

The Sacred Landscape of Gheralta



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ABBREVIATIONS

TNRS -----	Tigrai National Regional State
RHCs-----	Rock Hewn Churches
EMA-----	Ethiopian Mapping Agency
BoFED-----	Bureau of Finance and Economic Development
GPS-----	Global Positioning System
GIS-----	Geographic Information System
OLI-----	Operational Land Imagery
USGS-----	United States Geological Survey
EROS-----	Earth Resources Observation Systems
GCPs-----	Ground control points
TCC-----	False Color Composite
FCC-----	False Color Composite
3D-----	Three Dimensional
Ha -----	Hectares
FAO -----	Food and Agricultural Organization
DEM -30m-----	Digital Elevation Model 30meter resolution
LULC-----	Land Use Land Cover
Zone, Weredas and Tabias = Local administrative unit below region respectively	
Tigrai (Tigray)	
Gheralta (Geralta)	
Nominated Property Area (Core Zone)	
T/Haimanot (Teklehaimanot)	

1. INTRODUCTION

Tigrai, Ethiopia's northern most regions, has more than 150 rock-hewn churches. The rock churches of Tigrai do not well function primarily as tourist attraction because of many reasons some are: poor infrastructure, lack of promotion, lack of tourist accommodation centers and lack of attention from previous government for the tourism sector. Most of the rock hewn churches in Tigrai are monolithic and semi-monolithic churches and they were generally excavated using a very different method (yemane, 2011). Most of the rock hewn churches of Tigray region are of isolation and mystery and many remain unexplored by foreigners.

The **rock churches of Tigrai** are hidden away high up on cliffs and inside the side's of hills and mountains. They are carved right out of the stone themselves, a very difficult task to achieve. They are located in the north of Ethiopia, and it's not easy getting around seeing the rock churches, as the area is spread out and many are located high up on cliffs.

The majority of these churches have very atmospheric interiors with walls decorated with old murals, paintings and relief carvings and every church has its own oral tradition, regarding its founding and excavation. The **Gheralta region** of Tigray has spectacular scenery and the largest concentration of rock hewn churches; Abuna Yemata, Debre Tsion, and Mariam Korkor being the most famous.

Gheralta, which is a home of cluster rock-hewn churches in eastern Tigrai, is a chain of Spectacular Mountain extended in Hawzen and Kilte Awlalo weredas, has astonishing landscape in its nature. However, the tourism sector development and the community around benefit is not such developed due to afore mentioned reasons.

The reliability of tourism management can be justified, if well conserved the landscape and its components are well located and mapped. Thus, this study and map will address the impacts of unawareness towards the location of the landscape and its internal assets both internally and externally. As a result, the aim of this paper is therefore to map the cultural and natural landscape of Gheralta, Hawzen T/haimanot and Wukro Cherkos as well as its important components locating in Tigray National Regional State (exclusively in Hawzen and Kilte Awlalo woredas).

1.1. General objective:

To prepare a draft maps for the sacred land of Gheralta that will become part of the nomination Dossier for the cultural landscape of Gheralta.

1.2. Specific Objectives:

- Digital, Editable and print ready version of the following maps:
- To produce accurate vector form **boundary (four nominated property areas & three separated buffer zones)** delineation and map production of Gheralta landscape, Hawzen T/haimanot & Wukro Cherkos using detail GPS reading.
- To show **Accurate location of rock hewn churches, natural features, settlements** and other important assets that have to be included as a nominated property.
- To produce **road map** including foot paths served for traveling to each RHCs.
- **Land use** mapping and collecting necessary **socio-economic** data.
- To display **location map** showing the location of the property within administrative map (Ethiopia, Tigray, weredas & Tabias).
- **GPS readings** Collected for boundaries, sites and features.

1.3. Significance of the Study:

- It is very helpful for those decision makers to plan about the sacred landscape and its components.
- It is important to guide for tourists (local and international)
- It will play a great role as critical information for researchers in relation to Gheralta landscape and its important components.

1.4. Scope of the landscape:

The Gherlata landscape is found geographically in Hawzen and Kilte Awlalo Woredas which are found in Eastern Zone of TNRS. If buffer zones, the landscape of Gheralta is covered from 13° 46' 35'' - 13° 56' 51'' North latitude and 39° 13' 26'' - 39° 33' 24'' East longitude, at an altitudinal range between 1673 m and 2526m above sea level. The total area of the landscape is 37,385.35 ha (for buffer zone) and 16,084.11ha (for nominated property areas). It extends

If nominated property area, its geographical location extends from 13° 47' 37'' - 13° 56' 46'' North latitude and 39° 14' 13'' - 32° 30' 18'' East longitude, at an altitude range between 1694 m and 2493 m above sea level. The landscape also extends from suluh river (Abraha atsbeha tabia) in K/Awlaelo wereda up to Koraro-Afeget river in between Hawzen & Degua Temben woredas. The total area of the landscape is 16,084.11 ha. The following map shows black and white digital elevation model view map of gheralta landscape.

Hawzen T/haimanot is found in Hawzen town which is found in eastern zone of TNRS. The landscape of church is covered from 13° 58' 19'' - 13° 58' 33'' North latitude and 39° 25' 13'' - 39° 25' 32'' East longitude, at an altitudinal range between 2210m and 2236m above sea level. The total area of the landscape is 17 ha (for buffer zone) and 0.4ha (for nominated property area).

Wukro Cherkos is located geographically in Wukro town which is found in eastern zone of TNRS. The landscape of church is covered from 13° 47' 43'' - 13° 48' 27'' North latitude and 39° 36' 00'' - 39° 36' 52'' East longitude, at an altitudinal range between 1974 m and 2206 m above sea level. The total area of the landscape is 124 ha (for buffer zone) and 8.5ha (for nominated property area).

2. METHODS AND MATERIALS

2.1. Description of the study area

Gheralta landscape is located in Tigray regional state in Hawzen & Kilte Awlalo woredas, about 58kms away from Mekele, to the North-Western direction. If buffer zone, the landscape is located within $13^{\circ} 47' 39''$ - $13^{\circ} 56' 11''$ North latitude and $39^{\circ} 14' 04''$ - $39^{\circ} 30' 41''$ East longitude, at an altitude range between 1673 m and 2526m above sea level. The landscape extends from Abraha Atsbeha RHC's upper ridge (Abune Tomas ridge) in K/Awlaelo wereda up to Koraro-Afeget river's ridge in Degua Temben wereda. The total area of the landscape is 37,385.35 ha.

If nominated property area, its geographical location extends from $13^{\circ} 47' 37''$ - $13^{\circ} 56' 46''$ North latitude and $39^{\circ} 14' 13''$ - $32^{\circ} 30' 18''$ East longitude, at an altitude range between 1694 m and 2493 m above sea level. The landscape also extends from Suluh River (Abraha atsbeha tabia) in K/Awlaelo wereda up to Koraro-Afeget River in between Hawzen & Degua Temben woredas. The total area of the landscape is 16,084.11 ha. The following map shows the digital elevation model view map of gheralta landscape.

The sacred land of Gheralta is made up of different natural and cultural attractive features. It has different land covers and forms. It has attractive RHCs, settlements, rocky areas, forest covers and agricultural areas. It has also different attractive mountains, plateaus, ridges, gorges, valleys, and plain areas.

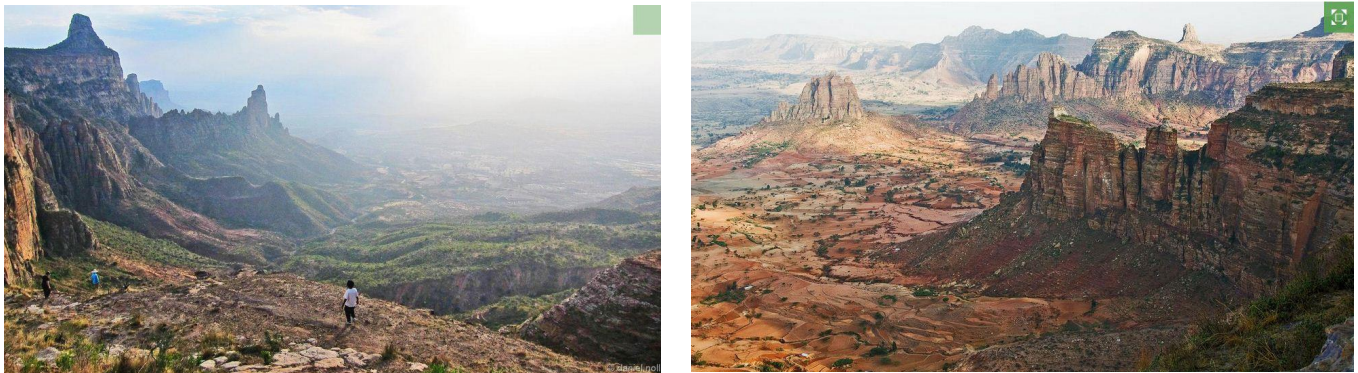


Fig-1; Portion of the sacred landscape of Gheralta

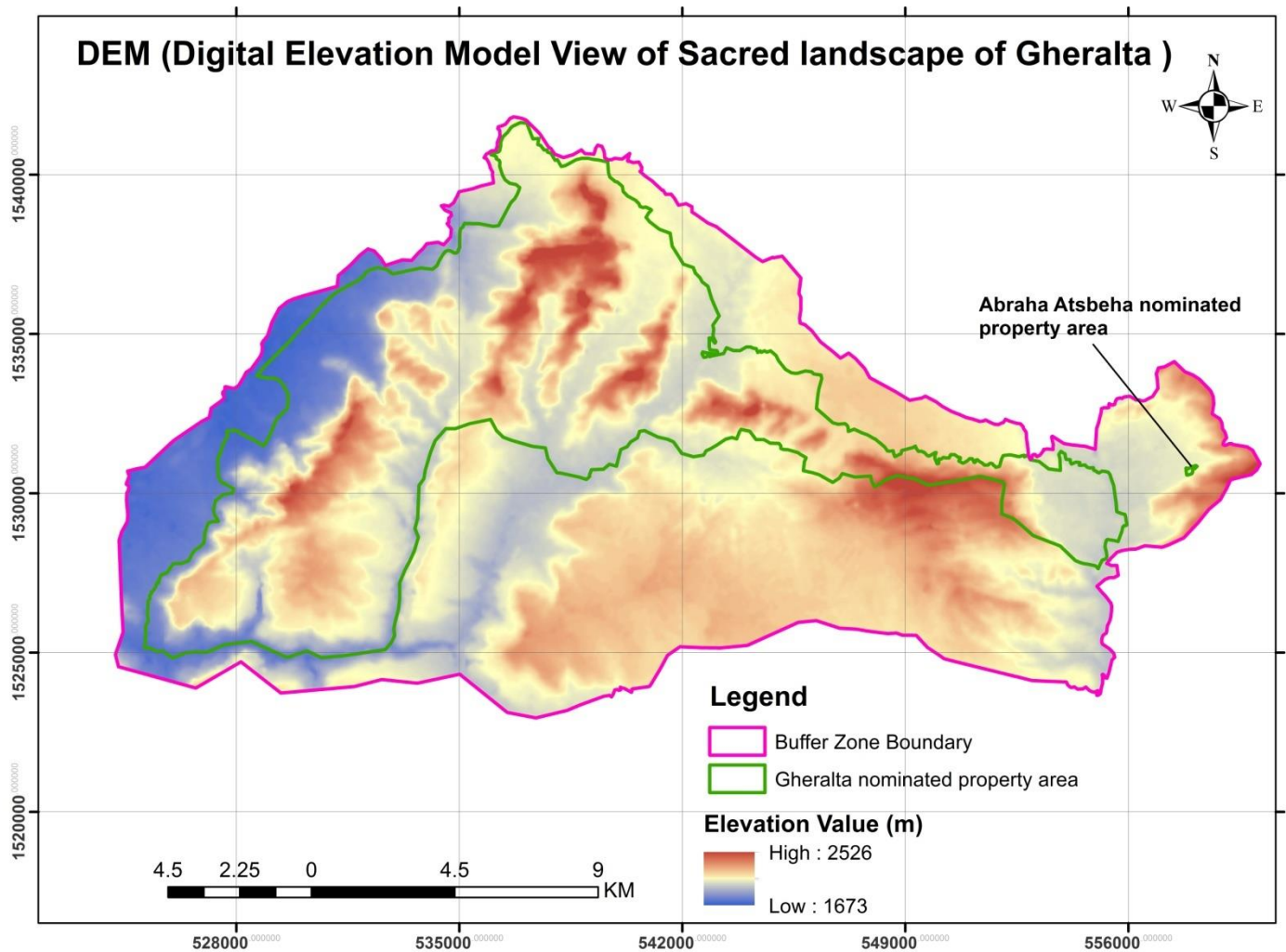


Fig-2; DEM views of the sacred landscape of Gheralta

The landscape has two important perennial rivers. The first river (Suluh River) is the starting boundary of Gheralta landscape from Abraha atsbeha tabia (Kelite Awlalo) side. The second river is flowing from Hawzen town through tabias Dugum, Fereweyni and Tsigereda to Afeget River.

Along the sides of these rivers there are lands cultivated by irrigation. Most of the RHCs have road access (gravel and asphalt). But, there are also RHCs with inaccessible roads like maryam megdelawit Alal, Medhanialem Alal, Arbaetu ensesa Tewleho, Arbaetu ensesa qemer, Abune G/meskel and Mariam Ayrefeda.

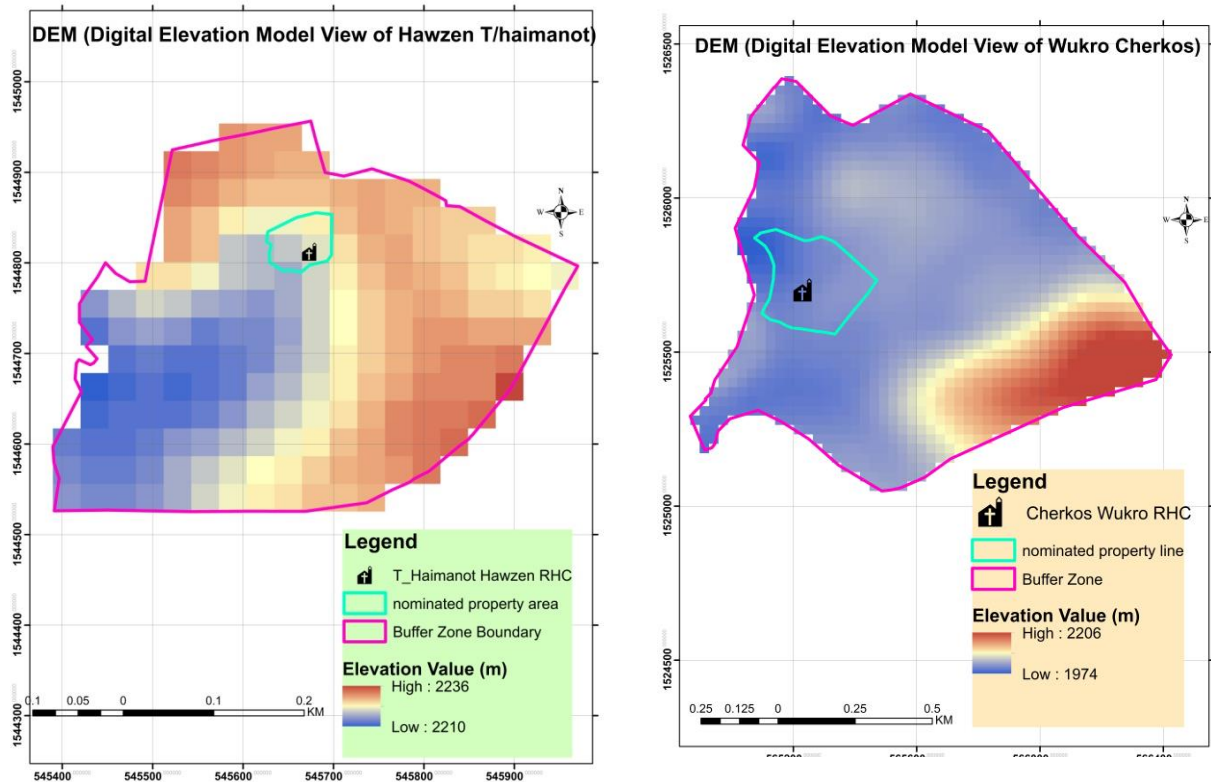


Fig-3; DEM views of Hawzen T/haimanot (Left) and Wukro Cherkos (Right)

Hawzen T/haimanot has also a rocky ridge on the western side. It has two basic covers (forest/most are eucalyptus, bare and farm lands). It has also Perennial River crossing the center of the proposed boundary. The dominant land form of the church's boundary is moderately slopping.

Wukro cherkos also has a big mountain called Debrenigo Mountain on eastern side of the boundary. The other land forms are located on the lower part of the mountain (dominantly sloppy areas).

Settlements and farm lands are the dominant coverage of the boundary. Most of forest coverage is found on the upper and hill sides of the mountain.

It has also Perennial River crossing the lower side of the boundary called Genfel River. Both of the two RHCs have a suitable road accessibility to go there.

