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APPLICATION OF GOOGLE EARTH FOR THE DEVELOPMENT OF BASE MAP IN THE CASE OF GISH ABBAY SEKELA, AMHARA STATE, ETHIOPIA

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ABSTRACT: *Google Earth is a virtual globe, map and Geographical Information Program that was originally called Earth Viewer 3D which is important to maps the Earth by the superimposition of images obtained from satellite imagery, aerial photography and Geographic Information System (GIS) 3D globe. Google Earth is useful for teachers are adopting Google Earth in the classroom for lesson planning; used to map homes and select a random sample for base map development for research. Classification of land use/land cover mapping (LULC) in scales such as urban district through high spatial resolution datasets is too expensive for many pilot projects mainly due to the cost of purchasing raw satellite images. Images from GE with high spatial resolution are free for public and can be used directly in LULC mapping in small geographical extend for mapping of green areas (forests, grasses) and buildings of a cities. Therefore, this study explores the possibility of mapping of green areas (forests, grasses) and buildings in Gish Abbay Sekela through images from Google Earth. After images are saved, georeferencing is taken and Maximum Likelihood Classification was used to develop base map. Under land use and land cover categories 5 (five) major land use land cover types are identified and Classified from the image. These are Agriculture land, Green area (Forest) land, Grazing Land, Building (Settlements) land others (like Market place, Road, Bare land…). The result showed that majority of the study area was covered by Grazing Land 221.534282 (ha) contributes 31.51600547% of the total area. Agriculture and green area/forest land cover an aerial size of 205.296619 ha (29.20599606 %) and 138.965081 ha (19.76951022 %) respectively, whereas the aerial coverage of Building/Settlement and other land use land cover is 6.699674908 ha (6.699674908 %) and 90.036514 ha (12.80881334 %) from the total area of the Gish Abbay town.*

KEYWORDS: *Google Earth, LULC, GIS, Georeferencing, Maximum Likelihood Classification*

INTRODUCTION

The study of Land use/cover pattern is providing information for managing dynamics of land use and meeting the demands of increasing human population (Yadav *et al*. 2010). On the other hand, Information on land and land cover change in the form of maps and statistical data is very vital for special planning, management and utilization of land for agriculture, forestry, pasture, urban-industrial, environmental studies, economic production etc (Roy and Giriraj, 2008). LULC mapping through remote sensing and satellite imagery is an essential part of urban planning and management in order to comprehend different effects of polices and decision made by authorities. Furthermore, urban plans can be monitored and their consequences can be predicted. Regarding to the cost of purchasing of raw satellite images with high spatial resolution, most practices in the past data with medium spatial resolution like Landsat imagery were used to create.

The acquisition, processing, integration, visualization and utilisation of various kinds of airborne or satellite derived data constitute several important problems, in the context of time limitations with respect to accessibility of sensors, the atmosphere influence (clouds presence, need for atmospheric corrections of measured radiance), insufficient spatial resolution, imperfection of models for the desired parameters derivation, etc (Dash, 2005).

In current, researchers tend to use high spatial resolution data in order to obtain more accurate and precise result. In this regard, images with high spatial resolution from Google earth that are free to the public are a good source of imagery including satellite images and air photos. Google earth (http://earth.google.com) provided by Google Inc., is a virtual globe programming that maps the earth by superimposition of high resolution satellite images (Shirkou and Aliakbar, 2013). Since it was released in June 2005, Google Earth has aims to provide viewers with "a more realistic view of the world". Beside Google Earth, map data and positional measurement can be obtained using different methods such as conventional or modern land survey methods, Global positional System (GPS) and remote sensing satellite imagery. Each of these methods is of a known positional accuracy (Nagi *et al*, 2013).

