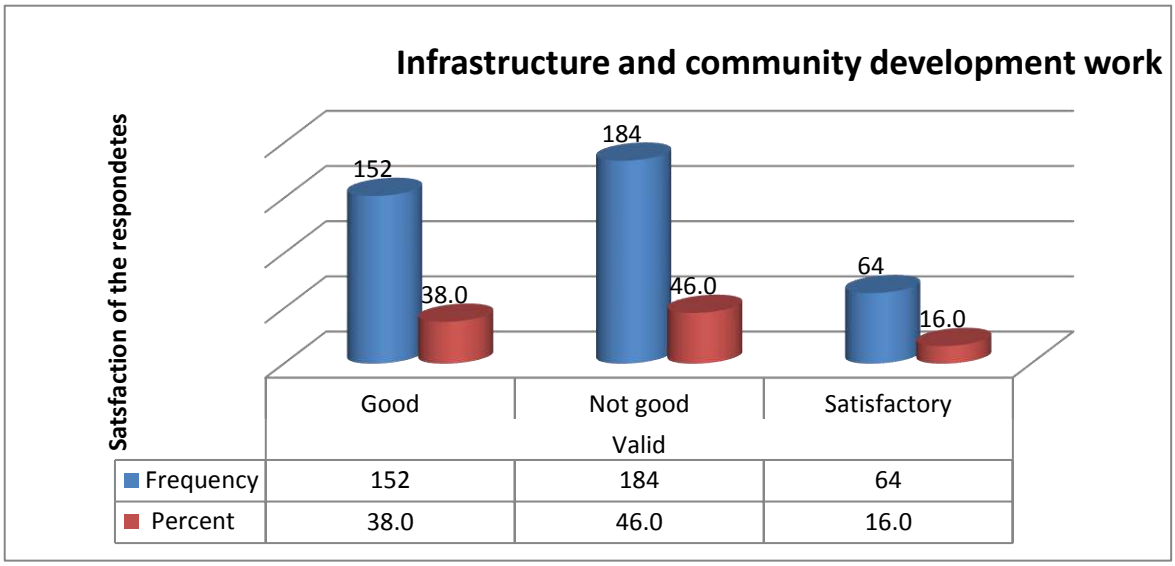
5.7.2 Infrastructure and Community development work

Infrastructure and community development work is one of the indirect benefits of large-scale farming and investments. The assessment team was asked the community representatives about the expectation of the local people from large scale farm investors during the FGDs, and they were expecting job opportunity, infrastructural development like health center, road, school and expansion of societal services. They stated the situation as follows:

"Every expectation from large scale farm is a dream rather we lost our instability and security. The locality people are tensioned due the expansion of the large-scale farming and its consequences. We wish, we would live in the push peacefully as our ancestor did".

The household survey also assessed the satisfaction of respondents by the infrastructure and community development work in their locality and as it is indicated in the *Graph 8* 184(46%) of the respondents evaluated the current infrastructure and community development work in the locality as "not good", 152(38%) of the respondents also evaluated it as "good" and the rest 64(16%) of the respondents evaluated that the infrastructure and community development work is "satisfactory". As per the KII responses, most of the woreda in the region which includes the study woredas, infrastructure development is in infant stage, even they lack basic services and community facilities like electricity, water and rural road connectivity.

Graph 8: Infrastructure and community development status



Source: Survey data, April 2018

5.7.3 Children School Enrolment

Overall enrollment for children 6-18 years of age is 56.7%. As per the FGDs respondents, most of this enrollment is at the primary level; the contribution of secondary enrollment to the total enrollment is less than the primary level and the enrollment in rural area is much lower than that of the small-town areas. As per the data given in *Table 22* below among 225 respondents whose children are in the age of 6-18, 25 respondents didn't send their children to school due to financial problem, demand for girls' labor for domestic works and lack of school in the nearby villages. Furthermore, the finding has indicated that conflict and instability has negatively impacted on children's enrolment and completion rates.

Table 22*: School enrollment for children*

	Available children (6-18) in the household		school enrolled children (6-18 years old)		satisfied with the education facilities and quality	
	Frequency	Valid Percent	Frequency	Valid Percent	Frequency	Valid Percent
Yes	225	63.7	200	56.7	258	65.3

No	128	36.3	153	43.3	137	34.7
Total	353	100.0	353	100.0	395	100.0

Source: Survey data, April 2018

The assessment also asked the respondents about the satisfaction with education facilities and quality of the education and the result indicated that 258(65.3%) of the respondents are satisfied with the facilities and the quality of education, whereas 137(34.7%) of the respondents are not satisfied with the facilities as well as on the qualities of the education provided in the woreda for their children.

5.7.4 Health Condition and Access to Health Services

Currently, due to the attention given to the health sector in general and to mothers and children health in particular, many health centers and health posts are built in the rural areas and trained health extension workers are deployed all over the country. Therefore, pregnant women and other community members can easily get primary health services at any time deemed necessary. However, during the FGD community members complained that these health infrastructures are not well equipped both professionally as well as materially. They also mentioned that there is high staff turnover and they could not even get basic drugs in the health centers and hence they are forced to purchase the drugs from other areas with higher prices.

Respondents were asked whether the household members have health problems or were sick in the last 12 months of the interview. From the total respondents around 12.7 % said that they had a health problem, 23.7% of the respondents confirm that their household members face a health problem which required treatment within the last 12 months, 4.4% and 14.9% of the respondents' household members suffer from any contagious diseases and water borne diseases within the last 12 months (Table 23). Despite the fact that the reported cases are small, the types of diseases are related to malaria, poor hygiene and sanitation. This was also confirmed by the discussion with the health office experts who mentioned that there is recurrent occurrence of diarrhea among children in the Woreda.