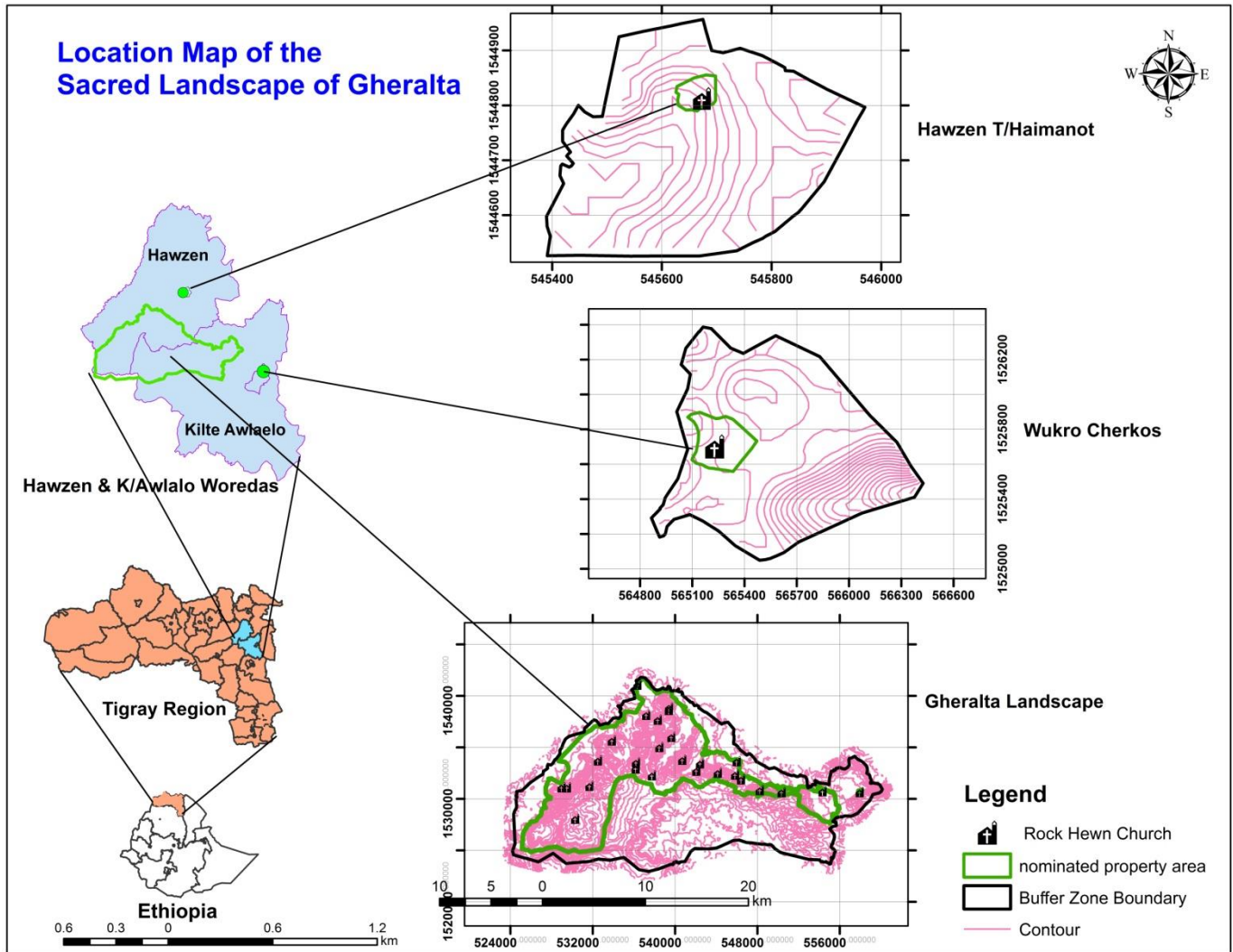


Figure-4: Location map of the sacred land of Gheralta

Based on the FAO agro-ecologic zone the sacred of gheralta landscape has two types of agro-ecologies. These are 96% of weinya dega (Mid land) and 9% is dega (highland). The dega part is located almost on the upper part of the mountains. The elevation values of Hawzen T/haimanot and Wukro Cherkos are between the intervals of 1500-2300m a.s.l. This FAO class is also called mid land (weina daga) agro-climatic zone. Therefore both the homes of 29 rock hewn churches have a suitable climatic condition for both incoming tourists & local communities.

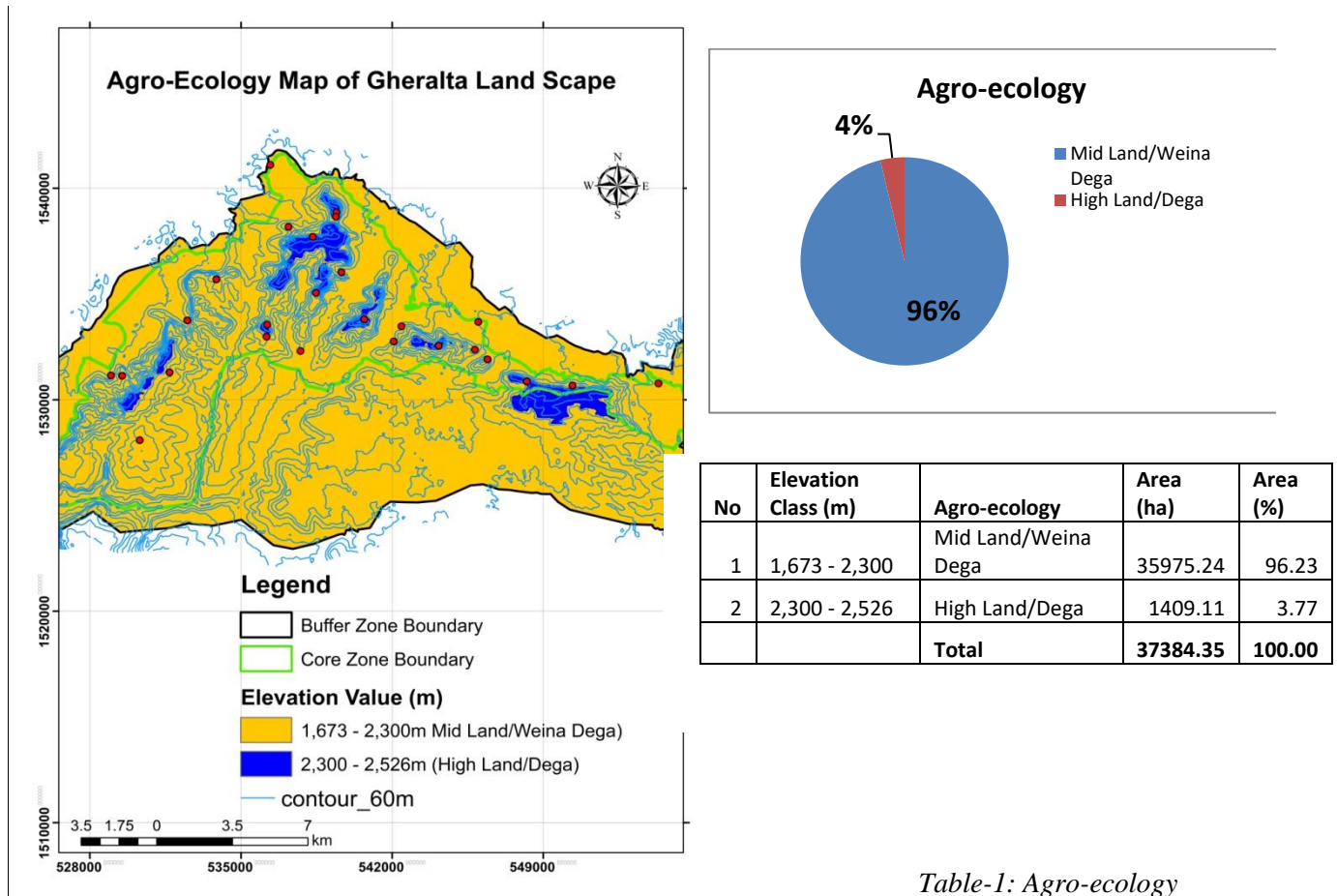


Table-1: Agro-ecology

Figure-5: Agro-ecology map

2.2. Data and Materials Used

Different kinds of data have been collected to conduct the map of the landscape and its important components. The data from **primary sources** include satellite imagery, field Observation, GPS ground control points, and information from woreda tourism experts, religious leaders as well as local communities. The data from **secondary sources** include different published books and Internet websites.

Table-2: Satellite images, software and materials used

No.	Satellite Image	Path-Row	Date of Acquisition	Source
1	Landsat-8 OLI 2017	169-050	06-Jan,2017	Earth explorer, USGS EROS or http://glovis.usgs.gov
2	DEM 30m resolution			http://gdex.cr.usgs.gov/gdex/
	Software Used			
1	ERDAS Imagine 9.2			Cracked download
2	Arc GIS 10.3			Cracked download
3	Google Earth Pro.			www.google earth.com
4	GLOBAL MAPPER V.11.00			Cracked download
	Materials			
1	GPS Garmin-72			Rental
2	Stationeries			Purchased
3	Topographic Map	Scale 1:50,000		EMA
4	Digital Camera			ADS Consult plc
5	Administrative Map			BoFED
6	Laptop Computer			ADS Consult plc

2.3. Methods to implement the task

2.3.1. Man Power

Man powers required to accomplish the task were 20 in number. These are:

- 18 daily data collectors have been trained for two days (how to operate GPS, how to take and register GPS reading) using the following print paper format:

Table-3: GPS Coordinates Collecting format

No.	X (Longitude)	Y (Latitude)	Z (Altitude)	Name	Remark
1					
2					
3					

b. 2 key experts: Coordinating, supervising, collecting GPS readings and mapping for the cultural landscape boundary, buffer zone, locate the rock hewn churches, land use, natural and artificial attractive areas, routs/roads, elevations (DEM), etc.

- 1 Non-key expert: - The contractor: supervising, resource identification, and collect socio-economic condition of the cultural landscape and submit the final report.

NB: Moreover, The concerned Tabia/kushet leaders, religious leaders, local communities and governmental experts of the study area have been participated to indicate, guide and support the team.

Action Plan:

A detailed action plan or implementation schedule has been prepared prior the field work was started.

Table-4: Implementation schedule

No.	Activity	W-1	W-2	W-3	W-4	W-5	W-6	W-7
1	Man power arrangement, Training & Orientation	✓						
1	Data Collection (GPS Reading and socio-economic data)	✓	✓	✓	✓			
2	Data organization, Analysis, mapping and Interpretation				✓	✓		
3	First draft report submission						✓	
4	Editing First draft Recommendations						✓	
5	Final report submission							✓
	NB: W= means weeks							

2.3.2. Data Collection and Analysis

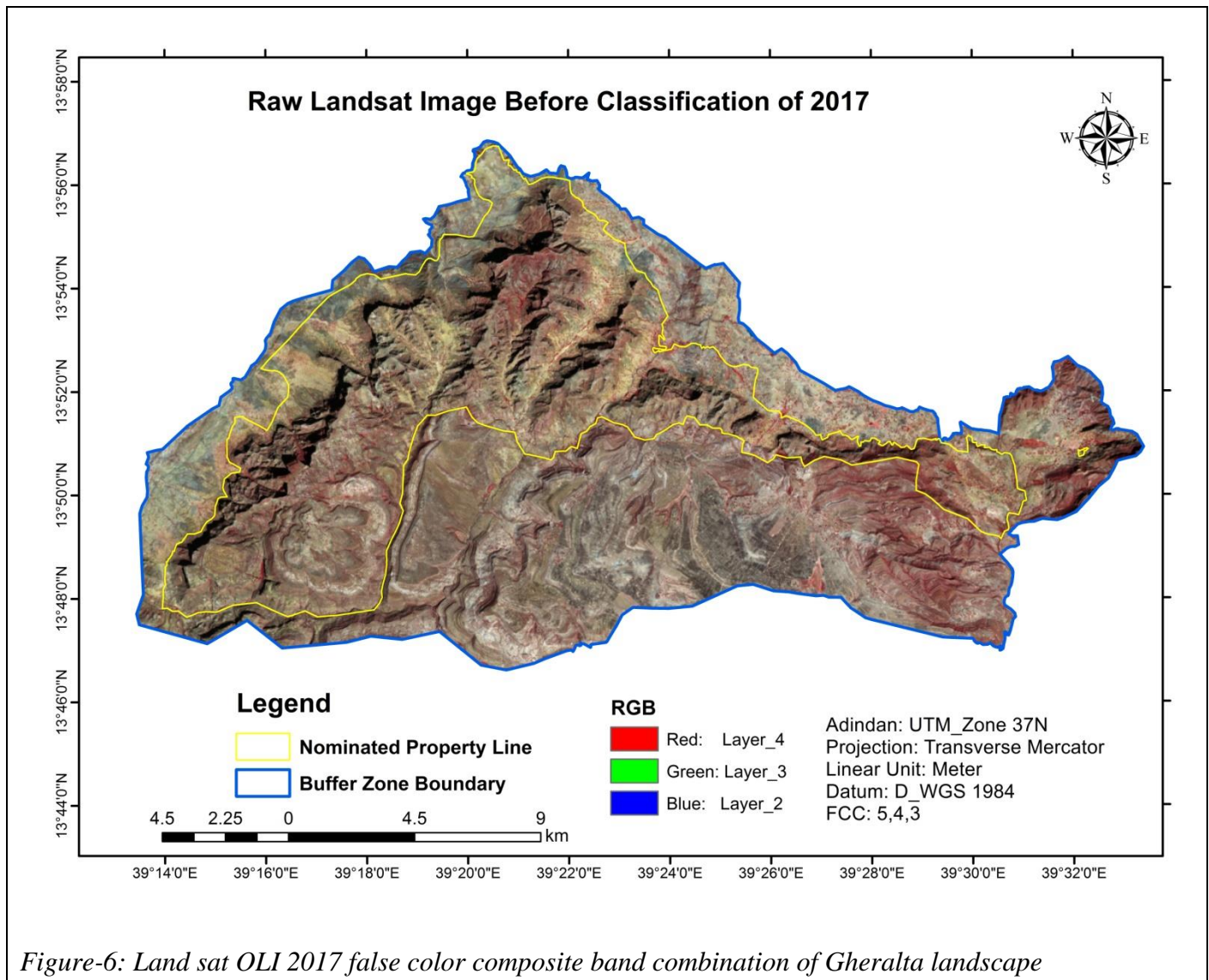
Prior to the field work, the necessary satellite imagery such as **Landsat-8 OLI 2017** and **DEM 30m resolution** were downloaded from the United States Geological Survey (USGS) Earth Resources Observation Systems (EROS) data center under the Land sat Archive collection. Literature review which clarifies the theoretical background of cultural landscape and its important components was conducted to become more familiar about the different aspect of the study. Field reconnaissance survey was carried out in the initial stage. During the field work, 50 Ground control points (GCPs) have been collected using GPS for land use land

cover classification and 25 GCPs for accuracy assessment. GCPs for accuracy assessment are taken from Aerial photograph (10 GCPs) and from field survey 15 GCPs.

In order to increase visual distinctions between features and increase the amount of information that can be visually interpreted from the data.

For accurate image classification, band selection also crucial since one feature which is not discriminated apparently may be clearly differentiated on another band. For this purposes FCC and TCC were utilized. The Land sat OLI 2017 image has 11 bands with a spatial resolution of 30m and 5:4:3 band combinations have been used for land use land cover mapping.

The following figure show the different raw satellite imagery color composite used in False Color Composite (FCC) band combination for land use and land cover classification (*Figure-4*).



Different stages of digital image processing techniques were followed in order to attain the objectives of this study. Supervised image classification using maximum classification was carried out on the year 2017 satellite images. *Figure-5* shows the general procedure of satellite image data analysis.

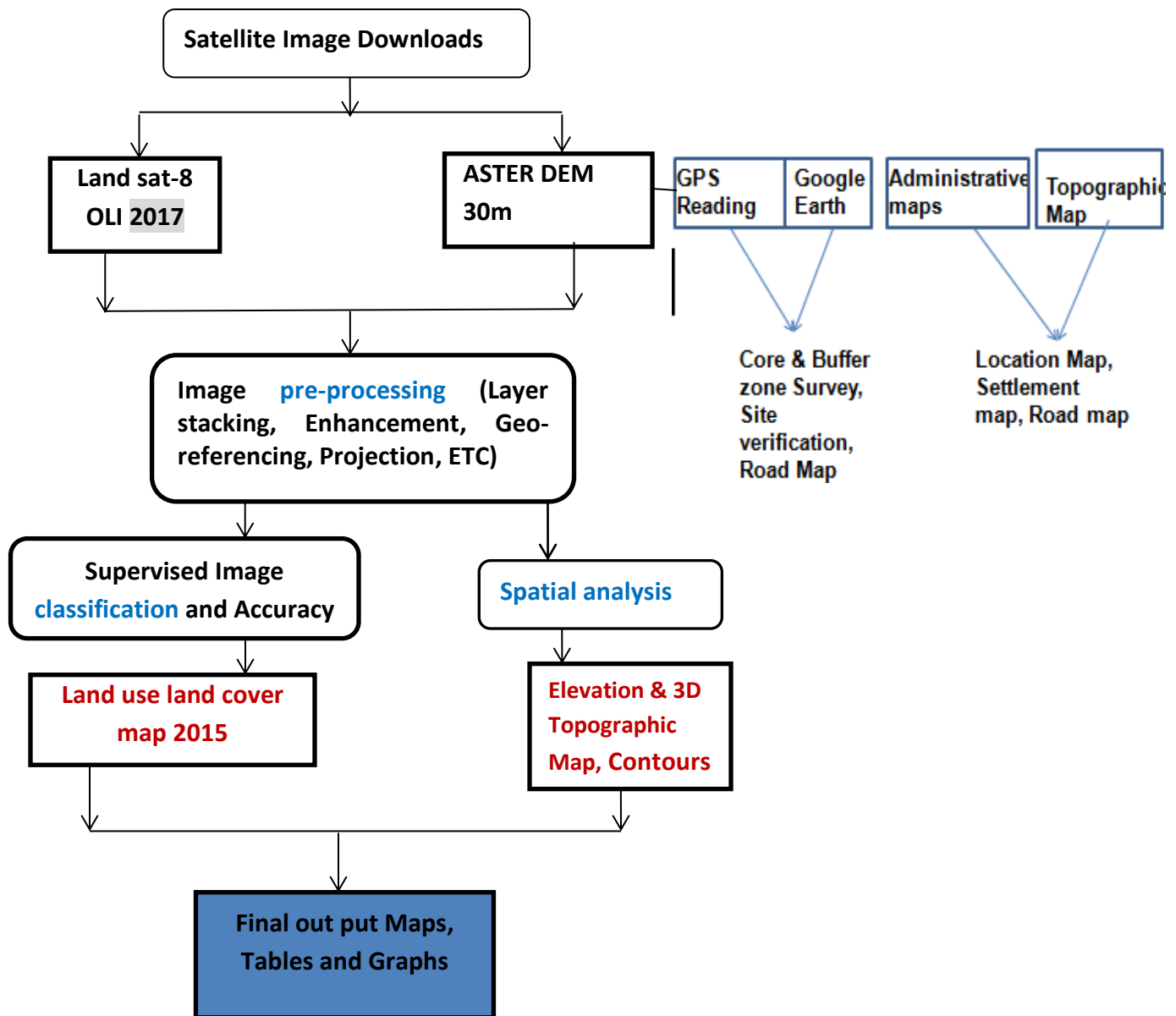


Fig-7: Flowchart of procedure for deriving land use/land covers data, Elevation and 3D topographic map from remotely sensed data.