Google earth high-resolution imagery does not contain an infrared band and sometimes has a slightly coarser spatial resolution than the native images provided directly from the sensor operators, yet a user of the GE environment is often able to readily discern land cover type, disturbance events, and other relevant attributes based solely on the imagery (David, 2008).
Is a virtual globe, map and geographical information program that was originally called Earth Viewer 3D, and was created by Keyhole, Inc, a Central Intelligence Agency (CIA) funded company acquired by Google in 2004. It maps the Earth by the superimposition of images obtained from satellite imagery, aerial photography and GIS 3D globe. Google Earth uses Digital Elevation Model (DEM) data collected by NASA's Shuttle Radar Topography Mission (SRTM). The internal coordinate system of Google Earth is geographic coordinates (latitude/longitude) on the World Geodetic System of 1984 (WGS84) datum i.e., the same datum that used by Global Position System (Nagi *et al*, 2013).

It is proved that land use/land cover mapping (LULC) in scales such as urban district through high spatial resolution datasets is too expensive for many pilot projects mainly due to the cost of purchasing raw satellite images and deciphering the LULC types with remote sensing techniques. Since the launching of Google Earth (GE) on June, 2005, its potential has been approved to be used in image processing and dissemination of scientific information. Images from GE with high spatial resolution are free for public and can be used directly in LULC mapping in small geographical extend like mapping of green areas of cities. Therefore, this study was intended to examine the Application of Google Earth for the Development of Base Map in the case of Gish Abay Sekela, Amhara State, Ethiopia.

SITE DESCRIPTION (LOCATION)

The study area is located in Amhara state; north western Ethiopia within the geographical grid coordinates of $10^0$55'00" to $11^0$05'00" North latitude and $37^0$05'00" to $37^0$15'00" East longitude. The District is bounded with Mecha District *in* the north, Yilmana Densa District in the north east, Burie District in the south, Jabi Tehinan District in the south east, Awi zone in the west and Quarit District in the east. Gish-Abay is the capital town of the District and it is situated about 425 kilometers northwest of Addis Ababa and around 175 kilometers southwest of Bihar Dar, the capital of Amhara Regional State.