Table 23*: Health status of respondents' family*

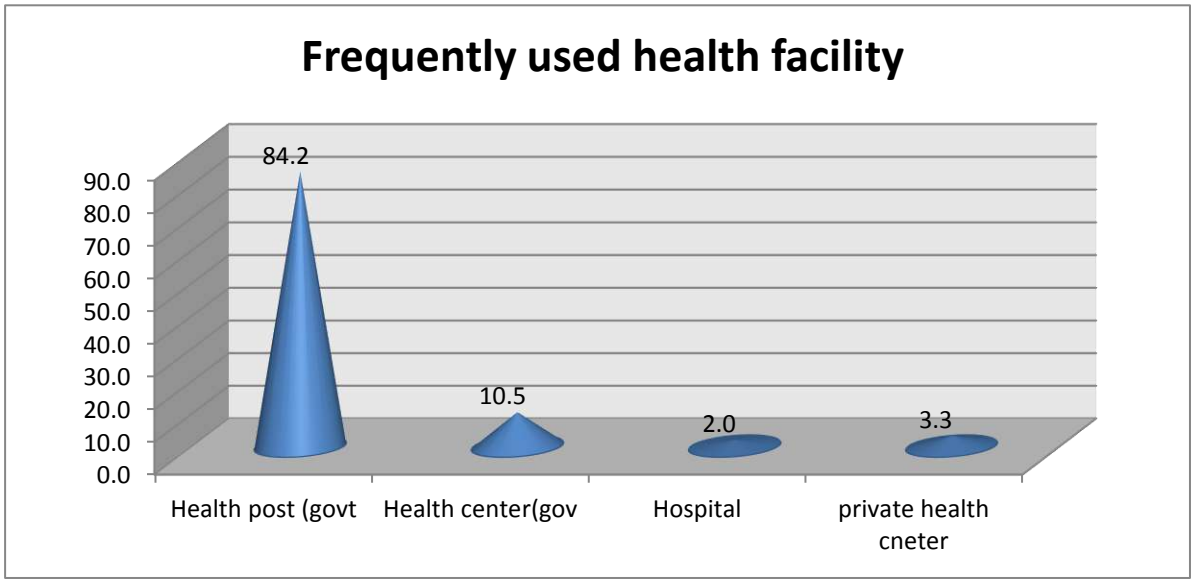
Questions for the woreda's people		woreda				Total
		Asossa	Belojiga	Guba	Dangur	
		Column N %	Column N %	Column N %	Column N %	
Any health problems of the respondent?	Yes	21.2%	18.8%	7.0%	4.0%	12.7
	No	78.8%	81.3%	93.0%	96.0%	87.3
Household members face a health problem which required treatment within the last 12 months?	Yes	43.5%	34.7%	4.1%	13.3%	23.7
	No	56.5%	65.3%	95.9%	86.7%	76.3
Household members suffer from any contagious diseases within the last 12 Months?	Yes	4.0%	12.6%	0.0%	1.1%	4.4
	No	96.0%	87.4%	100.0%	98.9%	95.5
Household members suffer from any water borne diseases within the last 12 Months?	Yes	16.2%	27.6%	12.5%	3.2%	14.9
	No	83.8%	72.4%	87.5%	96.8%	85.1

Source: Survey data, April 2018

With the improving health facilities in most parts of the country the tendency of people to go to the health centers to get health services is improving. In order to assess the use of health service, the respondents in the survey were asked to tell where they take their family during illnesses. From the total respondents 84.2% mentioned that they take their family to health post, 10.5% and 2% of the respondents respectively take their family to government health center and hospitals and only 3.3 % of the respondents take their family to private health

center during illness. Even if there is promising practice of using the existing health services in the locality 169(42.8%) of the respondents were not satisfied with the health services provision. Regarding the distance of health facilities, as mentioned above, most of the respondents use health service from the health post, it is not far to access the services, it is also confirmed by 88% of the respondents.

Graph 9: Health facilities utilization



Source: Survey data, April 2018

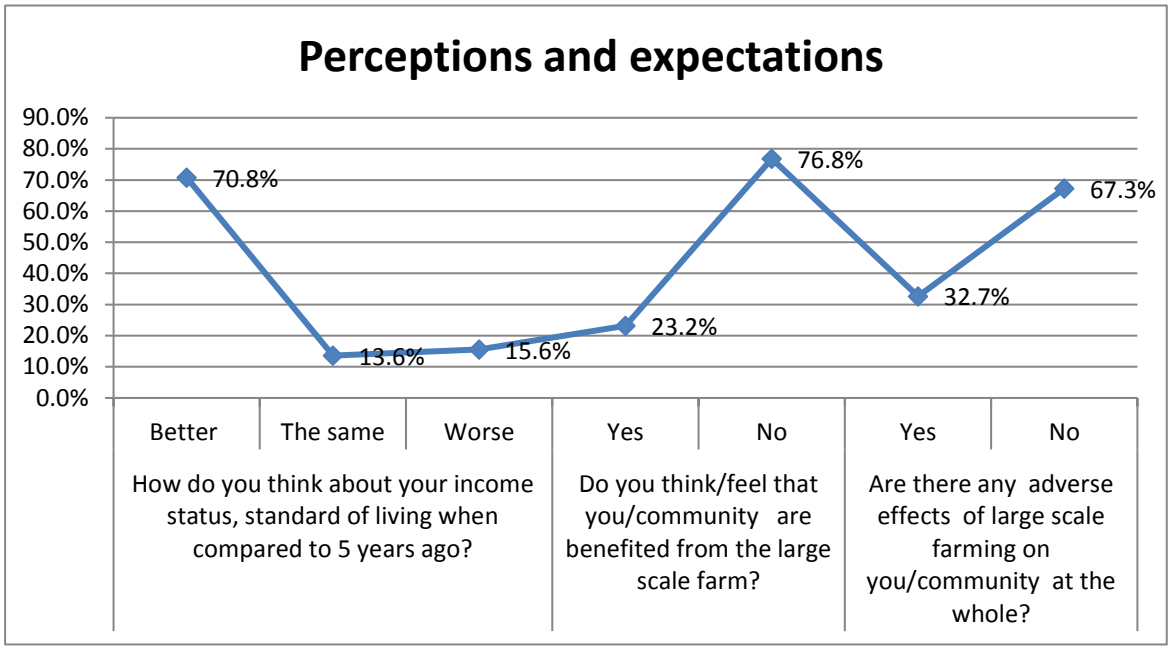
5.8 Perception of people towards large scale farms