Table-5: Land use land covers class description

No.	Land cover type	Description
1	Forest Land/Trees	Any Vegetation Cover like trees, bushes shrubs, typically a mix of trees of enrichment planting and natural re-vegetation
2	Agricultural Lands	Includes Rain fed, Irrigated lands, & Some rocky area
3	Grass land	Refers to those areas dominantly covered with grasses.
4	Settlement Areas	Clustered villages and Scattered settlements

After classification the result has been evaluated using **accuracy assessment** cell array. Accuracy assessment is a general term for comparing the classification to geographical data that are assumed to be true, in order to determine the accuracy of the classification.

The generated report has also revealed in **Kappa coefficient**. Kappa coefficient expresses the proportionate reduction in error generated by the classification process compared with the error of completely random classification. Based on this the overall classification accuracy 92%, where as the overall Kappa coefficient becomes 0.8991. Therefore, the overall classification accuracy nearest 100% is considered to be more accurate while overall Kappa coefficient nearest to 1 is said to be accurate.

Another ways we use to assess the accuracy of the land use land cove classification is the Google Earth. The classes have been overlaid to Google Earth using GIS Arc tool box geo-processing procedures. Therefore the coverage showing on Google Earth and the over laid land use class of the sacred land of Gheralta landscape are almost true. Ground verification after classification have been also accomplished on the ground using the map and field observation.

Land uses/covers of Hawzen T/haimanot and Wukro Cherkos have also classified using simple digitization. The data sources for the class digitization is GPS reading coordinates. As the map is produced from GPS ground survey, the land use land cover classes of the two RHCs are more accurate than the sacred landscape of Gheralta.

The exact locations of RHCs, nominated property areas boundary, buffer zone boundary and roads are mapped using detail GPS reading on the ground.

3. RESULT

3.1. Boundary (Nominated Property Areas and Buffer Zones)

3.1.1. Sacred Landscape of Gheralta (Nominated Property Area and Buffer Zone)

The wereda and tabia proportion of the nominated property area is quite different. The nominated property area of the landscape is identified based on known natural and cultural features. Based on these ground GPS readings have been taken as follows:

Table-6: GPS readings of nominated property area of Gheralta landscape

No.	Easting	Northing	Altitude	Specific Name	Wereda	Tabia	Land_Form	Land_Cover	Direction
1	546163	1532832	2100	Mihbae Shitol	Hawzen	Dugum	Moderately Slopping	Small Village	North
2	542867	1536091	1986	Maekel Adi Gudele	Hawzen	Freweyni	Foot of Mountain	Farm Land	North
3	540608	1538985	2053	Endagramach Teferi	Hawzen	Megab	Slopping	Gully	North
4	540233	1539315	2080	K/Mihret Megab	Hawzen	Megab	Foot of Mountain or Church	Forest Land	North
5	539194	1540468	2051	Beri Megab	Hawzen	Megab	Foot of Mountain	Asphalt Road	North
6	539719	1539876	2084	Gira Semere	Hawzen	Megab	Foot of Mountain	Farm Land	North
7	540045	1539621	2074	Daero Hutsa	Hawzen	Megab	Foot of Mountain	Farm Land	North
8	540975	1538890	2045	Adi Asqala	Hawzen	Megab	Slopping	Gully	North
9	540806	1538652	2049	Adi shum Weyanay	Hawzen	Megab	Moderately Slopping	Gully	North
10	541480	1538167	2035	Giraaras	Hawzen	Megab	Moderately Slopping	Gully	North
11	541617	1537752	2042	Gira Gedo	Hawzen	Megab	Plain	Farm Land	North
12	541768	1537504	2033	Road to Alal	Hawzen	Freweyni	Plain	Gravel Road	North
13	542184	1537105	2028	Foot of Emba Endasenbet	Hawzen	Freweyni	Foot of Mountain	Farm Land	North
14	542354	1536886	2021	Hadush Mender Adi haki	Hawzen	Freweyni	Foot of Mountain	Farm Land	North
15	543094	1535564	1971	Haguafo	Hawzen	Freweyni	Moderately Slopping	Perennial River	North
16	542909	1534982	1966	May Geleb	Hawzen	Freweyni	Moderately Slopping	Perennial River	North
17	542793	1534285	1959	May Beles	Hawzen	Freweyni	Moderately Slopping	Perennial River	North
18	543235	1534375	1966	Semhil	Hawzen	Freweyni	Plain	Grass Land	North
19	543886	1534545	1988	Adi Awhi	Hawzen	Freweyni	Undulated Land	Bush Land	North
20	544953	1534166	2055	May kalay	Hawzen	Dugum	Plain	Grass Land	North
21	544384	1534461	2022	May siye	Hawzen	Dugum	Undulated Land	Bush Land	North
22	545305	1533813	2069	Qetsalu	Hawzen	Dugum	Plain	Grass Land	North
23	545646	1533789	2086	Adi Bokila	Hawzen	Dugum	Plain	Open Land	North

24	545849	1533832	2099	Digum Market	Hawzen	Dugum	Plain	Bare Land	North
25	546272	1533451	2121	Da-kahnat	Hawzen	Dugum	Undulated Land	Small Village	North
26	546147	1532649	2108	Kelkel Netabi	Hawzen	Dugum	Foot of Mariam Ayrefeda RHC	Farm Land	North
27	546337	1532501	2115	siso	Hawzen	Dugum	Foot of Mariam Ayrefeda RHC	Farm Land	North
28	543643	1531691	2038	Mayda Hayam	Hawzen	Freweyni	Undulated Land	Small Village	South
29	542823	1531395	1994	Miaema	Hawzen	Freweyni	Gorge	Seasonal River	South
30	541553	1531650	1961	Shahshahta	Hawzen	Freweyni	Gorge	Seasonal River	South
31	540554	1531855	1944	Kudibdib	Hawzen	Freweyni	Gorge	Perennial River	South
32	540266	1531534	1937	Daero Mayhafeko	Hawzen	Freweyni	Gorge	Perennial River	South
33	534954	1537589	1866	May nugus Bridge	Hawzen	Debreselam	Gorge	Asphalt Road Megab_Koraro	North
34	535170	1538475	1866	Atebe Bridge	Hawzen	Debreselam	Gorge	Asphalt Road Megab_Koraro	North
35	534652	1537604	1880	Mindaf	Hawzen	May Gobo	Steep Slope	Asphalt Road Megab_Koraro	North
36	531621	1536595	1749	Mihtsay Awalid	Hawzen	May Gobo	Plain	Asphalt Road Megab_Koraro	West
37	530838	1536073	1738	Adi Nifaso	Hawzen	May Gobo	Plain	Asphalt Road Megab_Koraro	West
38	529614	1534779	1707	Asphalt Road Megab Koraro	Hawzen	Koraro	Plain	Asphalt Road Megab_Koraro	West
39	529254	1532308	1758	Koraro Health Center	Hawzen	Koraro	Slopping	Health Center	West
40	532778	1525279	1804	Midinbar	Hawzen	Alal	Gorge	Perennial River / Agefet	South
41	534157	1531624	1931	Denan	Hawzen	May Gobo	Gorge	Seasonal River	South
42	533654	1528702	1893	May Sefah	Hawzen	Alal	Gorge	Seasonal River	South
43	533358	1527821	1882	Musug	Hawzen	Alal	Gorge	Seasonal River	South
44	533086	1526586	1855	Baaliti Atwat	Hawzen	Alal	Gorge	Seasonal River	South
45	531795	1524965	1821	Debre Bukuan	Hawzen	Alal	Gorge	Perennial River / Agefet	South
46	530140	1525017	1766	Gereb May Kumel	Hawzen	Alal	Gorge	Perennial River / Agefet	South
47	528152	1525312	1747	Damugot	Hawzen	Alal	Gorge	Perennial River / Agefet	South

48	525730	1524945	1732	Dateneg	Hawzen	Koraro	Gorge	Perennial River / Agefet	South
49	525349	1526961	1785	Daedadaa	Hawzen	Koraro	Foot of Mountain	Farm Land	West
50	527364	1530976	1735	Enda abune aregawi	Hawzen	Koraro	Foot of Mountain	Church	West
51	527457	1530348	1753	Tsegogot	Hawzen	Koraro	Foot of Mountain	Farm Land	West
52	527375	1529112	1797	Tensoka	Hawzen	Koraro	Foot of Mountain	Farm Land	West
53	528648	1533690	1705	Af-Tsebibi	Hawzen	Koraro	Plain	Asphalt Road Megab_Koraro	West
54	529592	1533177	1728	Ende Gully	Hawzen	Koraro	Plain	Gully	West
55	529597	1532665	1741	Adi-Birhan	Hawzen	Koraro	Plain	Gully	West
56	528799	1531481	1740	Tsegee-Koraro	Hawzen	Koraro	Foot of Giorgis Koraro RHC	Farm Land	West
57	527655	1531953	1716	may-Ambelay	Hawzen	Koraro	Foot of Giorgis Koraro RHC	Farm Land	West
58	527836	1530066	1770	Af-Hutsa	Hawzen	Koraro	Foot of Mountain	Farm Land	West
59	536899	1539590	1993	Silassie D/Selam	Hawzen	Debreselam	Steep Slope	Church	North
60	540405	1539209	2064	Road to Mariam Korkor	Hawzen	Megab	Slopping	Gravel Road	North
61	538613	1540466	2048	Asphalt Road Megab-Koraro	Hawzen	Megab	Slopping	Asphalt Road	North
62	538138	1540239	2037	Asphalt Road Megab-Koraro	Hawzen	Debreselam	Slopping	Asphalt Road	North
63	537422	1541104	2022	Maichew Ridge	Hawzen	Debreselam	Ridge	Bush Land	North
64	536857	1541609	2014	Ridge	Hawzen	Debreselam	Ridge	Bush Land	North
65	536368	1541188	2016	Mariam Barakit Ridge	Hawzen	Debreselam	Ridge	Rocky	North
66	536243	1540729	2023	Rocky Ridge	Hawzen	Debreselam	Ridge	Rocky	North
67	535981	1540653	2016	Rocky Ridge	Hawzen	Debreselam	Ridge	Rocky	North
68	536496	1538992	1955	Gravel Road to Abuneyemata Guh church	Hawzen	Debreselam	Slopping	Gravel Road	North
69	536167	1538392	1914	Atebe River	Hawzen	Debreselam	Gorge	Seasonal River	North
70	534127	1537034	1750	Asphalt Road Megab Koraro	Hawzen	May Gobo	Steep Slope	Asphalt Road Megab_Koraro	West
71	532854	1536879	1784	Asphalt Road Megab Koraro	Hawzen	May Gobo	Steep Slope	Asphalt Road Megab_Koraro	West
72	532137	1536986	1753	Asphalt Road Megab Koraro	Hawzen	May Gobo	Steep Slope	Asphalt Road Megab_Koraro	West
73	530385	1535607	1730	Asphalt Road Megab Koraro	Hawzen	Koraro	Plain	Asphalt Road Megab_Koraro	West
74	525126	1525132	1727		Hawzen	Koraro	Gorge	Perennial River / Agefet	South

75	526508	1527884	1787		Hawzen	Koraro	Foot of Mountain	Farm Land	West
76	526978	1528435	1776		Hawzen	Koraro	Foot of Mountain	Farm Land	West
77	527339	1529757	1766		Hawzen	Koraro	Foot of Mountain	Farm Land	West
78	536439	1539834	1993		Hawzen	Debreselam	Steep Slope	Farm Land	North
79	539657	1540394	2040		Hawzen	Megab	Moderately Slopping	Asphalt Road Megab_Koraro	North
80	537121	1541612	2030		Hawzen	Debreselam	Ridge	Farm Land	North
81	543024	1534710	1967		Hawzen	Freweyni	Moderately Slopping	Perennial River	North
82	542839	1534869	1969		Hawzen	Freweyni	Moderately Slopping	Perennial River	North
83	542870	1534501	1961		Hawzen	Freweyni	Moderately Slopping	Perennial River	North
84	543088	1534474	1962		Hawzen	Freweyni	Moderately Slopping	Perennial River	North
85	542639	1534438	1962		Hawzen	Freweyni	Moderately Slopping	Perennial River	North
86	543068	1534362	1960		Hawzen	Freweyni	Moderately Slopping	Perennial River	North
87	543388	1534564	1969		Hawzen	Freweyni	Plain	Grass Land	North
88	546354	1533708	2122		Hawzen	Dugum	Plain	Gravel Road	North
89	538992	1530434	1916		Hawzen	Freweyni	Gorge	Seasonal River	South
90	538059	1530646	1912		Hawzen	Freweyni	Gorge	Seasonal River	South
91	539930	1530848	1931		Hawzen	Freweyni	Gorge	Seasonal River	South
92	527046	1525005	1747		Hawzen	Alal	Gorge	Perennial River / Agefet	South
93	529606	1524845	1767		Hawzen	Alal	Gorge	Perennial River / Agefet	South
94	544850	1531558	2053	Gira gombah	K/Awlaelo	Debretsion	Gorge	Bush Land	South
95	546582	1532279	2128	Kokhat	K/Awlaelo	Debretsion	Foot of Abune Abraham RHC	Small Village	North
96	547235	1531965	2103	Dugum Nursery Site	K/Awlaelo	Debretsion	Plain	Grass Land	North
97	547514	1531906	2113	May Kot	K/Awlaelo	Debretsion	Plain	Farm Land	North
98	547832	1531766	2123	Gedamat	K/Awlaelo	Debretsion	Foot of Yohans Meakudi RHC	Grass Land	North
99	548547	1531330	2145	Mariam Metari	K/Awlaelo	Debretsion	Foot of Yohans Meakudi RHC	Farm Land	North
100	552183	1531196	2055	Mukuyae	K/Awlaelo	Abraha Atsbeha	Foot of Darna Ridge	Gravel Road	North
101	552513	1531142	2032	Endabagabr (new)	K/Awlaelo	Abraha Atsbeha	Foot of Darna Ridge	Gravel Road	North
102	552786	1531182	2003	Endabagabr (Old)	K/Awlaelo	Abraha Atsbeha	Foot of Darna Ridge	Gravel Road	North

103	553391	1530792	1993	Mendae Road	K/Awlaelo	Abraha Atsbeha	Plain	Gravel Road	East
104	550056	1531076	2133	Sheshehlo	K/Awlaelo	Debretsion	Foot of Michael Abiy-Adi RHC	Bush Land	North
105	550609	1531131	2115	Gurambiya	K/Awlaelo	Debretsion	Foot of Michael Abiy-Adi RHC	Bush Land	North
106	549252	1531473	2139	Kelkel	K/Awlaelo	Debretsion	Foot of Mountain	Small Village	North
107	551294	1530971	2108	Daero Kolit	K/Awlaelo	Abraha Atsbeha	Foot of Michael Abiy-Adi RHC	Bush Land	North
108	555308	1530662	1955	Suluh River Bridge (Abraha Atsbeha- Megab way)	K/Awlaelo	Abraha Atsbeha	Gorge	Perennial River / Suluh	East
109	554118	1528019	2006	Ekele	K/Awlaelo	Abraha Atsbeha	Farm Land	Small Village	South
110	552030	1530315	2371	Darna Ridge	K/Awlaelo	Abraha Atsbeha	Ridge	Forest Land	South
111	550578	1530398	2380	Darna Ridge	K/Awlaelo	Abraha Atsbeha	Ridge	Forest Land	South
112	547414	1530516	2182	Ye-Ed Maiychelot	K/Awlaelo	Debretsion	Gorge	Dense Forest	South
113	549666	1530247	2449	Emba Alawo	K/Awlaelo	May Kuha	Ridge	Forest Land	South
114	548874	1530497	2452	meda Asrat	K/Awlaelo	May Kuha	Ridge	Forest Land	South
115	546520	1530405	2093	Mekabrat	K/Awlaelo	Debretsion	Gorge	Bush Land	South
116	545735	1530705	2050	Afewaz	K/Awlaelo	Debretsion	Gorge	Bush Land	South
117	545259	1531355	2056	Adi-wechi	K/Awlaelo	Debretsion	Gorge	Bush Land	South
118	544294	1531674	2038	May Filihti	K/Awlaelo	Freweyni	Small Village	Rocky	South
119	537208	1531468	1946	Mihrae Azabae	K/Awlaelo	Tsigereda	Farm Land	Gully	South
120	553834	1531307	1973	May Munguda	K/Awlaelo	Abraha Atsbeha	Gorge	Seasonal River	East
121	554397	1530953	1963	May Munguda	K/Awlaelo	Abraha Atsbeha	Gorge	Seasonal River	East
122	555296	1528543	1942	Suluh River	K/Awlaelo	Abraha Atsbeha	Gorge	Perennial River / Suluh	East
123	555054	1527631	1936	Suluh River	K/Awlaelo	Abraha Atsbeha	Gorge	Perennial River / Suluh	East
124	548863	1531240	2118		K/Awlaelo	Debretsion	Foot of Mountain	Gully	North
125	553867	1530719	1985		K/Awlaelo	Abraha Atsbeha	Plain	Gravel Road	East
126	551948	1530841	2100		K/Awlaelo	Abraha Atsbeha	Foot of Darna Ridge	Farm Land	North
127	555636	1529421	1953		K/Awlaelo	Abraha Atsbeha	Gorge	Perennial River / Suluh	East
128	555961	1529015	1951		K/Awlaelo	Abraha Atsbeha	Gorge	Perennial River / Suluh	East
129	555676	1528485	1946		K/Awlaelo	Abraha Atsbeha	Gorge	Perennial River / Suluh	East