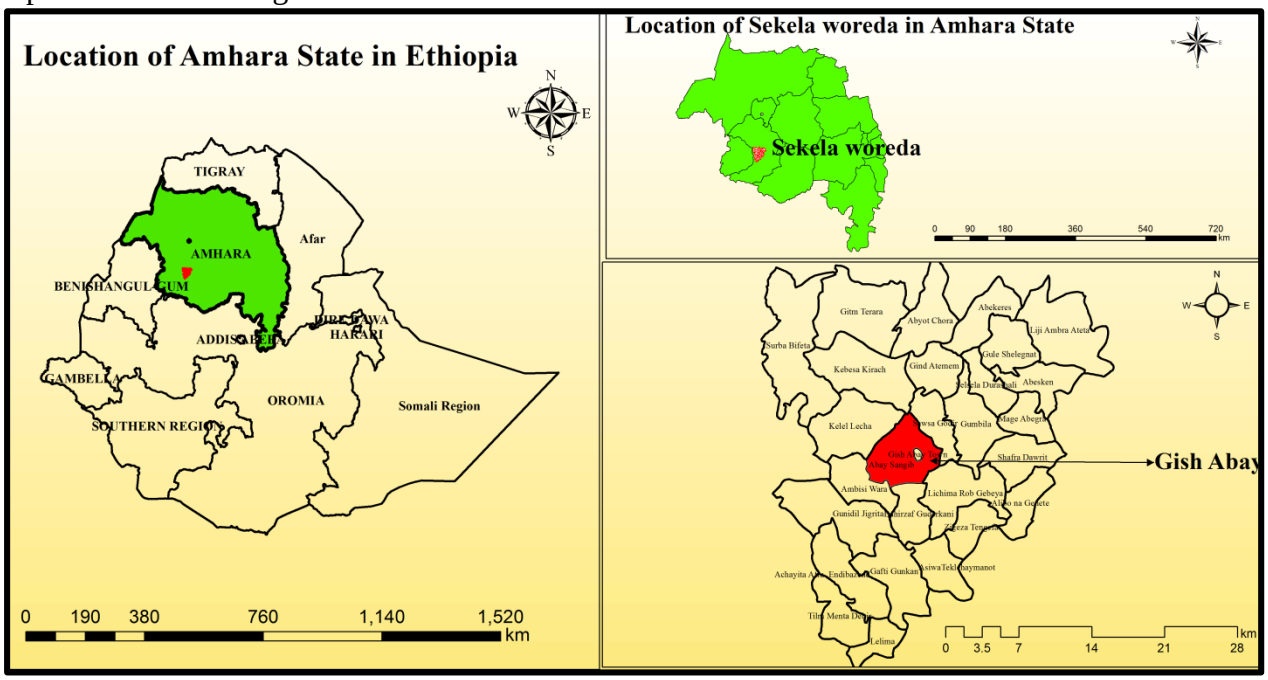


Figure 1: Location Map of the Study Area

Topography, Agro ecology, climate and water resources

Steep slope and undulated topography is a typical characteristic of the study area. The majority (75%) of the study area is mountainous and consists of dissected terrain with steep slopes, and the remaining (25%) has an undulated topography with gentle slopes. The study area is located in altitude ranges from 2000-3400m a.s.l (fig. 2). According to the traditional agro-climatic classification, the study area lies within *dega* (cool to cold humid) and *woinadega* (warm to cool semi humid). The climate is humid with an average annual rainfall of more than 1600 mm.

In Sekela woreda, there are 5 major rivers that flow permanitilly, 38 small tributaries, 105 springs and one lake are found. The major rivers are Abbay, Guder, Lahie and Jemma. Despite the widely held view that the Blue Nile originates from Lake Tana, the local people and *Woreda* level officials strongly believe that the Gish Mountain is the true source of Blue Nile.