When the survey assessed the income of the respondents, feeling of the local people on what they think on benefit and adverse impact on the local people due to the existence of large-scale farms. Regarding to the income as it is indicated in previous discussion in the graph 10, 70. 8% of the respondents think that the income and the standard of living of the local people is improved since the last 5 years, 13.6% of the respondents perceived that their income and living condition is the same in the last 5 years and the rest 15.6% of the respondents also think that their income and living slandered is becoming worse in the last 5 years. As per the response of FGDs, most of them responded that the life of the local people is highly affected by the expansion of the large-scale farms, due to the existence of the farms with huge number migrant laborers, the price of consumption goods is inflated, and our culture is distorted. To triangulate this result, the survey was asked the respondents weather the community is benefited from the large-scale farm or not and the majority of the respondents, which is 76.8%

of the respondents confirmed that the community did not get any benefited due to the existence of the large-scale farm in our locality.

Some of the discussants said that our income and living standard is not linked with the existence of large-scale farming, it is affected by globalization and national policy and regulation as other regions affected. 23.2% of the respondents felt that the community is benefited from the large-scale farming.

Graph 10: Perceived change and contribution of land scale farm



Source: Survey data, April 2018

5.8.1 Social Integration and Cohesion

Social integration and cohesion are one of the concerns when investment is expanded and new ethnic groups are inflow to and live with the local people. As it is discussed in the above, the survey team was asked the respondents about the relationship with the people who came for working in large scale farming, and weather the community faced any social, cultural crises and disputes with workers due to the expansion of large-scale farming. As per the respondents of the study population, more than half of the respondents (59.8%) confirmed that the local people don't have good relations with the people who came for working in large scale farming, and 37.2% of the respondents reflected that the community is facing any social and cultural crises due to the expansion of large-scale farming. 12.5% of the respondents also entrenched

the existence of disputes with the worker of large-scale farmer or another ethnic group in the past (Table 24).

Table 24*: Social integration and cohesion of the local people*

Social integration and cohesion of the local people		Column N %
You have good relations with the people who came for working in large scale farming?	Yes	40.2%
	No	59.8%
Your community faced any social and cultural crises due to the expansion of large-scale farming	Yes	37.2%
	No	62.8%
Have any disputes with the worker of large-scale farmer or other ethnic group in the past?	Yes	12.5%
	No	87.5%

6 Conclusion and Recommendation

6.1 Conclusion

Landscape transformation was quantified after mapping the Land use/Landover of the region in four reference years (1986, 2000, 2010 & 2017) with overall accuracies that range from 60-87%. Over the past three decades, croplands generally increased at the expenses of forests and woodlands, leading to deforestation and diminishing of wild animals. Forest and Woodlands combined reduced by 1%, 14% and 17% in the three-time trajectories considered i.e., 1986-2000, 2000-2010 & 2010-2017, respectively. Croplands steadily increased since 2000, dominantly at the expenses of forests and woodlands. In between each time trajectory the croplands increased on average by about 9%. However, the rate of increment per year was higher in the 2010-2017 trajectories when the cropland increases by about 1.77 % per year, while 1.22 and 0.09% increments per year were observed in the 2000-2010 and 1986-2000 trajectories, respectively. Land use/land cover change detection combined with EVI trend analysis identified hotspot areas that undergone to major transformations in three-time trajectories (1986-2000, 2000-2010, & 2010-2017). Hotspot areas of transformation in the region are caused by LSAI, small scale agricultural activities and other development works such as the construction of the GERD. LSAI become highly emerging in the 2010-2017 trajectory compared to the previous two. Despite this, agricultural practices conducted outside of areas designated as LSAI constitute the majority of the agricultural lands. In 2017 only about half of the LSAI areas were under cropland use type, showing that the lands given out for investors are highly underutilized. The expansion of LSAI over recent years in the region has brought about an increase rates of deforestation, diminishing of wild animals, increased occurrences of bushfires partly induced by the laborer's brought into the region by the investors, and increased use of pesticides. Pesticide use, apart from its benefits in controlling the weeds and insects, potential detrimental impacts on the environment and people were evident.

The study area is highly prone to deforestation, crime and diffusion of culture due to large scale farming, immigrant workers, and expansion of commercial sex worker. The main livelihood of the local people is agriculture with limited off-farm job opportunities.