130	553007	1528677	2216		K/Awlaelo	Abraha Atsbeha	Ridge	Bush Land	South
131	552024	1529355	2317		K/Awlaelo	Abraha Atsbeha	Ridge	Bush Land	South
132	548039	1530199	2344		K/Awlaelo	May Kuha	Gorge	Bush Land	South
133	535979	1532317	2071		K/Awlaelo	Tsigereda	Gorge	Bush Land	South

When we look on **Woreda** point of view greater than 86% of the landscape is located in Hawzen Woreda administrative maps. The remaining around 14% is laid in the neighboring another wereda called Kilte Awlalo woreda administrative maps. To elaborate the above fact the following respective graphs and maps are shown below;

Table-7: Gheralta landscape proportion of administrative location by wereda (nominated property area)

No.	ZONES	WEREDA	Area (ha)	Area (%)
1	Eastern	Hawzen	13889.99	86.33
2	Eastern	Kilte Awlalo	2199.10	13.67
		Total	16,089.09	100.00

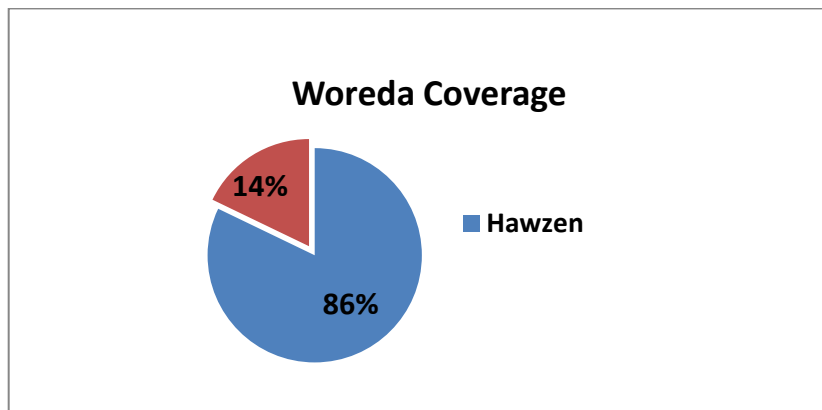


Fig-6: Pie Chart showing proportion of Gheralta landscape by Woredas.

If nominated property area, very big area is covered in Hawzen wereda. But, If buffed it based on the above features, it cover almost 50 by 50% of the two neighboring weredas.

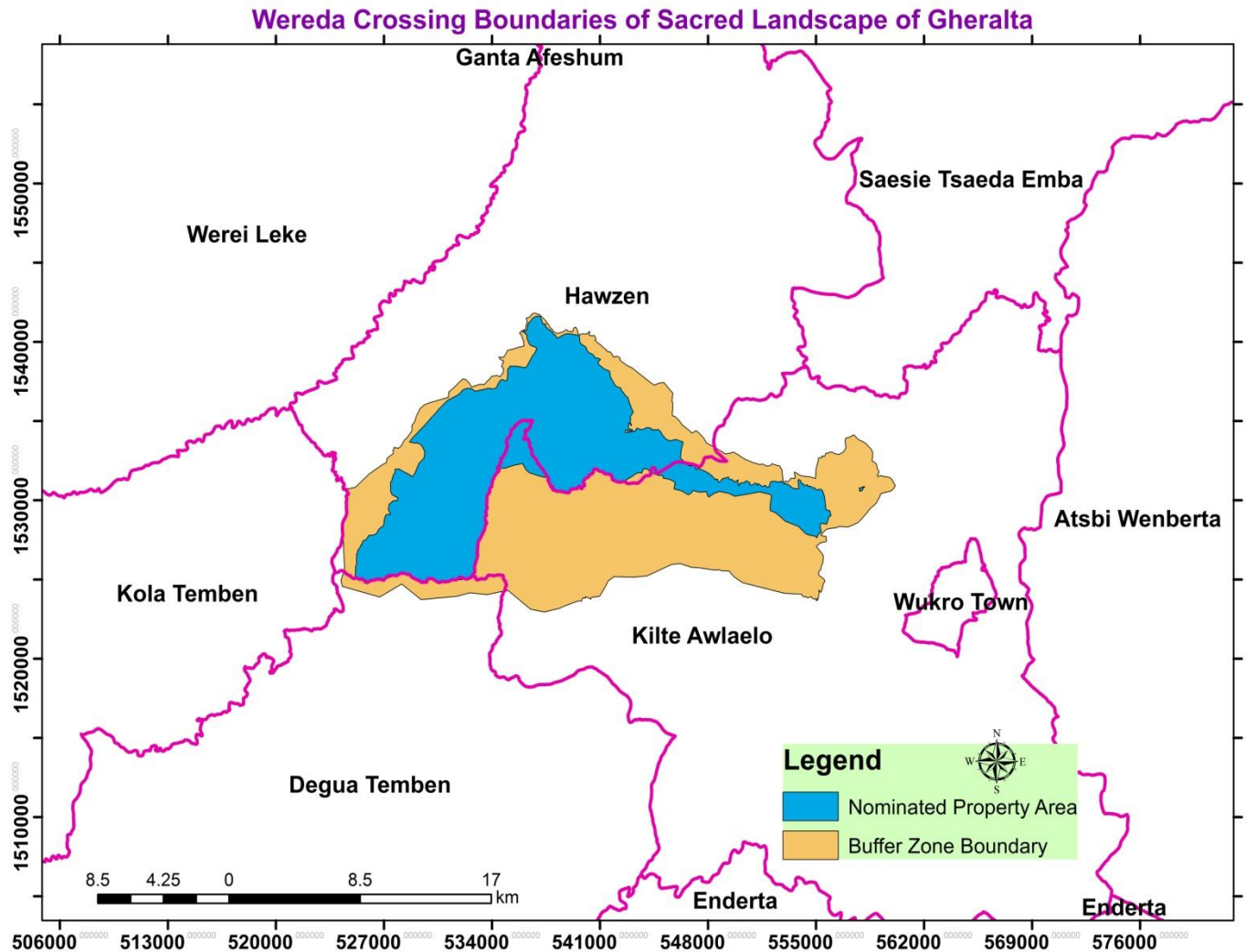


Fig-8: Woreda map of Gheralta landscape (nominated property area and Buffer zones)

The landscape (Gheralta Landscape) covers/crosses 11 administrative tabias. Seven of them are from Hawzen Woreda and four of them from Kilte Awlalo Woreda. This coverage is Tabias Freweyni, Alal and Maygobo respectively cover the highest proportion than the other tabias (together containing 66% of the landscape) where as Dugum, Maykuha and Megab shares very small proportion.

Table-8: Tabia coverage

No.	ZONES	WEREDA	TABIA	Area (ha)	Area (%)
1	Eastern	Hawzen	Debre Selam	903.99	5.62
2	Eastern	Hawzen	Megab	488.33	3.04
3	Eastern	Hawzen	Koraro	1477.72	9.18
4	Eastern	Hawzen	May Gobo	3045.94	18.93
5	Eastern	Hawzen	Fireweyni	4323.18	26.87
6	Eastern	Hawzen	Alal	3238.12	20.13
7	Eastern	Hawzen	Dugum	412.7	2.57
8	Eastern	Kilte Awlalo	Abraha Atsbaha	999.06	6.21
9	Eastern	Kilte Awlalo	Debre Tsion	586.38	3.64
10	Eastern	Kilte Awlalo	May Kuha	79.44	0.49
11	Eastern	Kilte Awlalo	Tsigereda	534.22	3.32
			Total	16089.08	100.00

Buffer zone is very important to know and decide what types of land use/cover surrounds the nominated property area, where direction and which land use/cover affects the nominated property area & its internal components, what mitigation measures to take, etc. Both the buffer zone and nominated property area mapping is based on known natural and cultural features.

➤ Cultural features:

- ✓ Non rock hewn churches, schools, and health centers
- ✓ Roads
- ✓ Known villages

➤ Natural features:

- ✓ Rivers
- ✓ Ridges
- ✓ Gorges
- ✓ Forest land, Grass Land
- ✓ Rocky areas
- ✓ Special names (for plain areas)

Table-9: GPS readings for Buffer zones of the sacred landscape of Gheralta

No.	Easting	Northing	Altitude	Name	Wereda	Tabia	Land_Form	Land_Cover	Direction
1	533746	1524067	2031	Newih Egri	Degua Temben	Adiwalka	Ridge	Bush Land	South
2	532058	1524050	2075	Newih Egri	Degua Temben	Adiwalka	Ridge	Bush Land	South
3	527967	1524564	2040	Hazgi	Degua Temben	Adiwalka	Ridge	Bush Land	South
4	526729	1523886	2118		Degua Temben	Adiwalka	Ridge	Rocky Area	South
5	529403	1523731	1834		Degua Temben	Adiwalka	Gorge	Seasonal River	South
6	527635	1533311	1694	may Arkay Mitihiwisal	Hawzen	Koraro	Gorge	Seasonal River	West
7	534428	1538994	1835	May Flatsa	Hawzen	Debreselam	Gorge	Seasonal River	North
8	535009	1539454	1937	Neguadi	Hawzen	Debreselam	Ridge	Rocky Area	North
9	536410	1541556	1997	May shinfila	Hawzen	Debreselam	Gorge	Forest	North
10	536875	1541766	1999	May Gah	Hawzen	Debreselam	Gorge	Bush Land	North
11	524259	1524696	1950	Dateneg	Hawzen	Koraro	Ridge	Rocky Area	South
12	524394	1526513	1920	Adi Enkirti	Hawzen	Koraro	Ridge	Rocky Area	West
13	540437	1540355	2072	Megab Police Station	Hawzen	Megab	Plain	Megab Center	North
14	540656	1540079	2055	May Righe	Hawzen	Megab	Plain	Dense Tree	North
15	541015	1539809	2048	Daero Kuhila	Hawzen	Megab	Undulated Land	Bush Land	North
16	541174	1539634	2044	Enda-Abraha Bishiu	Hawzen	Megab	Undulated Land	Bush Land	North
17	541392	1539498	2042	May Koray	Hawzen	Megab	Undulated Land	Bush Land	North
18	541742	1539243	2034	Sentsir	Hawzen	Megab	Undulated Land	Bush Land	North
19	541874	1539024	2033	Daero Momona	Hawzen	Megab	Undulated Land	Bush Land	North
20	542393	1538759	2044	Adi-Kehar	Hawzen	Megab	Plain	Farm Land	North
21	542887	1538425	2034	Bereka chila	Hawzen	Megab	Undulated Land	Rocky Area	North
22	543143	1538301	2036	Daney-Entiya	Hawzen	Megab	Undulated Land	Rocky Area	North
23	543752	1537814	2026	Tsigeno	Hawzen	Megab	Undulated Land	Farm Land	North
24	544277	1537408	2012	Qalay Dahra River	Hawzen	Megab	Gorge	Perennial River	North
25	545683	1536773	2084	Adi-Araesti	Hawzen	Debre Birhan	Moderate Sloping	Farm Land	North
26	545718	1536091	2092	Kelkel	Hawzen	Debre Birhan	Plain	Farm Land	North
27	546088	1535037	2076	Golgol Meala Dam	Hawzen	Dugum	Moderate Sloping	Reservoir Dam	North
28	546950	1534224	2097	Endaba simon Church	Hawzen	Dugum	Steep Slope	Church	North
29	547639	1533982	2115	Golgol Chiwot	Hawzen	Dugum	Plain	Grass Land	North
30	548059	1533496	2143	Godagudi Mender	Hawzen	Dugum	Plain	Farm Land	North

31	526054	1531677	1740	Enda-abune Aregawi Church	Hawzen	Koraro	Steep Slope	Church	West
32	524599	1530680	1704	Mikfal river	Hawzen	Koraro	Undulated Land	Seasonal River	West
33	540341	1540641	2086	Megab Cross Road	Hawzen	Megab	Plain	Asphalt Road Megeb_Koraro	North
34	531143	1536454	1716	Old Road to Koraro	Hawzen	May Gobo	Plain	Farm Land	West
35	529574	1535961	1707	Old Road to Koraro	Hawzen	Koraro	Plain	Farm Land	West
36	528962	1534921	1702	Old Road to Koraro	Hawzen	Koraro	Plain	Farm Land	West
37	528453	1533883	1716	Old Road to Koraro	Hawzen	Koraro	Plain	Farm Land	West
38	528062	1533361	1717	Old Road to Koraro	Hawzen	Koraro	Plain	Farm Land	West
39	524548	1529868	1712	Mikfal river	Hawzen	Koraro	Undulated Land	Seasonal River	West
40	524550	1529064	1719	Bridge	Hawzen	Koraro	Moderate Sloping	Asphalt Road Megeb_Koraro	West
41	531217	1536835	1745	Mihtsay Awalid School	Hawzen	May Gobo	Moderate Sloping	School	West
42	534743	1538091	1856	Atebe River	Hawzen	Debreselam	Gorge	Seasonal River	North
43	532761	1537161	1777	Hutsa Aboy Gerechaal	Hawzen	May Gobo	Gorge	Forest/River	North
44	537925	1540720	2007	Maichew	Hawzen	Debreselam	Gorge	Bush Land	North
45	545136	1537440	2043		Hawzen	Debre Birhan	Moderate Sloping	Farm Land	North
46	539345	1540923	2016		Hawzen	Megab	Gorge	Seasonal River	North
47	536077	1539740	1986		Hawzen	Debreselam	Sloping	Farm Land	North
48	532133	1537666	1749		Hawzen	May Gobo	Gorge	Seasonal River	North
49	535777	1540531	2014		Hawzen	Debreselam	Ridge	Rocky Area	North
50	548677	1533182	2134	Adi-Berekti	Kilte Awlaelo	Gule	Plain	Farm Land	North
51	549151	1532891	2113	Golgol Adi werekti	Kilte Awlaelo	Gule	Plain	Grass Land	North
52	550060	1532768	2094	Daero maysiye	Kilte Awlaelo	Gule	Plain	Grass Land	North
53	551465	1532275	2075	Abiy Adi elementary School	Kilte Awlaelo	Gule	Moderate Sloping	School	North
54	552335	1532226	2042	Maichew Gule	Kilte Awlaelo	Abraha Atsbeha	Moderate Sloping	Small Village	North
55	552790	1531739	2016	Endabagabir mukuae	Kilte Awlaelo	Abraha Atsbeha	Gorge	Bush Land	North
56	538776	1523338	1984	Tsigereda School	Kilte Awlaelo	Tsigereda	Gorge	School	South
57	542760	1525134	2125	Enda-Cherkos church	Kilte Awlaelo	May Kuha	Steep Slope	Gravel Road Wukro_Tsigereda	South
58	543866	1525192	2136	Bet Korkos Village	Kilte Awlaelo	May Kuha	Plain	Gravel Road Wukro_Tsigereda	South
59	545025	1525657	2149	Mumat Memhir	Kilte Awlaelo	May Kuha	Farm Land	Gravel Road Wukro_Tsigereda	South
60	548500	1525586	2095	Beati Akor	Kilte Awlaelo	May Kuha	Plain	Gravel Road Wukro_Tsigereda	South
61	548704	1525595	2092	Azilo	Kilte Awlaelo	May Kuha	Moderate Sloping	Gravel Road Wukro_Tsigereda	South