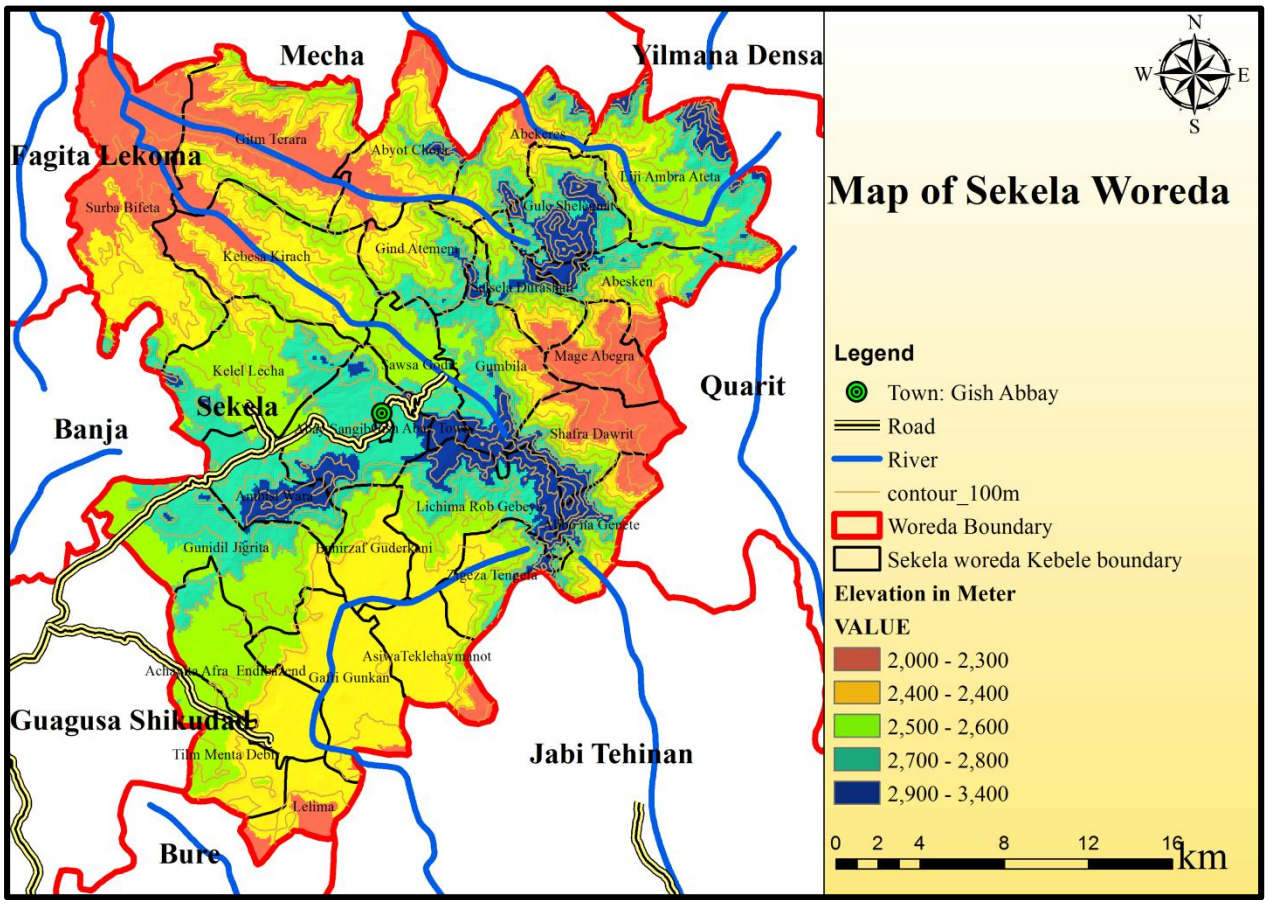


Figure 2: Elevation, Contour, Road and River map of Sekela woreda

MATERIALS AND METHODS

For this study Free Google Earth which was Build in Date 5/17/2013 was used for image classification and the resolution of the image is 3.4607meter by 3.4607meter (3.4607*3.4607m). Arc GIS 10.1 Software Used is used for classification of Images and Maximum Likelihood Classification was used to develop base map.

Methods of data analysis

Free Google Earth which was Build in Date 5/17/2013 is saved and defined of coordinate system of the image. That means converting a raster dataset from a non-real-world coordinate system (image space) to a real-world coordinate system. To georeference a raster dataset from image space to a real-world coordinate system, more than 8 Ground Control Points (GCPs) was collected from the Google earth itself.

RESULTS AND DISCUSSION

Based on the Google earth image observed and through observation of the current situation a classification scheme was developed for the study area. Since Images from Google Earth with high

spatial resolution are free for public and can be used directly in land use land cover mapping in small geographical extend for mapping of green areas (forests, grasses) and buildings of a cities, for this study 5 (five) major land use land cover types are identified and Classified from the image. These are Agriculture land, Green area (Forest) land, Grazing Land, Building (Settlements) land others (like Market place, Road, Bare land…).

Table 1: Description of each land use land cover type in the study area.

No	LULC Classes	Description of each land use class
1	Agriculture	Areas currently under crop, fallow or land under preparation for agriculture.
2	Building/Settlement	Land being used for settlement/ urban land
3	Grazing Land	Land covered by grass
4	Green area/Forest	Areas covered by trees forming closed or nearly closed canopies; Forest; Plantation forest
5	Others	Land covered by roads, bare land and market places