The average family size of the woreda is 5.39, which is slightly above the country's average family size of 5. Most of the respondents of the survey are illiterate or did not attend any

formal education. Almost all surveyed HHs dependent on farm income which is subsistence agriculture and there are very limited optional income sources more than 27.7% of the households are living below the poverty line with the monthly income of 1,650 birr. Almost all surveyed HHs dependent on farm income which is subsistence agriculture and there are very limited optional income sources

The average land holding of the target study population was 10 - 12 ha. Most of them owning the land traditionally/customary with no title deed for the land they have been using but by paying annual tax.

There is no community consultation, discussions and sense of ownership creation program during land is transferred. There were grievance complains and conflict during and after the land is transferred. The local community was not happy when land is transferred. Thus, the community didn't feel sense of ownership on investors and on large scale farms.

The community is not happy by the investors as the government took their land with out their consultation. Because priority for the farm lands are not given to local people, the persistent conflict that arise with workers/ laborers, deforestation of the area and the culture and tradition of the local people is seriously affected. Most of the community responded that the large-scale famer fails to meet the expected result in production as well as benefiting the local people.

In general, in Ethiopia and in particular in the target area, health infrastructure is improving and extension services are available. However due to limited availability of health professionals to work at kebele level and high staff turnover, the health service is poor. Even if the health posts and health centers are built, they don't have the necessary professional and facilities to provide service. Health problems related to children are caused by food shortage and lack of hygiene and sanitation.

The agricultural practice is traditional and limited to rain season production. The consulting team has learnt that there is very minimum practice of irrigation even though there are some opportunities and resources. Maize, wheat and haricot bean are the most common products of the target area

The use of improved varieties of seeds is limited because of the poor qualities of improved seeds; discouraging many farmers from using them. Investors are reluctant to distribute improved seed and fertilizer to the local community. Most of the farmers apply natural fertilizer to keep their minimum production. There are farmers who used traditional means of compost application (which just throwing animal dung on the farm land) in their back yard.

About 11.9% of the respondents transferred their agricultural land to government and investors for the purpose of large-scale farming for the last 5 years and more half of them transferred their land without any negotiation and getting in kind and in cash compensation.

Availability of potable water is limited and most of the population of the area are access water from well, hand well and river). Fetching water from distance by caring at their back is the role of women and girls.

Women highly participate in productive activities of the household in addition to their role in the day household activities including cooking, cleaning, child caring etc. However, participation of women in managing money and making decision on strategic household issues is limited. Moreover, engagement of men in economic activities is higher than women in the family.

6.2 Recommendations

As per the findings of the socio-economic survey, the following recommendations are forwarded focusing on those areas that need much emphasis and future interventions.

- Strengthen community consultation before and during the land is transferred to investors.
- Create sense of ownership on large scale farming for local community.
- Strengthen the agreement between the federal, local government and the investor on job creation, infrastructure development and community development work.
- Strengthen the security of the local community because due to large number of immigrant workers and farms to the local community, their security and culture is disturbed.

- Provide additional budget for public service for immigrants. Public sectors especially health service overburdened because of huge number of laborers who came from another place to the land farms. Particularly, the local government should encourage investors to provide the services.

- There should be enforcement of the law on investors who couldn't invest on the agricultural land they took from the community.

- There should be a follow up to ensure the benefit of local community. The local government should follow the contribution of the farms to the local community.

- Strengthen proper monitoring and evaluation of the progress of the large-scale farms.

- Promoting natural fertilizer preparation and application through continuous training and technical support is very important to improve productivity. This can be done in collaboration with the government offices experts and development agents.

- Supporting the communities to diversify their sources of incomes through engaging in on-farm and off-farm activities is also important to ensure their livelihood.

- Community should be sensitized to mobilize their own resource and should be empowered to be the leaders of the development work in their areas through structured means/strategies.

- Strengthen environmental protection and forest protection work. As a result of expansion of large-scale farms, it is very common to observe huge woody masses in every commercial farm, and on-going land-clearing and preparation (deforestation).

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7 Annex

Socio-Economic survey GiZ in large scale farming – Benshagule Gumez

Household survey questionnaire

This structured questionnaire is developed to conduct socio economic survey. The target population for this survey is household heads (spouse or husband) in Benishangul-Gumuz. The household assessment tool is a standard tool used to gather information from household about the impact of large-scale farming in the region. The purpose of this survey is to collect the socio-economic information of the local community to know the benefit and impact of large scale farming on local community.

The questionnaire takes between 30-40 minutes to complete. Whatever information you provide will be kept strictly confidential. Also, no identifying information such as your name is recorded or needed. Participation in this survey is completely voluntary and you can chose not to answer any individual questions or all of the questions. If you do have questions or points of clarifications, you can ask any time before you answer the questions. You may stop participation at any time if you feel discomfort or unhappy by the process or dislike a specific item. However, we hope that you will participate fully in this survey since your experiences and advices are important for the study.

Are you willing to participate in the survey?