62	550572	1524697	2096	Road Around Tsaeda emni	Kilte Awlaelo	Awaleo	Plain	Gravel Road Wukro_Tsigereda	South
63	547124	1525764	2102	Ruba Kolal	Kilte Awlaelo	May Kuha	Sloping	Gravel Road Wukro_Tsigereda	South
64	549577	1525264	2081	Ketin Kalay	Kilte Awlaelo	May Kuha	Sloping	Gravel Road Wukro_Tsigereda	South
65	552296	1524274	2059	Daero Walka	Kilte Awlaelo	Awaleo	Plain	Gravel Road Wukro_Tsigereda	South
66	553632	1531496	1979	May Munguda	Kilte Awlaelo	Abraha Atsbeha	Gorge	Seasonal River	North
67	553785	1531660	1983	Golgol Shum	Kilte Awlaelo	Abraha Atsbeha	Plain	Grass Land	North
68	554269	1531498	1979	Path Way Maichew-Gule	Kilte Awlaelo	Abraha Atsbeha	Plain	Road	North
69	554958	1531356	1963	Suluh River	Kilte Awlaelo	Abraha Atsbeha	Gorge	Perennial River/ Suluh	North
70	559996	1530685	2528	Abune Tomas Church	Kilte Awlaelo	Abraha Atsbeha	Ridge	Bush Land	East
71	558115	1528994	2286	Weyni Ridge	Kilte Awlaelo	Abraha Atsbeha	Ridge	Bush Land	South East
72	556984	1528302	2098	Adinifas Ridge	Kilte Awlaelo	Abraha Atsbeha	Ridge	Bush Land	South East
73	555180	1526861	1933	Suluh River	Kilte Awlaelo	Abraha Atsbeha	Gorge	Perennial River/ Suluh	South East
74	555320	1524180	1922	Suluh Bridge (Wukro-Tsigereda Way)	Kilte Awlaelo	Awaleo	Gorge	Gravel Road Wukro_Tsigereda	South
75	555377	1532756	1976	Suluh River	Kilte Awlaelo	Abraha Atsbeha	Gorge	Perennial River/ Suluh	North
76	558960	1531513	2272	Emba Koray	Kilte Awlaelo	Abraha Atsbeha	Ridge	Bush Land	East
77	558626	1532520	2283	Akeb Tsaeda	Kilte Awlaelo	Abraha Atsbeha	Ridge	Bush Land	East
78	558653	1532672	2278	Sahah	Kilte Awlaelo	Abraha Atsbeha	Ridge	Bush Land	East
79	557881	1533750	2263	Tenqebena	Kilte Awlaelo	Abraha Atsbeha	Ridge	Bush Land	East
80	557301	1534047	2311	Endamichael church	Kilte Awlaelo	Abraha Atsbeha	Ridge	Church	East
81	556899	1533425	2095	Anadil	Kilte Awlaelo	Abraha Atsbeha	Gorge	Small Village	North
82	535006	1524305	1909	Enda G_Menfes Kidus Agefet	Kilte Awlaelo	Tsigereda	Gorge	Church	South
83	536505	1523122	1891		Kilte Awlaelo	Tsigereda	Gorge	Seasonal River	South
84	540955	1523933	2085		Kilte Awlaelo	Tsigereda	Slopping	Gravel Road Wukro_Tsigereda	South
85	555009	1523659	1967		Kilte Awlaelo	Awaleo	Steep Slope	Gravel Road Wukro_Tsigereda	South
86	555320	1527799	1946		Kilte Awlaelo	Abraha Atsbeha	Steep Slope	Bush Land	South East
87	552936	1531073	2015		Kilte Awlaelo	Abraha Atsbeha	Gorge	Seasonal River	North

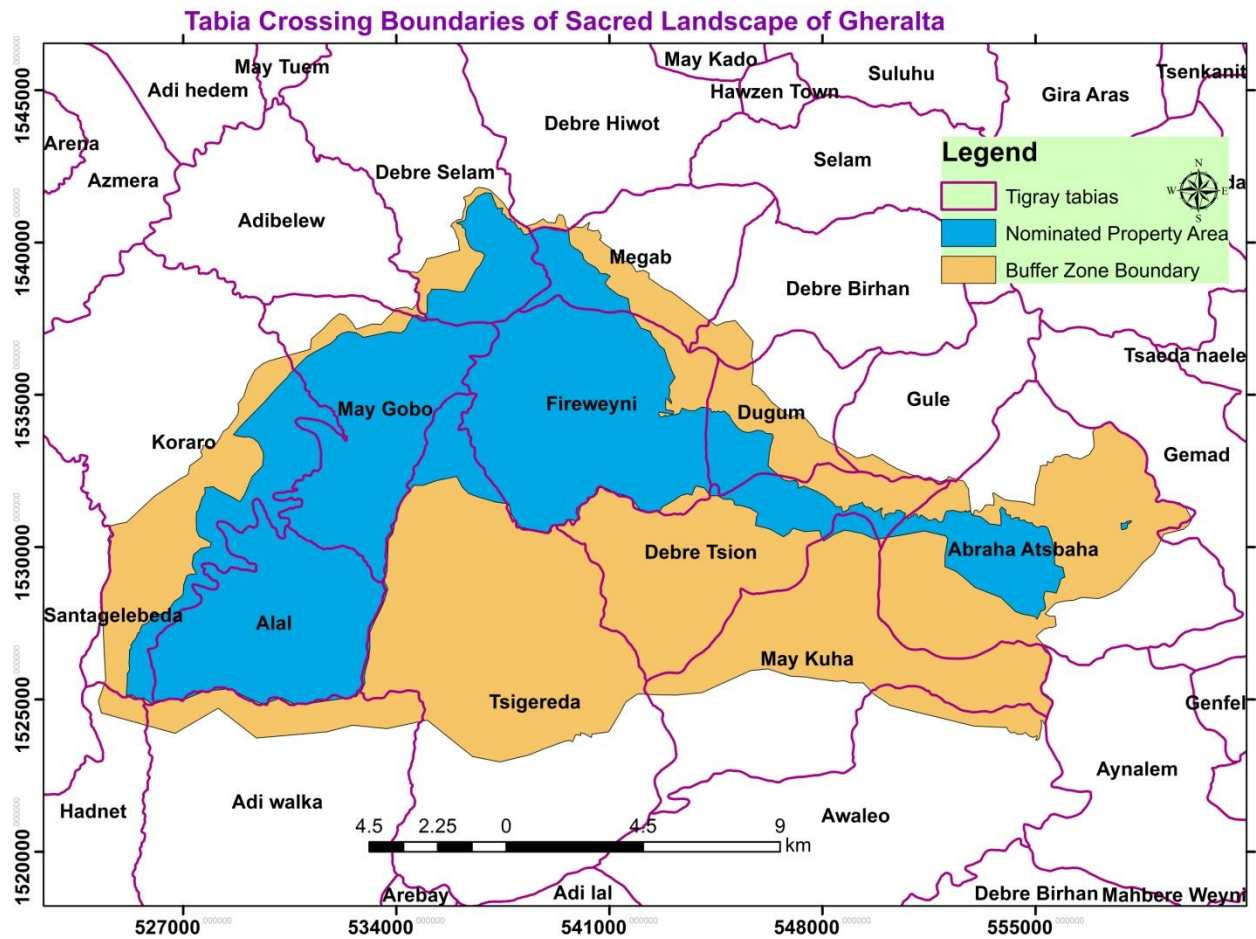


Fig-9; *Tabia crossing Boundaries of the Sacred Landscape of Gheralta*

When buffered based on the above features, it is added some parts of the third wereda called D/Temben. Totally, parts of five new tabias are included. These are; some parts of Hadnet & Adiwalka from Degua Temben Woreda, parts of Awaleo and Gule from K/Awlaelo wereda and Debrebirhan from hawzen Woreda. Therefore, after buffer the landscape covers 16 administrative tabias.

Table-10: *Wereda coverage proportion of the buffer zone*

No.	ZONES	WEREDA	Area (ha)	Area (%)
1	South East	Degua Temben	1031.41	2.76
2	Eastern	Hawzen	18194.42	48.67
3	Eastern	Kilte Awlaelo	18159.51	48.57
		Total	37385.35	100.00

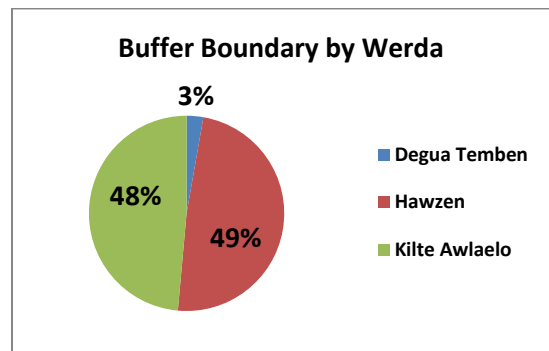
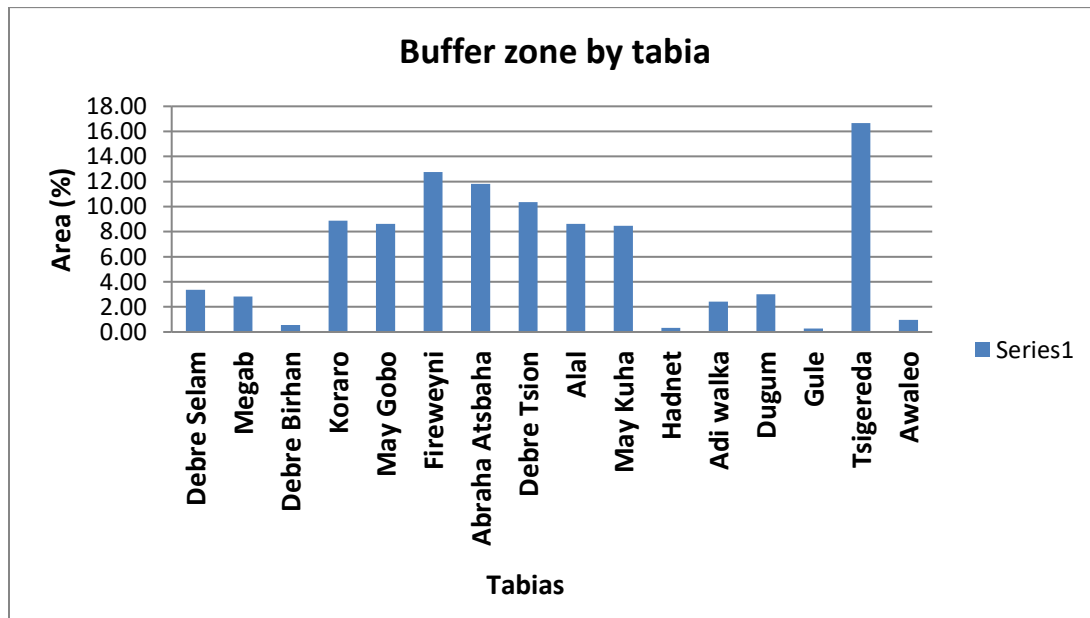


Table-11: *Tabia coverage proportion of the buffer zone*

No.	ZONES	WEREDA	TABIA	Area (ha)	Area (%)
1	Eastern	Hawzen	Debre Selam	1257.12	3.36
2	Eastern	Hawzen	Megab	1059.66	2.83
3	Eastern	Hawzen	Debre Birhan	207.69	0.56
4	Eastern	Hawzen	Koraro	3320.84	8.88
5	Eastern	Hawzen	May Gobo	3227.79	8.63
6	Eastern	Hawzen	Fireweyni	4774.28	12.77
7	Eastern	Kilte Awlalo	Abraha Atsbaha	4414.09	11.81
8	Eastern	Kilte Awlalo	Debre Tsion	3871.11	10.35
9	Eastern	Hawzen	Alal	3227.03	8.63
10	Eastern	Kilte Awlalo	May Kuha	3170.09	8.48
11	South East	Degua Temben	Hadnet	122.34	0.33
12	South East	Degua Temben	Adi walka	909.08	2.43
13	Eastern	Hawzen	Dugum	1120.02	3.00
14	Eastern	Kilte Awlalo	Gule	106.09	0.28
15	Eastern	Kilte Awlalo	Tsigereda	6233.49	16.67
16	Eastern	Kilte Awlalo	Awaleo	364.63	0.98
			Total	37385.35	100.00



3.1.2. Hawzen T/haimanot (Nominated property area and Buffer Zone)

Hawzen T/haimanot RHC is located in hawzen town with an altitudinal range between 2210m and 2236m above sea level. The total area of the landscape is 17 ha (for buffer zone) and 0.4ha (for nominated property area).

The nominated property area is delineated based on the existed building fences where as the buffer zone is based on the following GPS readings (natural and cultural):

Table-12: GPS readings for Buffer zones of Hawzen T/haimanot landscape

No.	Easting	Northing	Altitude	Specific Name
1	545970	1544797	2237	Bridge
2	545896	1544661	2237	Road Hawzen-Megab
3	545803	1544571	2240	Road Hawzen-Megab
4	545737	1544535	2238	Road Hawzen-Megab
5	545391	1544526	2222	Road Hawzen-Megab
6	545390	1544597	2215	Endazebrabruk
7	545824	1544869	2241	Own Fence
8	545840	1544862	2241	Own Fence
9	545743	1544904	2238	Own Fence
10	545691	1544900	2239	Own Fence
11	545675	1544957	2242	Own Fence
12	545522	1544925	2248	Own Fence
13	545492	1544780	2234	Nursery Site Fence
14	545448	1544800	2235	Nursery Site Fence
15	545419	1544755	2225	Nursery Site Fence
16	545419	1544734	2222	Nursery Site Fence
17	545433	1544715	2221	Nursery Site Fence
18	545416	1544648	2216	Perennial River

Even though it was better to use natural features for buffer zone boundary delineation, we have forced to use most of cultural features (due to lack of known natural features). Therefore, except the perennial river crossing the RHCs buffer boundary all of the remaining bounding features are known cultural features (Like; Roads, Bridge, and Permanent fences).



Fig-10; Google Earth Image of Hawzen T/haimanot Church (from Gheralta Lodge View)

As on the above map, a perennial river is crossing the center of the buffer zone boundary. The Gheralta lodge and the asphalt road are found eastern side of the boundary. The north western side of the area constitutes a rocky ridge and the north eastern side is found the Hawzen town. On central part of the boundary there are wide areas of irrigated lands and forest covers (dominantly Eucalyptus tree species). Some parts of bare lands, homesteads, rocky areas and agricultural lands are existed inside the buffered zone.

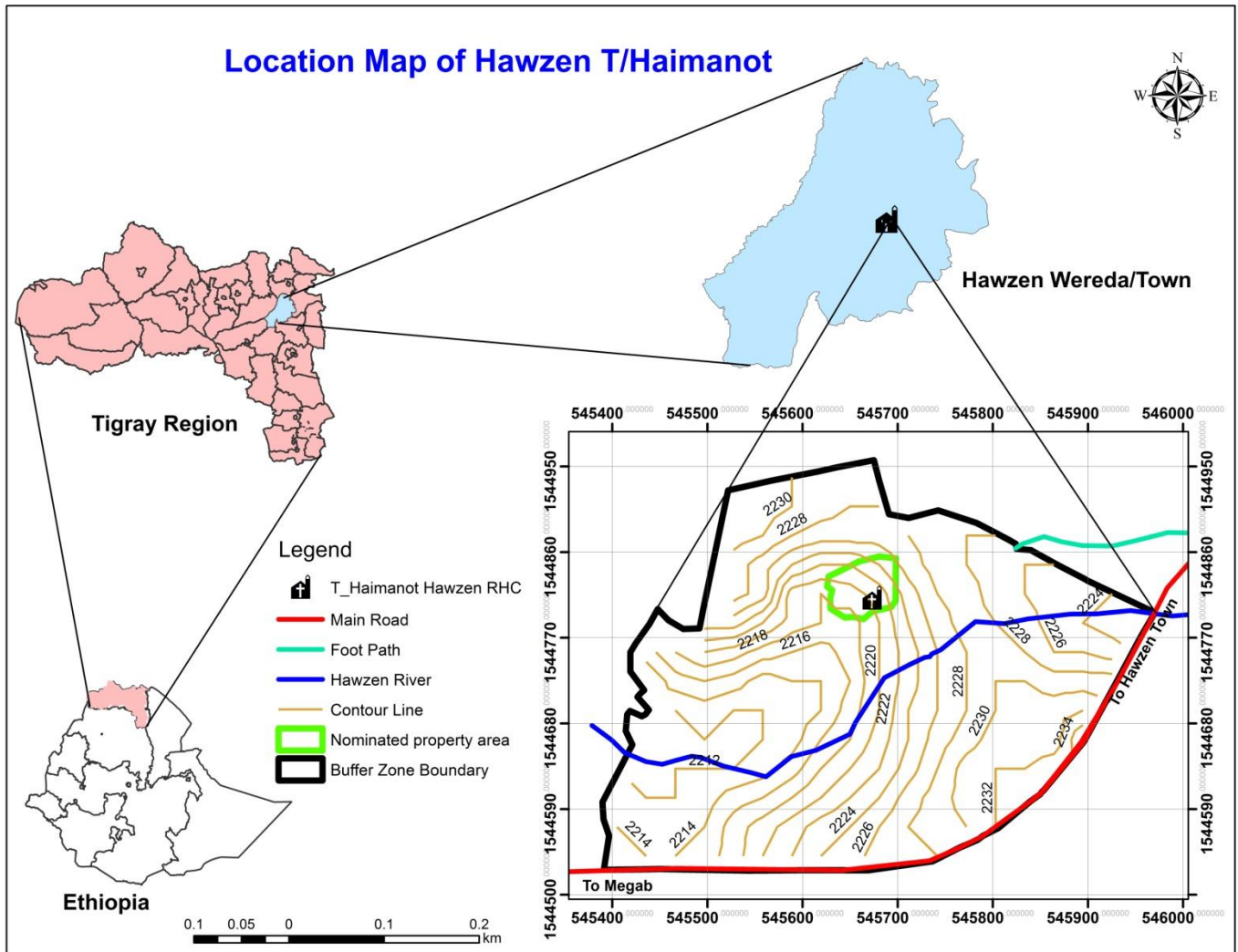


Fig: 11; Location Map of Hawzen T/haimanot

3.1.3. Wukro Cherkos (nominated property area and Buffer Zone)

Wukro cherkos RHC is located in Wukro town with an altitudinal range between 1974 m and 2206 m above sea level. The total area of the landscape is 124 ha (for buffer zone) and 8.5ha (for nominated property area).