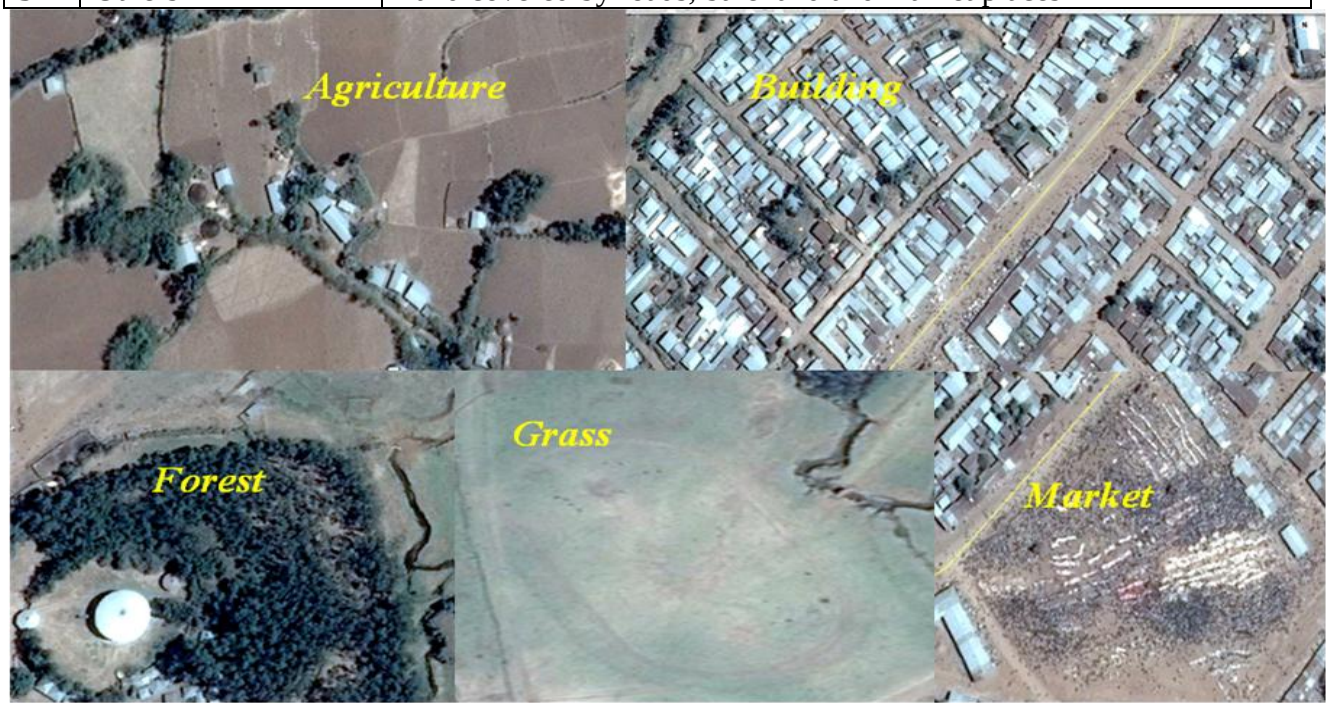


Figure 3: Examples of each land use land cover types

Land Use Land Cover Classification

After Georeferencing of Google earth image, **supervised image classification was used.** Which means, the analysts trains the computer to recognize patterns in the data by selecting pixels that represents patterns or land cover features that she recognizes, The signature files thus created are then used in the classification process where each pixel is categorized into the land cover class it mostly resembles. Products of this process being a thematic map, tables of statistics of the various lands cover classes, and digital data files that can be included in a GIS.