1. Yes >>> if yes, continue the survey

2. No >>> if no, stop!

Dear interviewer, kindly proceed to the interview only if the respondent is willing (answers yes to the above question) to participate in the survey

I. Basic Information

Check eligibility criteria	Age 18-60(both female and male	Category 1:	

Geographical area:	Region:---------- Zone:---------- Woreda:---------- Kebele:----------		☐ Male headed household ☐ Female headed household ☐ Women in polygamy family
Date (dd/mm/yy):	___/___/	Category 2:	☐ Female (18-60) ☐ Male (18-6)
Enumerator name and signature :	----------	Category 3	☐ Resident ☐ Displaced in host family ☐ Displaced in settlement
Supervisor name and signature	----------		

II. Demographic characteristic

Family identification no	1. Gender	2. Age	3. R/s with head	4. Marital status	5. Religion	6. Current schooling status
	1. Male 2. Female	(please write the completed age)	1. Household head 2. Wife/husband 3. Son 4. Daughter 5. Son/daughter in-law 6. Grandchild 7. Parent 8. Brother/sister 9. Grand parent 10. Others (specify) 11. I do not know	1. Single 2. Married 3. Divorced 4. Widowed 5. Separated 6. I don't know	1.muslim 2.orthodox 3.protestant 4.catholic 5.other	1. Can't read and write 2. Read and write 3. Elementary school 4. Secondary school 5. Above secondary school

7.	How long have you been living here as household/family? In years?	---------- years

8.	Have you as a household ever lived in another place, such as another village? If yes, where have you lived before?	a. Yes (----------) b. No
9.	If your answer yes in the previous question Why did you move here? (tick as much as relevant)	1. Schooling of children 2. Look for work 3. Start new job 4. Escape war/ violence 5. Escape drought/ famine 6. Escape a family conflict 7. Other (specify)
10.	Had any of your relatives/friends lived here before you came?	1. Yes 2. No
11.	Was it easy to settle here?	1. Yes 2. No
12.	Did you experience any difficulties when you came?	1. Yes 2. No
13.	Please explain if you faced difficulties when you/your family moved to this place?	1. ---------- 2. ---------- 3. ----------

III. Income

	Section v. Livelihoods and income	
14.	What are the main income sources of your family? (read all the options to the interviewee. 1 important, 2 less important, 3 least important, 0 none*)*	
	☐1. No paid activities	
	☐2. Farming(agriculture)	
	☐3. Small trade	
	☐4.livestock	
	☐5. Homestead gardening	
	☐6. Daily labour	
	☐7. Other (specify):	

15.	How many hours of paid work do you work per day?	
16.	Do have additional income sources outside of your paid livelihood?	1. Yes 2. No
17.	If yes for the previous question, what is it?	1. Humanitarian aid 2. Remittance 3. Support from relatives
18.	Could you estimate your current monthly income (from all sources)?	..... birr
19.	What is the average monthly income of the household? (Other than subsistence production)?	..... birr
20.	What is the average yearly income of the household? (Other than subsistence production)?	..... birr
21.	Do you have any subsistence production? Is yes Please state the approximate equal value of your subsistence production (enter zero if not produced)?	1. Yes 2. No(skip to 22)
i.	Fruits/ Vegetables etc.	
ii.	Egg, milk and milk Products	
iii.	Meat	
	Other (please Specify)	
22.	Total household expenditure	……. Birr
i.	How much do spend monthly for food/drinks? In birr	
ii.	How much do you spend annually for closing and housing related?	
iii.	How much do you spend annually for health/?	
iv.	How much do you spend annually for schooling?	

v.	How much do you spend annually for other utilities /bills?	
vi.	Other total expenditure?	
23.	How much do you save yearly?	..... Birr

IV. Land use and agriculture		
24.	Do you or a member of your household has any agricultural land or do farming?	1. Yes 2. No(skip to --)
25.	How many parcels do you own/cultivate and please state total ha?	…… ha
26.	How is the ownership status of the land?	1. I own and cultivated 2. I own but not cultivated 3. I rented this land from someone else 4. I rented out this land 5. I am a share holder 6. I own and cultivated some of land and I rented some of the lard
27.	How seem the legality your land?	1. With title- Deed 2. Without title-Deed 3. Customary 4. Other
28.	For what propose you have been used this land?	1. For Subsistence use 2. For Selling for local market 3. For selling for external market
29.	What is the approximate value of the product from the land per year?	……
30.	Did you transfer your agricultural land to government and investors for the purpose of large scale farming for the last 5 years?	1. Yes 2. No (skip to 42)

31.	If your answer is yes, for previous question, did you have negotiations during transfer?	1. Yes 2. No
32.	Did you get in kind or cash compensation for your land?	1. Yes, In kind 2. Yes, In Cash 3. No , I didn't get any of the two
33.	Do /did you feel/felt that, you benefited from the negotiation offer?	1. Yes 2. No
34.	If your dealing was in cash, for what purpose you spent the money that you get from your land deal?	1.---------- 2.---------- 3. ----------
35.	If you get cash compensation, did you able to buy a parcel /plot/of similar/better size and quality?	1. Yes, I bought a land which is better quality and/or bigger in size 2. Yes, I bought a land of similar size and quality 3. No I didn't buy a similar/better land 4. Not applicable (the negotiations haven't completed)
36.	Did you get land replacement from the government as a composition?	1. Yes 2. No
37.	How much quintals of agricultural production you produced before you transfer your land?	1. Product 1. ---------- 2. Product 2. ---------- 3. Product 3---------- 4. Total ----------