The same as Hawzen T/haimanot, nominated property area is delineated based on the existed building fences where as the buffer zone is based on known natural and cultural features. Most of the features are river, mountain, and road. The following GPS readings show the known natural and cultural features surrounding the RHC:

Table-13: GPS readings for Buffer zones of Wukro cherkos

No.	Easting	Northing	Altitude	Specific Name
1	566404	1525425	2202	Debre Nigo Mt.
2	566087	1525912	2024	Laelay Wukro Dam
3	565572	1526338	2005	Genfel River
4	565096	1526307	2006	Wukro Nursey Site
5	565055	1525849	2000	Gud Bahri Diversion
6	564863	1525294	1996	Wukro Bridge
7	564934	1525196	1998	Enda Birhane Berhe Tej House
8	565141	1525242	2014	Wukro Prison
9	565534	1525032	2030	Laelay Wukro Village
10	565041	1526070	2002	Daderhu
11	565346	1526260	2006	Genfel River

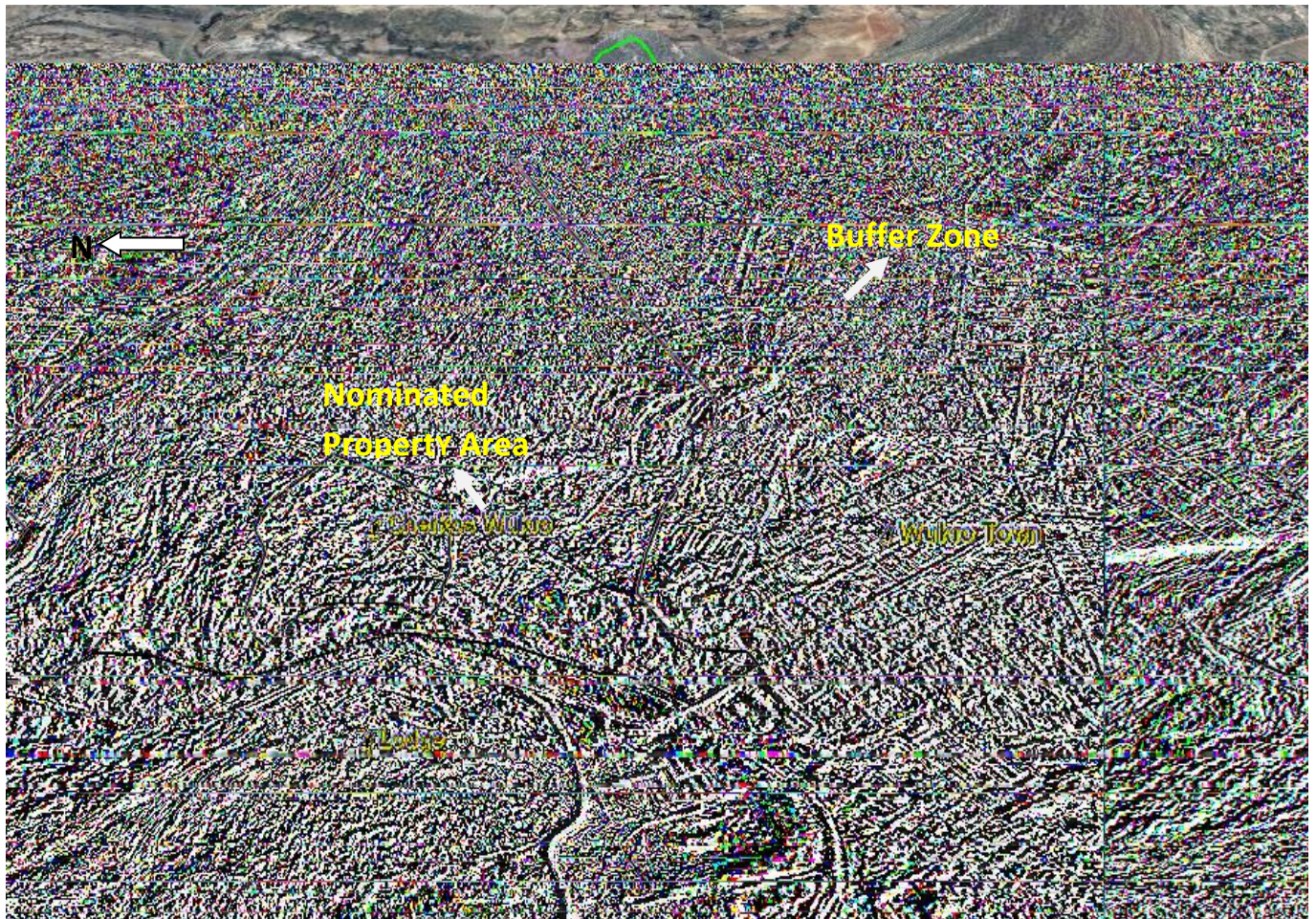


Fig-12; Google Earth Image /3D View of Cherkos Wukro (From the Wukro Lodge View)

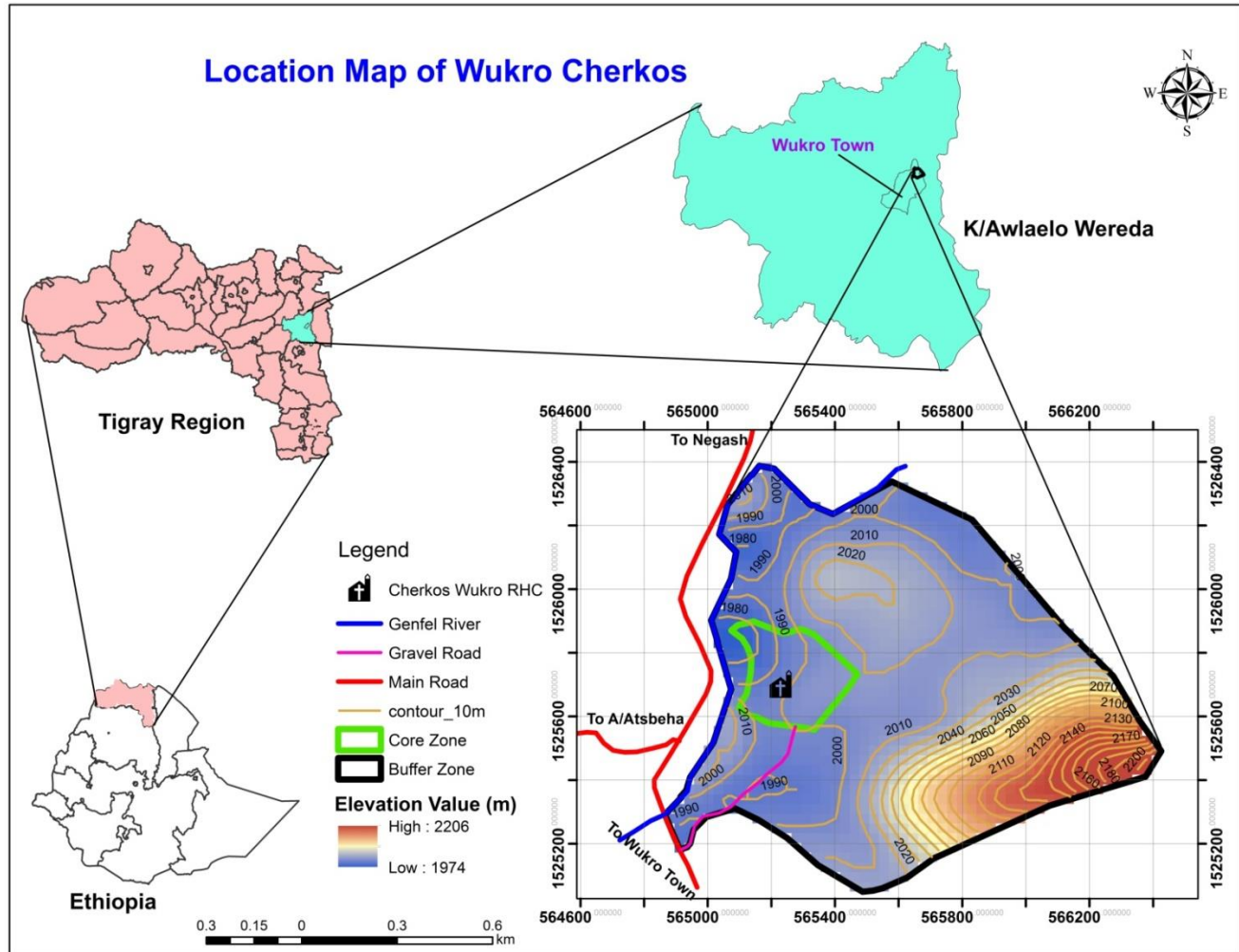


Fig-14; Location Map of Wukro Cherkos

The eastern and western side of the church is surrounded by Debrenigo Mountain and Wukro lodge respectively. Genfel River is also crossing the eastern boundary of the zone.

3.3. RHCs (Rock Hewn Churches), Routes and Land Use/Covers

3.3.1. RHCs (Rock Hewn Churches)

The sacred land of Gheralta contains **29 rock hewn churches**. 6 of them are located in Kilte Awlalo Woreda, 1 is in Wukro Town where as the remaining 22 RHCs are located in Hawzen Woreda. Among these only six RHCs (Abune Yemata Guh (From Debreselam), Mariam Korkor and Daniel Korkor (from megab), Abune G/Michael (From Koraro), Mariam Papaseyti (from freweini), Abune Abraham (From Debebretsion, and Abraha-we-Atsbeha) are the most visited Rock Hewn Churches. The detail information of all RHCs is listed below.

Table-15: List of Rock Hewn Churches in the sacred Landscape of Gheralta by Woreda and Tbias

No.	Name	Wereda	Tabia	Easting	Northing	Altitude
1	Mariam Korkor	Hawzen	Megab	539420	1538869	2292
2	Daniel Korkor	Hawzen	Megab	539399	1538653	2293
3	Abune yemata Guh	Hawzen	Debreselam	537206	1538169	2124
4	Arbaete Ensessa Qemer	Hawzen	Freweyni	538329	1537704	2486
5	Mariam Korar	Hawzen	Freweyni	539654	1536023	2127
6	Arbaete Ensessa Agoza	Hawzen	May Gobo	533862	1535687	2140
7	Michael Gundo	Hawzen	Freweyni	538478	1535047	2333
8	Arbaete Ensessa Tewliho	Hawzen	May Gobo	532518	1533747	1950
9	Abune Zebrabruk	Hawzen	Freweyni	540709	1533803	2409
10	Giorgis Angua	Hawzen	Freweyni	536218	1533547	2410
11	Michael Haregua	Hawzen	Freweyni	542436	1533472	2004
12	Mariam papaseyti	Hawzen	Freweyni	542076	1532756	2009
13	Michael Angua	Hawzen	Freweyni	536181	1532980	2220
14	Mariam Ayrefeda	Hawzen	Dugum	545838	1532367	2215
15	Aba Gerima Selae	Hawzen	Freweyni	537758	1532299	1980
16	Medhanialem Alal	Hawzen	May Gobo	531698	1531287	2245
17	Giorgis Koraro	Hawzen	Koraro	528978	1531147	1770
18	Abune G/micael	Hawzen	Koraro	529498	1531127	1893
19	Mariam Megdelawit Alal	Hawzen	Alal	530310	1528084	2201
20	Mariam Barakit	Hawzen	Debreselam	536359	1541100	2015
21	Selasie Dugum	Hawzen	Dugum	545994	1533677	2110
22	Giorgis Debremaar	Kilte Awlalo	Debretsion	544158	1532547	2385
23	Abune Abraham	Kilte Awlalo	Debretsion	546418	1531907	2287
24	Yohanis Makudi	Kilte Awlalo	Debretsion	548238	1530867	2368
25	Michael Abiy-Adi	Kilte Awlalo	Abraha Atsbeha	550358	1530667	2252
26	Abraha Atsbeha	Kilte Awlalo	Abraha Atsbeha	557942	1530669	2034
27	Michael Mendae	Kilte Awlalo	Abraha Atsbeha	554344	1530765	1993
28	T/Haimanot Hawzen Church	Hawzen Town	Town	545673	1544812	2239
29	Cherkos Wukro	Wukro Town	Town	565230	1525702	2017

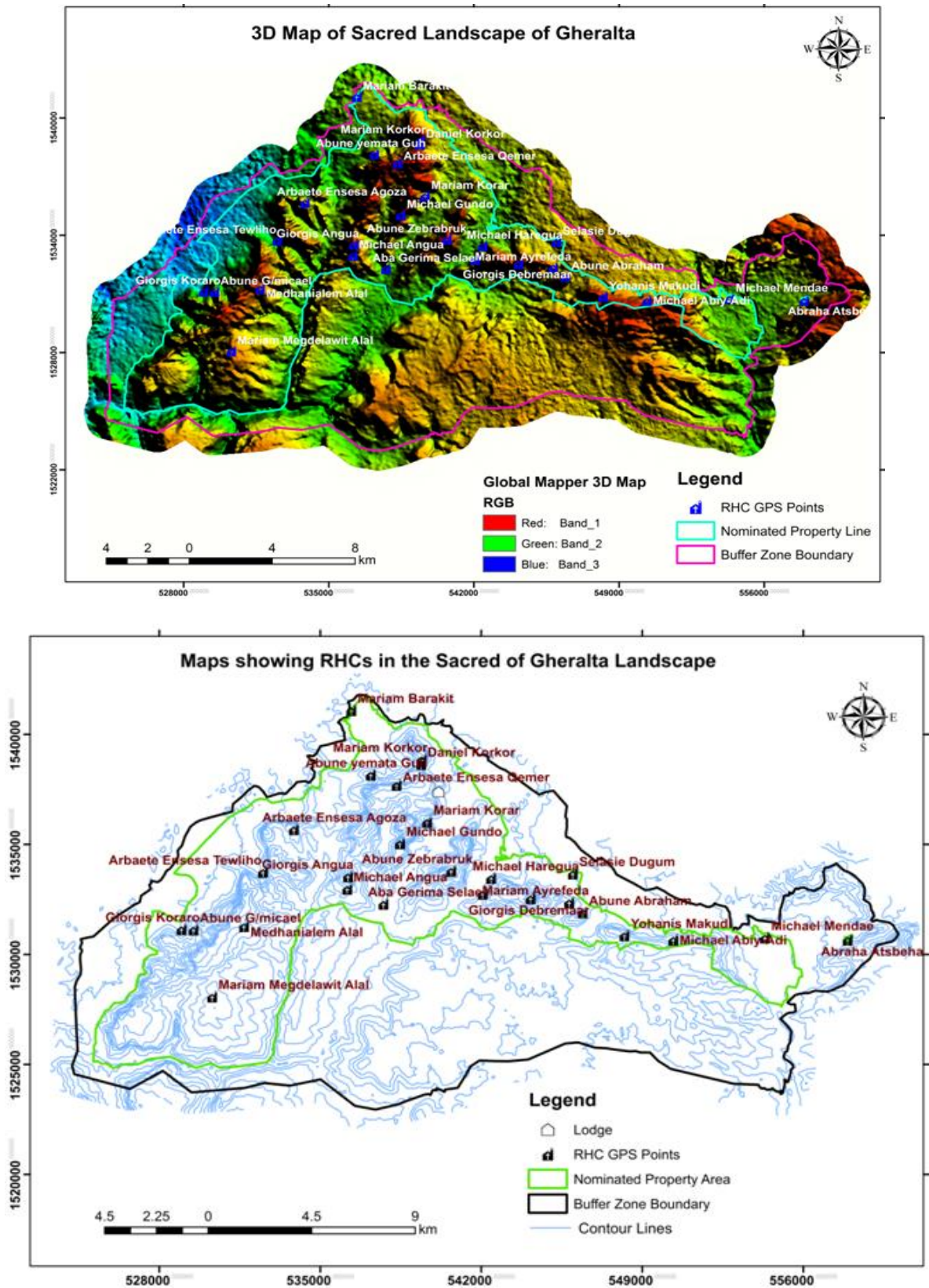


Figure-14: Location map of Rock- Hewn Churches in Gheralta landscape 3D (upper) and 2D (lower map)

3.3.2. Routs/Roads

The landscape has three important main road linkages. These are Wukro-Megab-Koraro, Hawzen-Megab-Koraro and Wukro-Tsgereda roads. Their distance is listed below:-

Table-16: Main Road Distances

No.	Start	End	Distance (km)	Remark
1	Wukro	Abraha Atsbeha	14.3	Gravel
2	Abraha Atsbeha	Dugum	13.7	Gravel
3	Dugum	Megab	10.3	Gravel
4	Megab	Hawzen	8.2	Asphalt
5	Megab	Koraro	16.5	Asphalt

There are also gravel-roads connecting from the three main roads to the foot of most of the landscape. Tourists can use vehicles through those gravel roads.