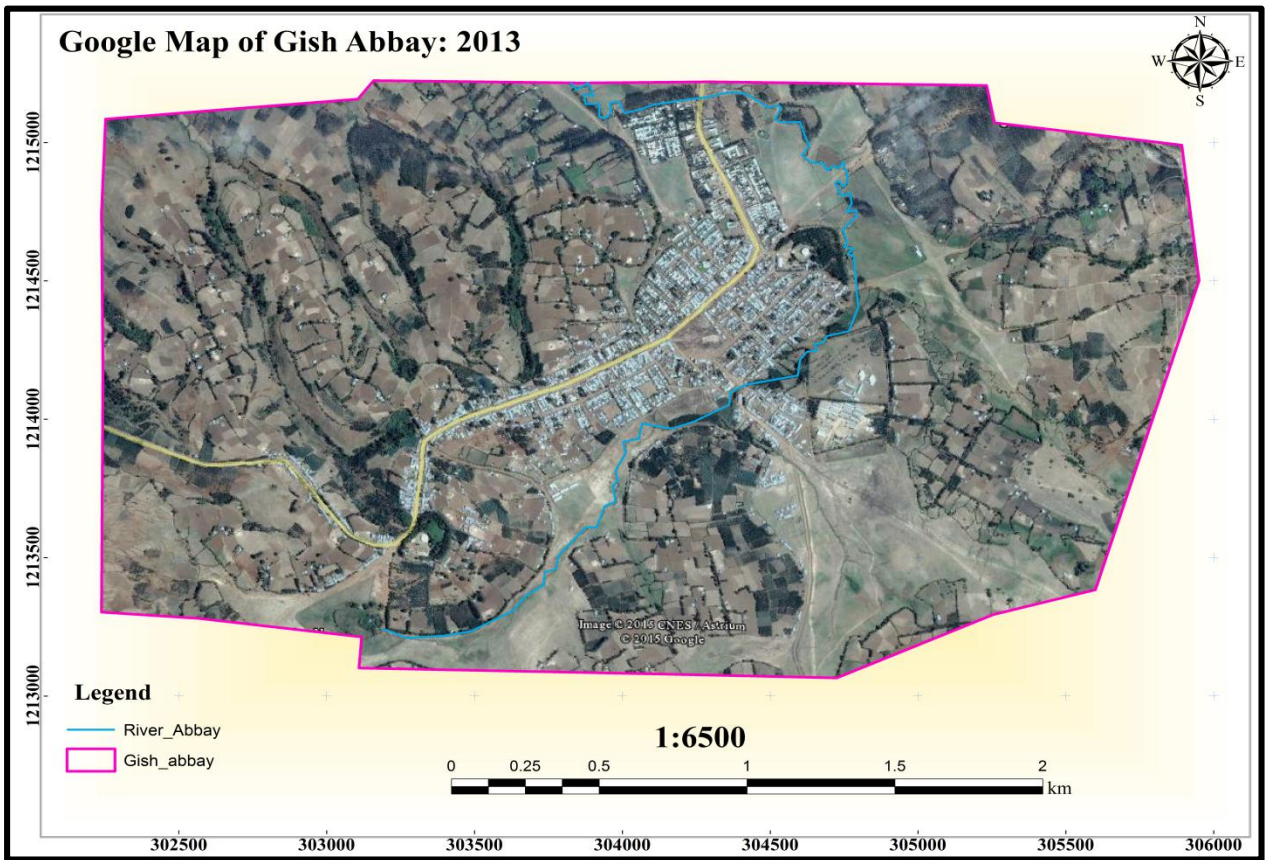


Figure 4: Google earth image of Gish Abbay Town: 2013

From the Google earth five land use land cover types were identified. The land use land cover classification from Google earth (table 2) showed that majority of the study area was covered by Grazing Land 221.534282 (ha) contributes 31.51600547% of the total area. Agriculture and green area/forest land cover an aerial size of 205.296619 ha (29.20599606 %) and 138.965081 ha (19.76951022 %) respectively, whereas the aerial coverage of Building/Settlement and other land use land cover is 6.699674908 ha (6.699674908 %) and 90.036514 ha (12.80881334 %) from the total area of the Gish Abbay town.