38.	How much quintals of agricultural production you produce after you transfer your land?	1. Product 1. ---------- 2. Product 2. ---------- 3. Product 3---------- 4. Total ----------
39.	Did you have any grievances about the land acquisition during/ after the land transfer?	1. Yes 2. No
40.	If your answer is yes, for the previous question, what was the reason for grievance? (please explain it)	---------- ---------- ---------- ----------
41.	Do you/ your community benefited from large scale farming?	1. Employment 2. Surplus production at local market 3. Technology transfer 4. Infrastructure 5. Other(specify)----------
42.	What happened to your agricultural production in the last 5 years?	1. Increased 2. Decreased (skip to 46) 3. Did not change (skip to 48)
43.	Why did the agricultural production increase? (please tick as much as relevant)	1. Usage quality of seeds got better 2. Usage of chemical fertilizers and pesticides have increased 3. Usage of organic fertilizers have increased 4. Irrigation has improved 5. I bought agricultural vehicles 6. Other, please specify----------
44.	Do you think, productivity of agricultural production related with the existence of large scale farming	1. Yes 2. No
45.	Why did the agricultural production decrease? (please tick as	1. Erosion 2. Lack of agricultural

	much as relevant) Do you think, the reduction	vehicles 3. Not using enough fertilizer/pesticide 4. Lack of labor 5. Low product prices 6. Other, please specify
46.	Of agricultural production linked with large-scale farming? Why?	1. Yes , ---------- ---------- ---------- ---------- 2. No

V.	Housing , Education and health	
47.	What is your ownership status of your house?	1. Owner of the house 2. Rent 3. Provided by employer 4. User not paying rent 5. Other
48.	What is the main building material of your house? (the surveyor should make observation and confirm it with the interviewee - tick only one)	1. Brick 2. Concrete 3. Wooden 4. Stone 5. Soil 6. I do not know 7. Other specify)……
49.	How many rooms are there in your house (including the living room) list and write the number	……
50.	What is the domestic water source in your house?	1. Water pump 2. Well water 3. Village fountain other

		4. Please specify
51.	Do you have any problems with water supply?	1. Yes 2. No (skip 54)
52.	What are your problems with water supply? (Tick as much as relevant. Can be more than one)	1. Water cut 2. Not clean 3. Expensive 4. Difficult to access 5. Low quality 6. Other (specify)----------
53.	Do you have electricity in your house?	1. Yes 2. No
54.	Do you have transportation access to the nearest town / woreda	1. Yes 2. No
55.	How do you see the infrastructure and community development work in your locality	1. Good 2. Not good 3. Satisfactory
56.	Do you have children 6-18 years old?	3. Yes 4. No
57.	Do all your children go to school?	1. Yes 2. No (state how many)
58.	Why do not some/any of your children going to school?	----------
59.	Are you satisfied with the education facilities and quality of education?	1. Yes 2. No
60.	Do you have any health problems/issues? Please explain.	1. Yes……. 2. No
61.	Do any of household members have a permanent/chronic disease/health problem?	1. Yes---------- 2. No
62.	Did any of the household members face a health problem which required treatment within the last 12 months?	1. Yes---------- 2. No
63.	Did any of the household members suffer from any	1. Yes----------

	contagious diseases within the last 12 Months?	---------- 2. No
64.	Did any of the household members suffer from any water borne diseases within the last 12 Months?	1. Yes---------- ---------- 2. No
65.	When you experience a health problem, which health facility do you go?	1. Health post(Gov't) 2. Health center (Gov't) 3. Hospital(gov't) 4. Private health facilities
66.	Are you satisfied with the health facilities in the region?	1. Yes 2. No
67.	How is the distance of health center from your village	1. Near 2. Far 3. Very far

	VI. Perceptions and expectations	
68.	In your perception, what are the most important three problems (development) issues in your village?	
i.	At household level	1.---------- 2.---------- 3.----------
ii.	At community level	1.---------- 2.---------- 3.----------
iii	How do you think about your income status, standard of living when compared to 5 years ago?	1. Better (skip to 72) 2. The same (skip to 72) 3. Worse
69.	If your income/standard of living is worse, What is the reason for this?	1. ---------- 2. ---------- 3. ----------
70.	Do you think/feel that you/community are benefited	1. Yes

	from the large scale farm?	2. No (skip to 73)
i.	As your family	1.---------- 2. ---------- 3.----------
ii.	As the village	1.---------- 2. ---------- 3.----------
iii.	As the country	1.---------- 2. ---------- 3.----------
71.	Are there any adverse effects of large scale farming on you/community at the whole?	1. Yes 2. No
72.	What kind of adverse effects can the large scale farm cause?	
i.	As your family	1.---------- 2. ---------- 3.----------
ii.	As the village	1.---------- 2. ---------- 3.----------
iii.	As the country	1.---------- 2. ---------- 3.----------

	VII. Social integration and cohesion	
73.	Do you think that you have good relations with the people who came for working in large scale farming?	1. Yes 2. No
74.	Have you / your community faced any social and cultural crises due to the expansion of large scale farming	1. Yes 2. No
75.	Your answer is yes for the previous question, what kind of social and cultural crises you/community faced?	1.---------- 2.---------- 3.----------
76.	Do your community is challenged by the following listed crisis due to the expansion of large-scale farming(can tick more than one)	1. Cultural conflict 2. Criminal is expanded 3. HIV / STIs is increased 4. GBV 5. Security is worsen 6. Other (specify)
77.	If you moved from other place due to expansion of large scale agriculture, what do you have been experienced	1. Cultural conflict 2. Criminal is expanded 3. HIV / STIs is increased 4. GBV 5. Security is worsen 6. Other (specify)
78.	Did your household have any disputes with the worker of large scale farmer or other ethnic group in the past?	1. Yes 2. No
79.	If "yes" what was the reason?	1. ---------- 2. ---------- 3. ----------
80.	If "yes", how was it resolved? Please specify.	1.----------

		2.---------- 3.----------

Land use coverage change: FGD -Assessment Tool-2

Focus Group Discussion

Purpose: Gather information about the opinions, thought, the existing practices and benefits and impacts of large scale farming on the local and local development.