Table-17: RHCs Distance from Main Road

No.	Name Of RHCs	Distance By Type (km)		
		Gravel	Foot Path	Total
1	Abraha Atsbeha		0.3	0.3
2	Michael Mendae		0.2	0.2
3	Michael Abyi adi		1.1	1.1
4	Yohanis Makudi	1.4	1.3	2.6
5	Abune Abraham	3.1	1.7	4.8
6	Mariam Ayrefeda		2.1	2.1
7	Selasie Dugum		0.1	0.1
8	Giorgis Debremaar	0.7	2.3	3.0
9	Michael Haregua	5.9	1.0	6.9
10	Mariam Papaseyti	5.9	1.9	7.8
11	Abune Zebrabruk	7.1	3.7	10.8
12	Mariam Korar	3.5	0.5	4.0
13	Michael Gundo	8.5	3.8	12.3
14	Aba Gerima Selae	8.5	0.2	8.7
15	Michael Angua	8.6	2.1	10.7
16	Giorgis Angua	8.6	2.9	11.5
17	Mariam Megdelawit Alal	15.0	4.6	19.6

18	Mariam Korkor	2.0	1.2	3.2
19	Daniel Korkor	2.0	1.5	3.5
20	Arebaete Ensessa Qemer	3.5	3.9	7.4
21	Abune Yemata Guh	1.4	0.6	2.0
22	Mariam Barakit	2.0		2.0
23	Arebaete Ensessa Agoza	1.1	2.7	3.8
24	Arebaete Ensessa Tewliho		3.3	3.3
25	Medhanialem Alal	13.2	3.7	16.9
26	Abune G/michael	1.4	2.0	3.4
27	Giorgis Koraro	1.4	1.2	2.6
28	Hawzen T/haimanot		0.2	0.2
29	Wukro Cherkos	0.5		0.5
30	Lodge	3.1		3.1

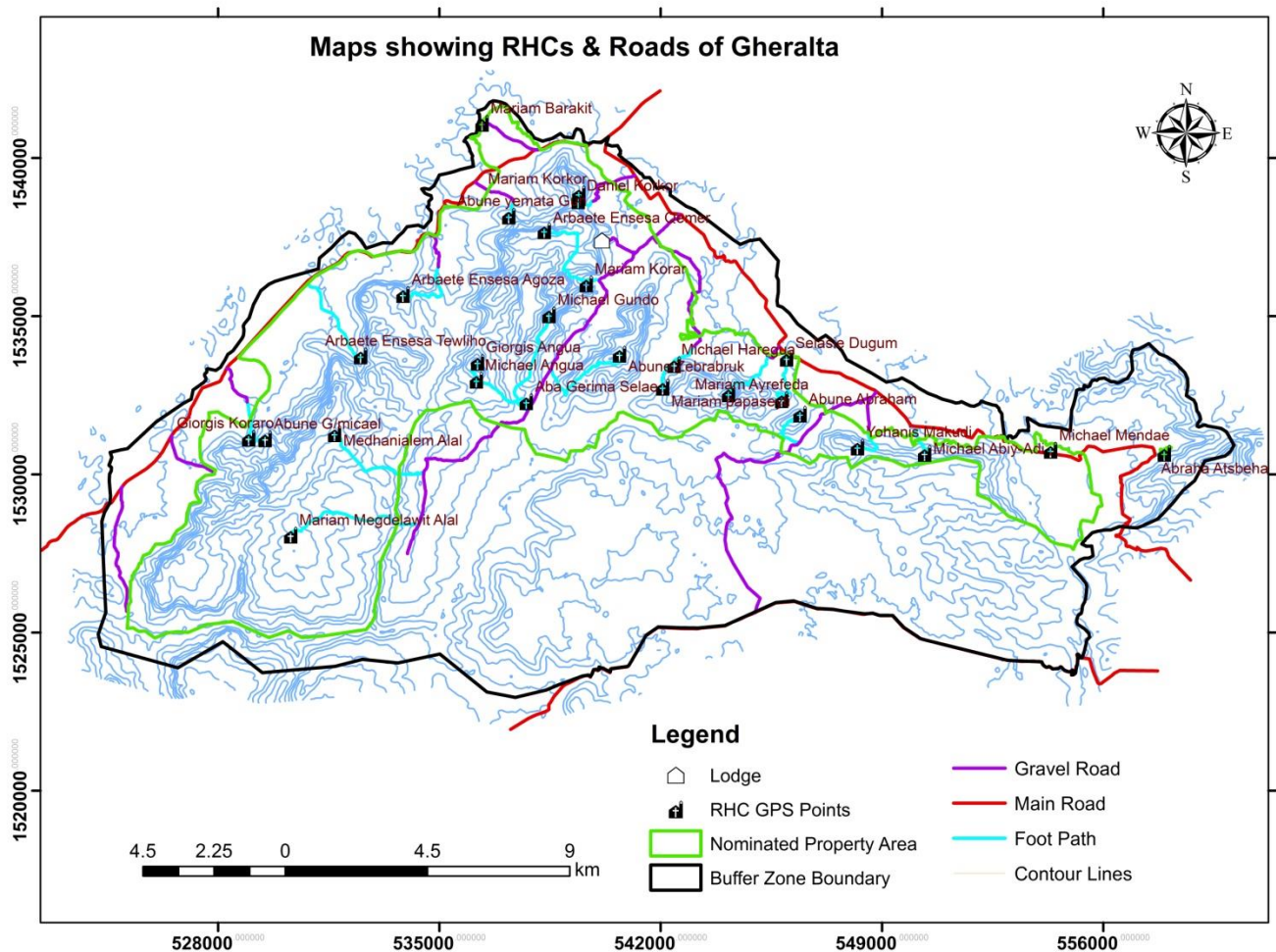


Fig-15; RHCs and Routs of the sacred landscape of Gheralta

Although most of RHCs have gravel road accessibilities, there are also some churches need to be construct road accessibility. These are **maryam megdelawit Alal, Medhanialem Alal, Arbaetu ensesa Tewleho, Arbaetu ensesa qemer, Abune G/meskel and Mariam Ayrefeda.**

3.3.3. Land use land cover

The LULC of for nominated property area and buffer zones of the Gheralta landscape is not equal due to their different areal coverage.

Table-18: Land use land cover of the sacred landscape of Gheralta (Buffer Zone)

No.	Land Use/Cover Type	Area (ha)	Area (%)
1	Agricultural Land	22815.33	61.0
2	Forest Land/Trees	12133.17	32.5
3	Grass Land	219.89	0.6
4	Settlement Area	2216.97	5.9
	Total	37385.35	100.0

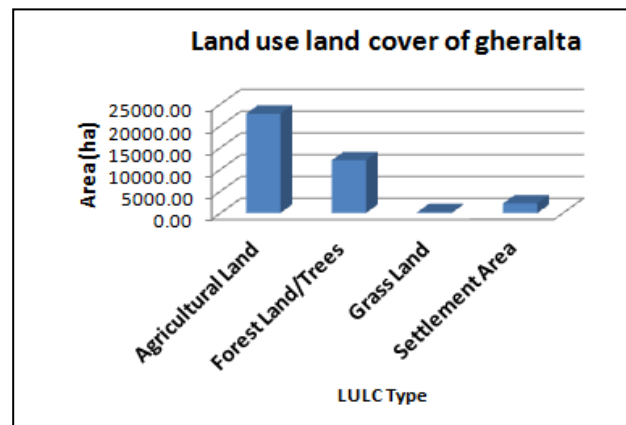
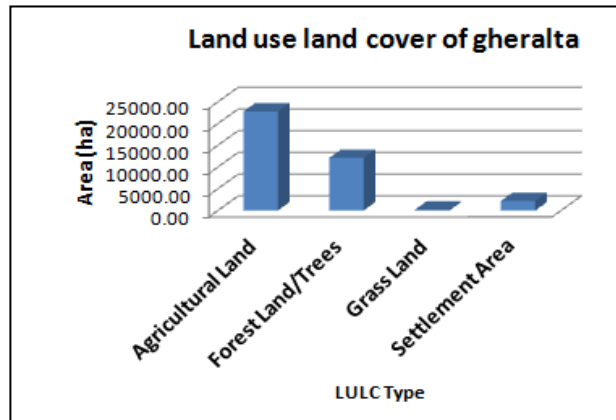


Table-19: Land use land cover of Gheralta landscape (nominated property area)

No.	Land Use/Cover Type	Area (ha)	Area (%)
1	Agricultural Land	9464.59	58.83
2	Forest Areas/Trees	5783.09	35.94
3	Grass Land	84.30	0.52
4	Settlement Areas	757.11	4.71
	Total	16089.09	100.00



In comparison the two boundaries LULC, agricultural land is the dominant cover than the other land covers. But, the forest areas/trees in the nominated area (36%) are better than buffer zone (32.5%). This is because when we buffer the nominated area it includes a wide areas of farm land (specially, around the southern part of the landscape).

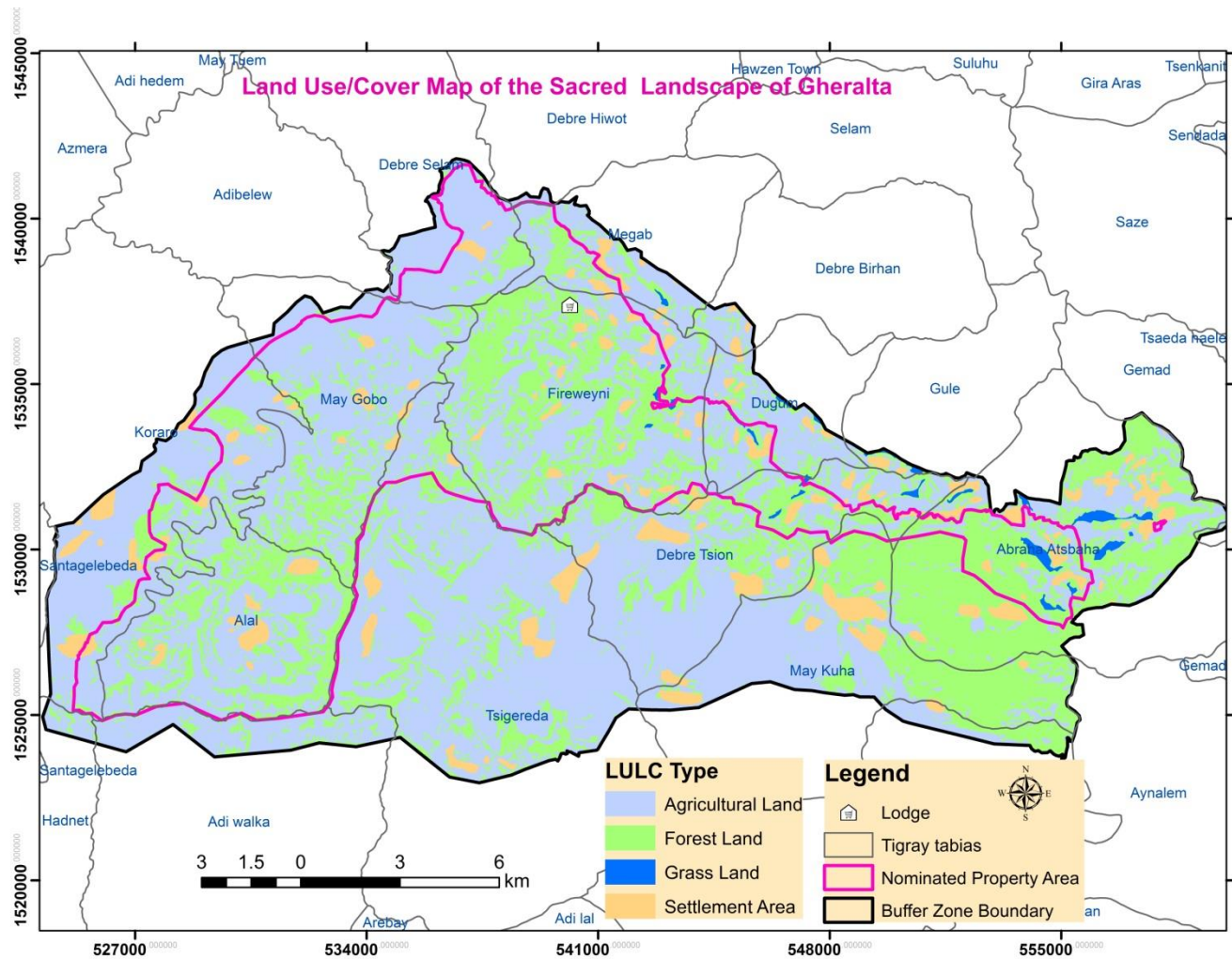


Figure-16: Land use/Land cover map of the Sacred Landscape of Gheralta (2017)

From the analysis of the 2017 satellite image classification (Buffer zone) reveals that agricultural land covered 61% of the landscape. This is a mixture of Rained, Irrigation, bare lands & rocky areas. This land cover dominantly covers part of megab, Maygobo, Debreselam, and Dugum tabias from Hawzen where as Tsigereda, and Debretsion from K/Awlaelo weredas. The remaining more than 32% are vegetation areas (Dense forest, Bushes and scattered trees) dominantly founded in Abraha Atsbeha, Freweyni and Alal Tabias. Grass land covers very small part (Less than 1%) of the landscape, which founds in Tabias Abraha Atsbeha, Dugum and Freweyni.

Hawzen T/haimanot and Wukro cherkos has also their own land use/cover as follows:-

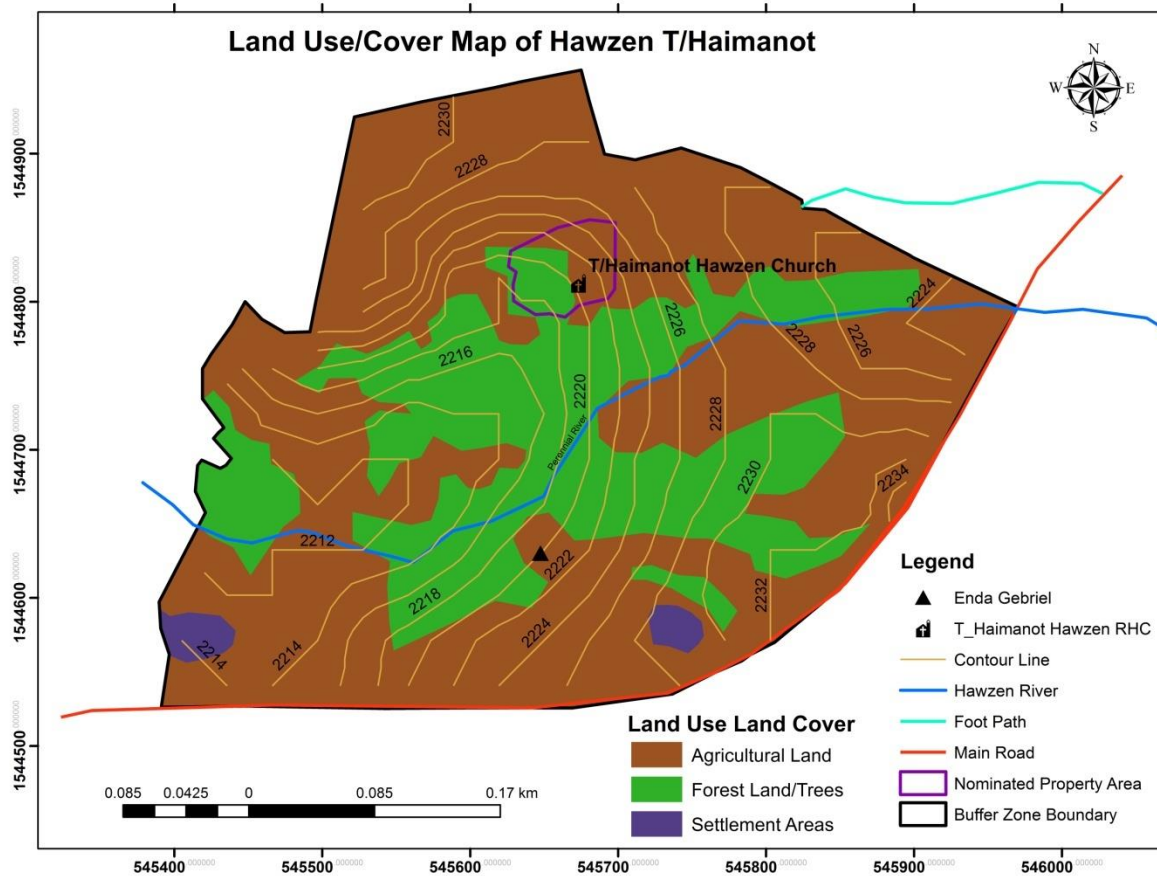
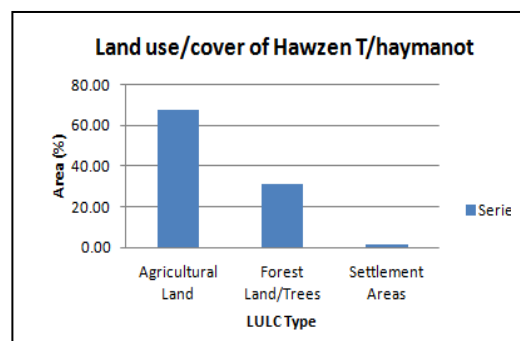


Figure-17; Land use/Cover map of Hawzen T/haimanot

As on the above map, a perennial river is crossing the center of the buffer zone boundary. The Gheralta lodge and the asphalt road are found eastern side of the boundary. The north western side of the area a rocky ridge and the north eastern side are found the hawzen town. On central part of the boundary there are wide areas of irrigated lands and forest covers (dominantly Eucalyptus tree species)

Table-20: LULC of Hawzen T/haimanot

No.	Land use/cover type	Area_ha	Area (%)
1	Agricultural Land	11.47	67.73
2	Forest Land/Trees	5.24	30.94
3	Settlement Areas	0.23	1.33
	Total	16.93	100.00