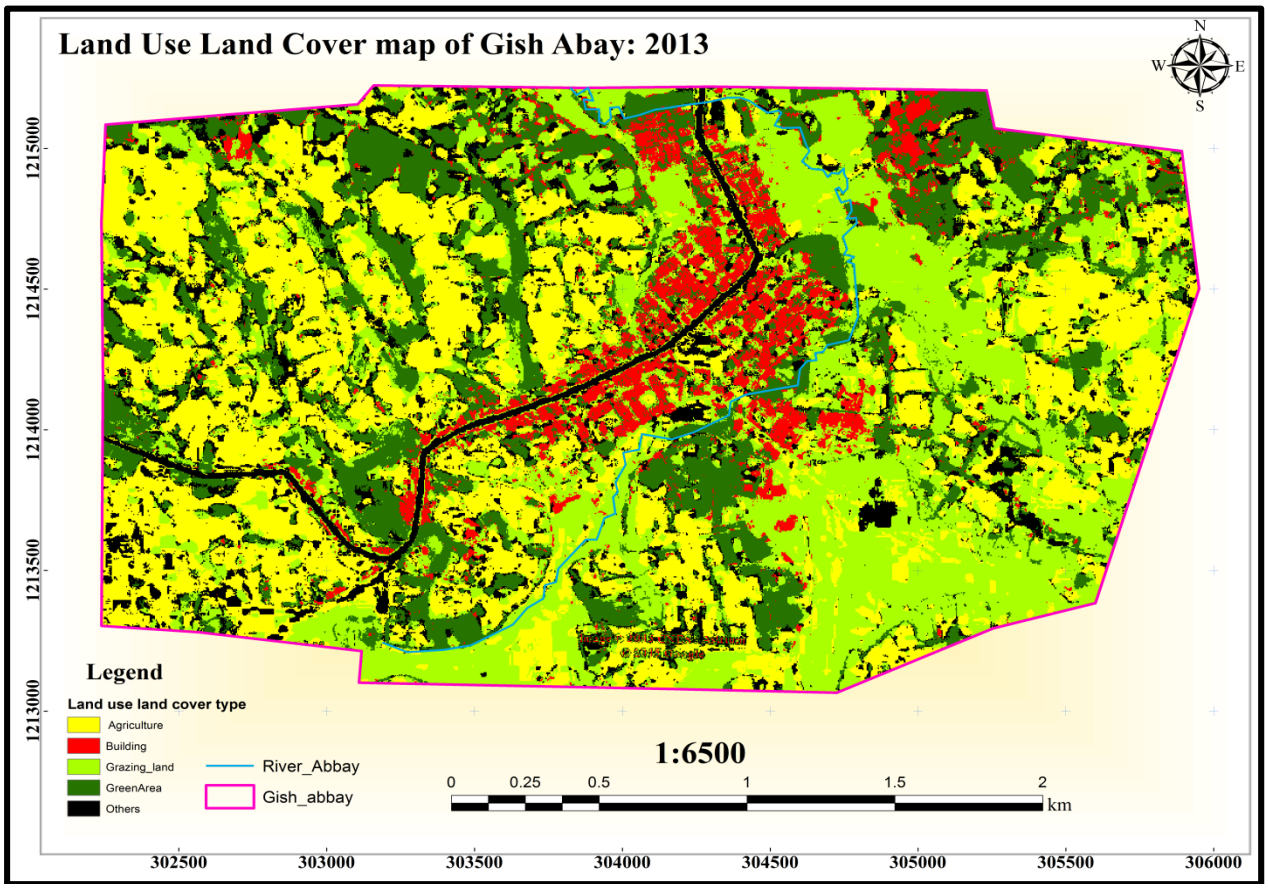
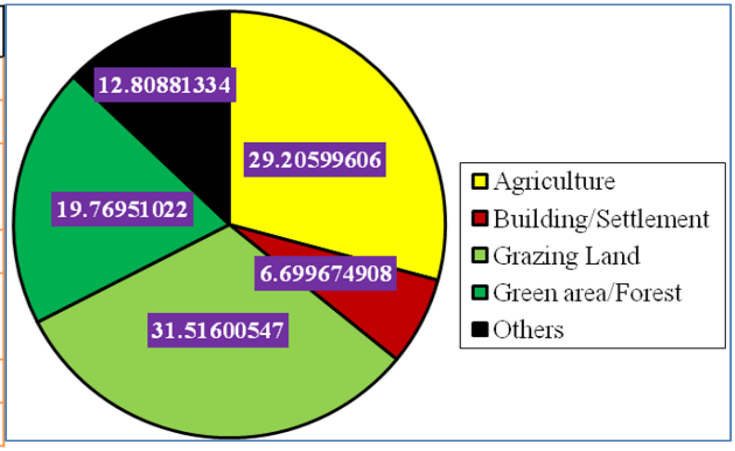


Figure 5: Land use and land cover map of Gish Abbay Town in 2013 from Google earth image

Table 2: LU/LC classes, their corresponding areas for 2013

LULC Categories	2013	
	Area (Ha.)	Area (%)
Agriculture	205.296619	29.20599606
Building/Settlement	47.093775	6.699674908
Grazing Land	221.534282	31.51600547
Green area/Forest	138.965081	19.76951022
Others	90.036514	12.80881334
TOTAL	702.926271	100



CONCLUSION

Google Earth represents a powerful and attractive source of positional data that can be used for investigation and preliminary studies with suitable accuracy and low cost. Since Images from

Google Earth with high spatial resolution are free for public and can be used directly in land use land cover mapping in small geographical extend. So Google earth is very important for mapping of different types of land use/land cover in a small area.

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