Tool Notes: This tool should be used during small group discussions. The group should be made of people from similar backgrounds or experiences and should not include more than 8-12 participants. The FGD is led by a facilitator who introduces the topics of discussion and helps to ensure that all members participate evenly in the discussions. The facilitator should assure participants that all information shared will remain confidential.

Sector specific questions can be included to gather more detailed information on specific topics relevant to your context or situation.

Target: community Leader, Men group and women Groups, youth groups

Consent Form

Good morning/afternoon: My name is _____ and I work at GiZ Ethiopia. We are here to assess and learn how GIZ can improve the large scale farming and benefit of local communities. The information discussed will be used to plan these programs.

I would like to now introduce my team. This is _____ (note taker) and _____ (translator).

Your participation is voluntary. No one is obligated to respond to any questions if s/he does not wish. Participants can leave the discussion at any time. No one is obligated to share personal experiences if s/he does not wish. Individual names will not be taken. Please be respectful when others speak. The facilitator might interrupt discussion, but only to ensure that everyone has an opportunity to speak and no one person dominates the discussion.

We will obtain informed consent for attending the session, then permission to write (record) everyone's responses. We are recording the responses only so that their valuable information is not missed. We will keep all discussion confidential. We will not share details of the discussion any time.

Are you willing to participate in the study?

- Geographic Location:_____
- Translation necessary for the interview: 1. Yes 2. No

- Date: _____
- Facilitator's Name: _____
- Note Taker's Name: _____

Introduction

1. Thank the informants for participating in interview
2. Explain the objectives and expectations of the interview
3. Outline the session and the amount of time the discussion will take
4. Obtain informed consent to record the discussion and/or take pictures.

Participant characteristics

	Age in completed years	Education (Grade)	Marital Status	Number of Children	Duration of stay in camp
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Thematic areas	Guiding questions	Probing -Issues to be addressed
I. Land ownership	1. How you see the land ownership of the local people in your village? 2. How do you evaluate land transfer land and HH food security, productivity? 3. Is there a formal or informal Agreement with government and with whom? 4. Can people deal with investor directly to transfer? 5. How the government gave the people's land to investors (term, conditions	• *Land lease and land transfer is common for investor , How is often, in what term and agreement, how the process is proceed (gov't interference or not)* • *Type of agreement , land ownership certificates*
II. Agricultural productivity and land use coverage change	1. How do you describe the agricultural productivity of the local people? 2. Do people in the village own land (small and large scale)? 3. How do you see the land use coverage of the region since the last ten years?	○ *Can you give some information about agricultural production? Which agricultural products do you produce?* ○ *Are farms small or large?* ○ *Productivity / per ha* ○ *Increasing , decreasing , How do you expect future land use coverage* ○ *Compare productivity before and after land transfer* ○ *HH benefits during transferring*
IV. Large scale farming As opportunity	1. How do you describe the opportunity of large-scale farming for local people? 2. Who are the most beneficiaries from large scale farm as individual, community?	*Labour, surplus production for local market, job opportunity infrastructure* *Youth, HH, women,*
V. Large scale farming As threats	1. What is the adverse effect of large-scale farming for local community and locality? Why it comes 2. Who is the most affected section of the society	○ *Culture crisis* ○ *Productivity* ○ *Criminal , HIV /STI and security concern* ○ *Who was responsible for challenges? who is the most affected*

VI. Expectation of local people from large scale farming	1. How do you see the effectively and productivity of large scale framings 2. Do you think that large scale farming are not effective and it is benefiting the community	○ *From productivity perspective* ○ *From local community involvement and employment* ○ *From building local infrastructure and community projects*
VII. Community ownership and says	1. How do you see the involvement of local government, local community on the expansion of large-scale farming	- *From initial - process-production ,* - *Feasibility , stakeholder participation* - *Community conversation, consultation, awareness, community ownership , community projects*
VIII. Suggestion and recommendation	2. Please give us any suggestion and recommendation to benefit the local community and increase agricultural production of large-scale farming?	*From individual* *Local community , community development , production , land use change and land use change , climate change*

Land use coverage change: KII -Assessment Tool-3

Key informant Interview

Purpose: Gather information about the opinions, thought, the existing practices and benefits and impacts of large-scale farming on the local and local development.

Tool Notes: This tool uses the format of semi-structured interviews. The tool is designed for investors/ personable person of the farm. Fill out the relevant sections in regards to your key informant.

Supplemental questions can be found in the Sector Specific document.

Target: owner / responsible person of owner

Consent Form

Good morning/afternoon: My name is _____ and I work at GIZ Ethiopia. We are here to assess and learn how GIZ can improve the large-scale farming and benefit of local communities. The information discussed will be used to plan these programs.

I would like to now introduce my team. This is _____ (note taker) and _____ (translator).

Your participation is voluntary. No one is obligated to respond to any questions if s/he does not wish. Participants can leave the discussion at any time. No one is obligated to share personal experiences if s/he does not wish. Individual names will not be taken. Please be respectful when others speak. The facilitator might interrupt discussion, but only to ensure that everyone has an opportunity to speak and no one person dominates the discussion.

We will obtain informed consent for attending the session, then permission to write (record) everyone's responses. We are recording the responses only so that their valuable information is not missed. We will keep all discussion confidential. We will not share details of the discussion any time.

Are you willing to participate in the study? If yes, continue the interview

Geographic Location: Name of interview:

Interview date: Place of interview:

Translation necessary for the interview: 1. Yes 2. NO

Participant characteristics

Age: _____

Sex: _____

Position: _____

Organization: _____

Profession: _____

Experience: _____

Camp Name: _____

Date: _____

Key informant's role in the community: ----------

Introduction

1. Thank the participant(s) for the interview
2. Explain the objectives and expectations of the interview
3. Outline the amount of time interview will take
4. Obtain the informant's consent to record the interview and/or take pictures

Thematic areas	Guiding questions	Probing -Issues to be addressed
II. project initiation	6. How you get started agricultural investment in this region? 7. How was the land transfer and investment on agricultural process	• *When you start , what kind of investment you have, legality* • *Any conflict with local people*
II. supports land transfer process	1. what kind of support you get from government , local community during land transferring and the process of investment 2. Did you conduct community awareness creation and ownership creation program	○ *Government support (federal , regional , local government)* ○ *community mobilization effort and community ownership*
IX. Large scale farming Achievement	3. How is the progress of your farm? 4. Did your farm generate production? How is the profitability of the farm? 5. Do you think the progress of the farm is on the right track in achieving its plan? If not why? please explains	○ *When you started , what was your plan , plan VS achievement* ○ *What was your plan and are you on the progress of achieving your mission in production?* ○ *reason for not achieving your plan (from investor side , government side , local community side)*

X. Large scale farming Opportunity and threats	3. What kind of opportunity your farm created for local community 4. Do you think your farm is benefiting the local community? How? 5. How is the feeling and welcoming of the local people to your farm workers? 6. Is there any adverse effect on the local community due to the existence of your farm	*Employment , technology transfer , infrastructure , community development works* *Any adverse effect (culture, HIV , other*
XI. Suggestion and recommendation	3. Please give us any suggestion and recommendation on any issue to make large scale farms more productive and to benefit the local community, country at large	*Expansion , productivity , Local community , community development , production , land use change and land use change , climate change*

Land use coverage change: FGD -Assessment Tool-4

Key informant Interview

Purpose: Gather information about the opinions, thought, the existing practices and benefits and impacts of large-scale farming on the local and local development.

Tool Notes: This tool uses the format of semi-structured interviews. The tool is designed for investors/ personable person of the farm. Fill out the relevant sections in regards to your key informant.

Supplemental questions can be found in the Sector Specific document.

. *Target: investment office, agriculture and food security office, forest development enterprise office*

Consent Form

Good morning/afternoon: My name is _____ and I work at GIZ Ethiopia. We are here to assess and learn how GIZ can improve the large-scale farming and benefit of local communities. The information discussed will be used to plan these programs.

I would like to now introduce my team. This is _____ (note taker) and _____ (translator).

Your participation is voluntary. No one is obligated to respond to any questions if s/he does not wish. Participants can leave the discussion at any time. No one is obligated to share personal experiences if s/he does not wish. Individual names will not be taken. Please be respectful when others speak. The facilitator might interrupt discussion, but only to ensure that everyone has an opportunity to speak and no one person dominates the discussion.

We will obtain informed consent for attending the session, then permission to write (record) everyone's responses. We are recording the responses only so that their valuable information is not missed. We will keep all discussion confidential. We will not share details of the discussion any time.

Are you willing to participate in the study? If yes, continue the interview

Geographic Location: Name of interview:

Interview date: Place of interview:

Translation necessary for the interview: 1. Yes 2. NO

Participant characteristics

Age: _____

Sex: _____

Position: _____

Organization: _____

Profession: _____

Experience: _____

Camp Name: _____

Date: _____

Key informant's role in the community:----------

Introduction

5. Thank the participant(s) for the interview
6. Explain the objectives and expectations of the interview
7. Outline the amount of time interview will take
8. Obtain the informant's consent to record the interview and/or take pictures

Thematic areas	Guiding questions	Probing -Issues to be addressed
III. Progress of land transfer and land use coverage change	8. How do you see large scale farming and government policies in expansion of large-scale farming investment? 9. How does your office involve in the transfer of land and following up of the progress of investment? 10.	• *Polices , procedures ,* • *M and E tools* • *land Type of agreement , land ownership certificates*
II. land transfer process	3. How larges transfer from government owed to investors and from local people owed to investors 4. How do you evaluate land transfer land and HH food security, productivity? Is that effective? 5. Is there a formal or informal Agreement with government and with whom? 6. Can people deal with investor directly to transfer? 7. How the government gave the people's land to investors , (term , conations, benefits …)	○ *Procedures, agreement , benefit packages ,* ○ *community mobilization effort and community ownership*

XII. Large scale farming As opportunity	6. How do you describe the opportunity of large-scale farming for local people? 7. Who are the most beneficiaries from large scale farm as individual, community?	*Labour, surplus production for local market, job opportunity infrastructure* *Youth, HH, women,.....*
XIII. Large scale farming As threats	7. What is the adverse effect of large-scale farming for local community and locality? Why it comes 8. Who is the most affected section of the society	○ *Culture crisis* ○ *Productivity* ○ *Criminal , HIV /STI and security concern* ○ *Who was responsible for challenges? who is the most affected*
XIV. Suggestion and recommendation	4. Please give us any suggestion and recommendation to benefit the local community and increase agricultural production of large-scale farming?	*From individual* *Local community , community development , production , land use change and land use change , climate change*

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MINISTRY OF AGRICULTURE

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