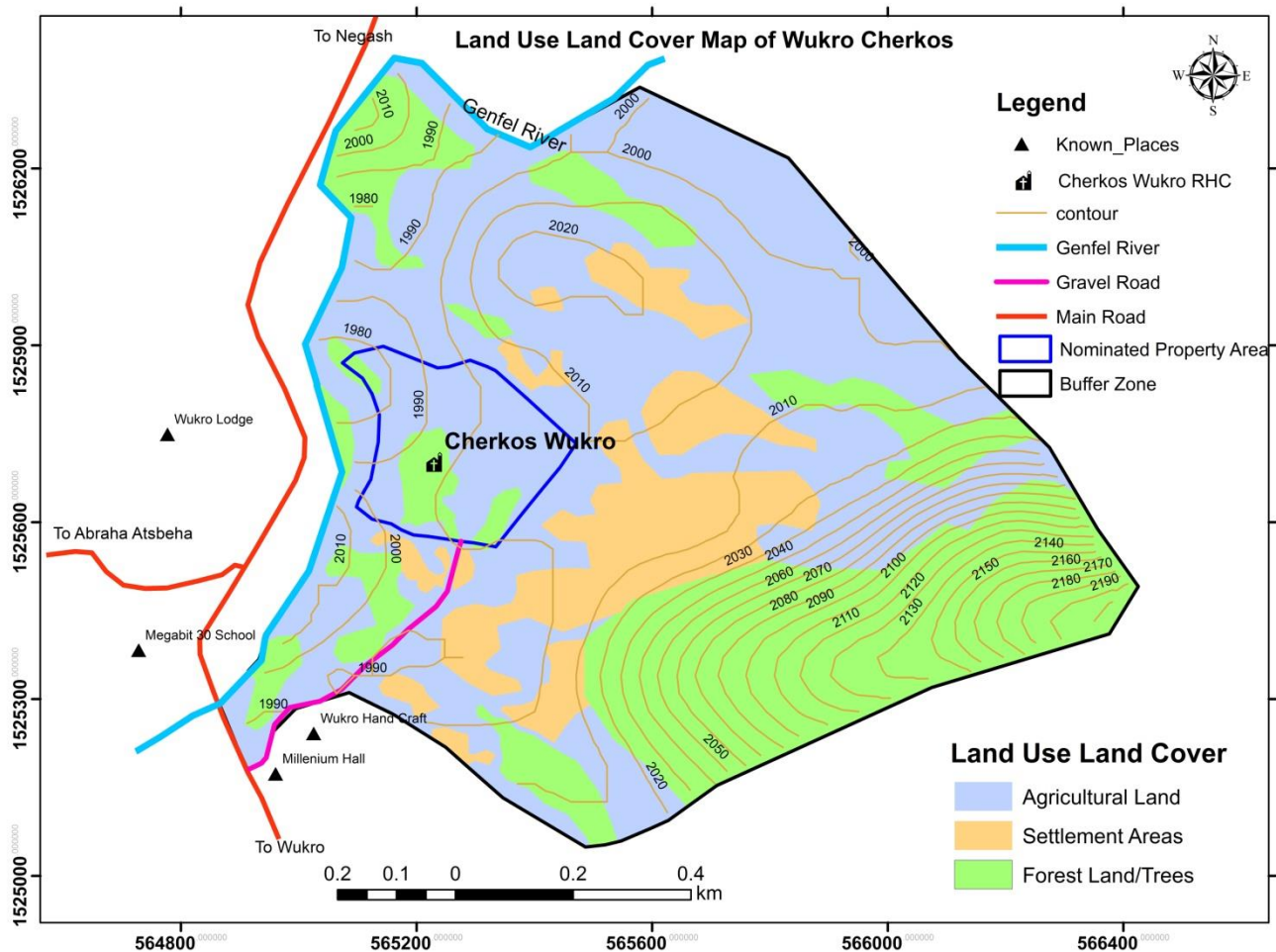
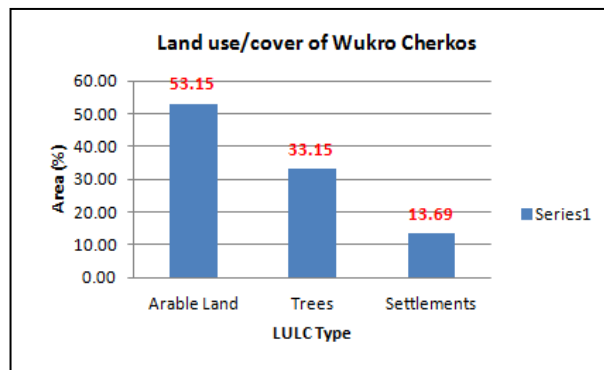


Figure-17; Land use/Cover map of Wukro Cherkos

In both churches (Hawzen T/haimanot and Wukro Cherkos) agricultural lands constitute the largest proportion other than the other land use land covers (59% for gheralta landscape, 68% for Hawzen T/haimanot and 53% for wukro cherkos church respectively).

Table-21: LULC of Wukro Cherkos

No.	LULC_Type	Area_ha	Area (%)
1	Agricultural Land	65.88	53.15
2	Forest lands/Trees	41.09	33.15
3	Settlement Area	16.97	13.69
	Total	123.95	100.00



4. CONCLUSION AND RECOMMENDATION

- ✚ During our field visit we have been discussed and extracted important information from those experts working in “culture & tourism agency wukro branch”, Gheralta tour guid association and “megab-kolla gheralta woreda religious office”. We observe that there was no well documented information (both hard and softcopy) regarding the tourist areas. This is due to lack of **materials** (computer, GPS, Transportation, etc) and **capacities** (GIS software, GPS application, common documentation system, etc). Therefore, we recommend giving focuses urgently for the above problems.
- ✚ Although most of RHCs have gravel road accessibilities which could access all seasons, there are also some churches need to be **construct road accessibility**. These are maryam megdelawit Alal, Medhanialem Alal, Arbaetu ensesa Tewleho, Arbaetu ensesa qemer, Abune G/meskel and Mariam Ayrefeda.
- ✚ We and the local people strongly also recommend to connect **electricity** for those attractive RHCs as it is crucial to be more attractive and have economic value.
- ✚ It is also better to do different water flooding diversion activities as there is a damage of **flooding** which may destruct to the rock hewn churches Mariam papaseyti and Mariam korkor.
- ✚ There should be **Guards** who protect and keep the ancient RHC internal and expensive articles from some thefts.
- ✚ Some tourist accommodations (Lodges and Hotels) are not enough and we recommend increasing in number and quality of the accommodation to local and international tourists.
- ✚ There is high rate of deforestation in the landscape. There for, as forests very important to make the landscape more attractive and bring eco-tourism, there should be protect as quick as possible.

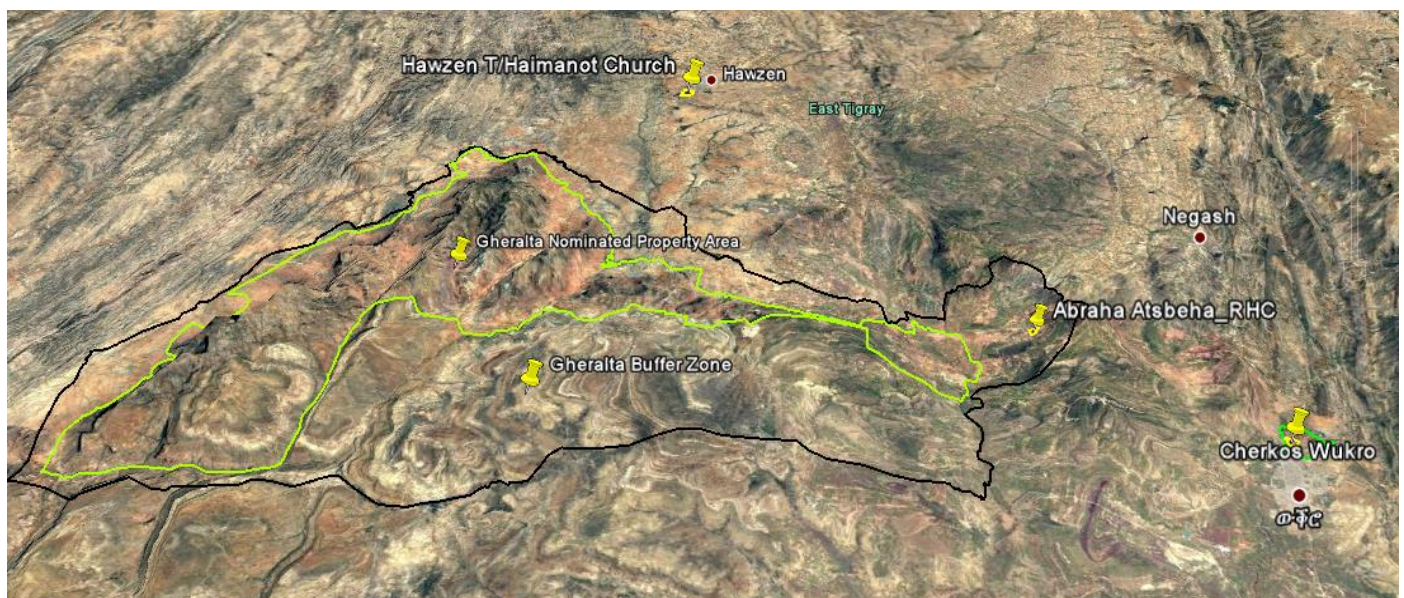
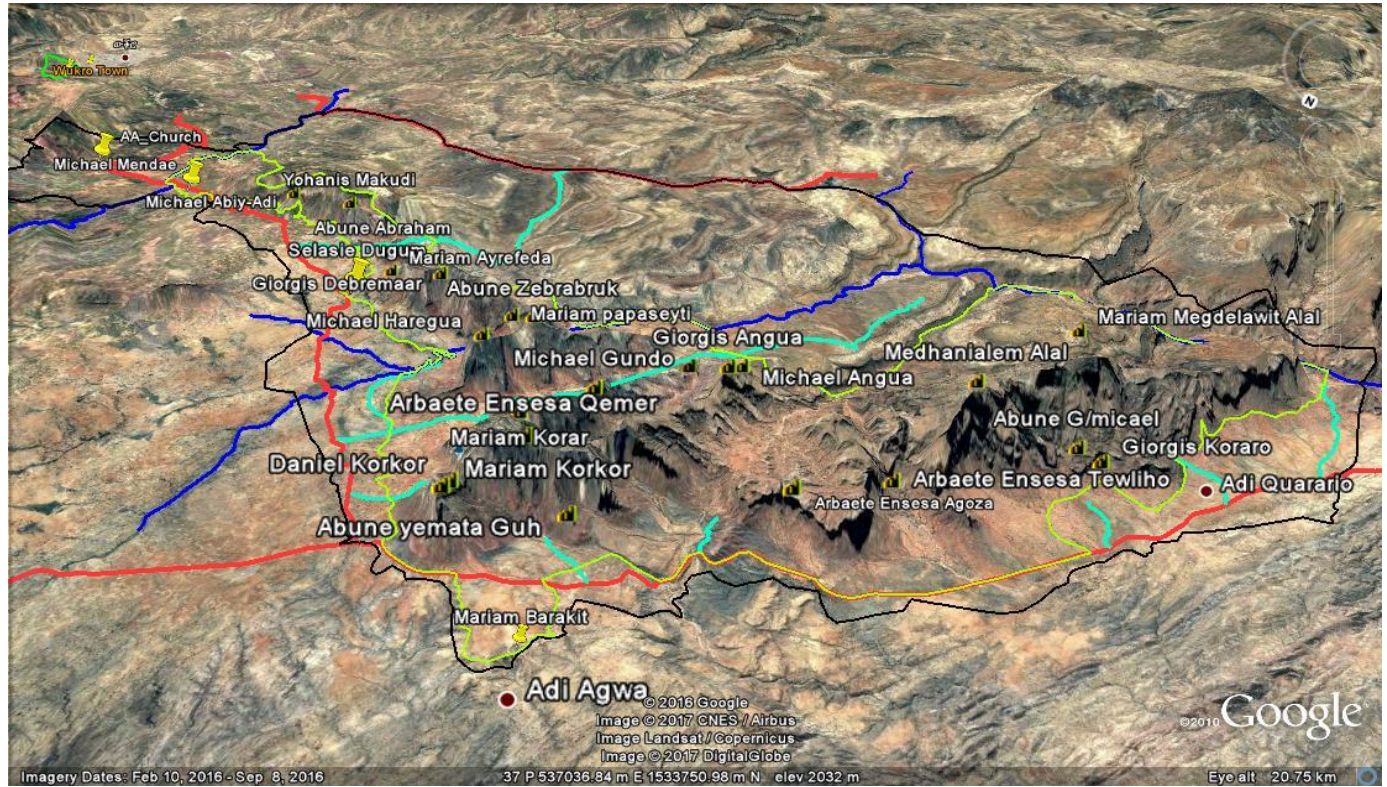
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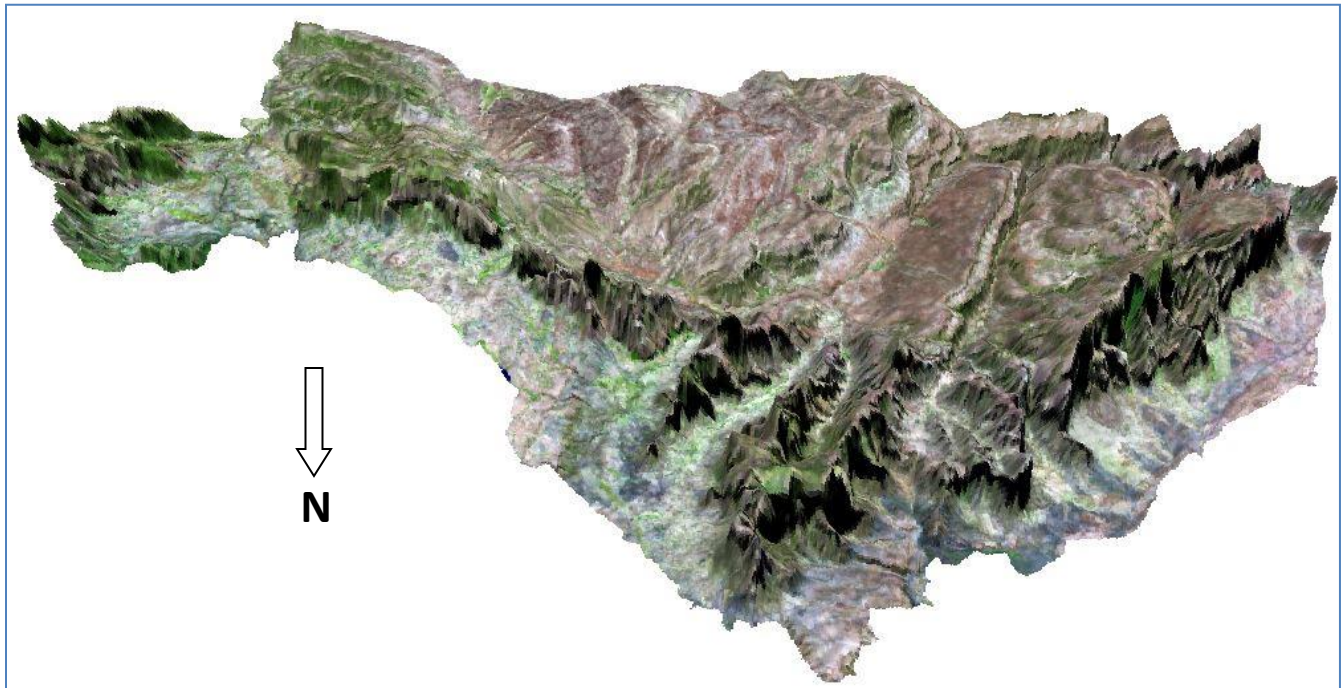
6. ANNEX

1. Satellite Images and Photos of the Sacred landscape of Gheralta and selected rock hewn churches

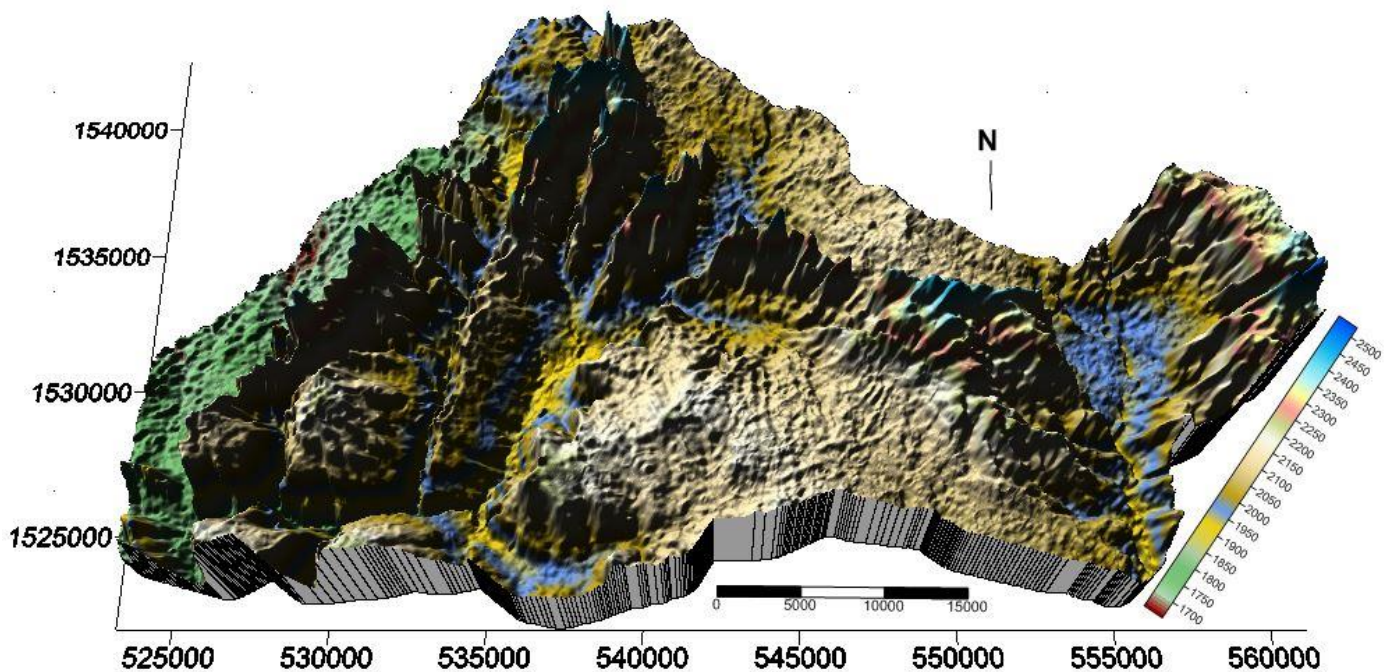
- Gheralta Landscape Google Earth Image



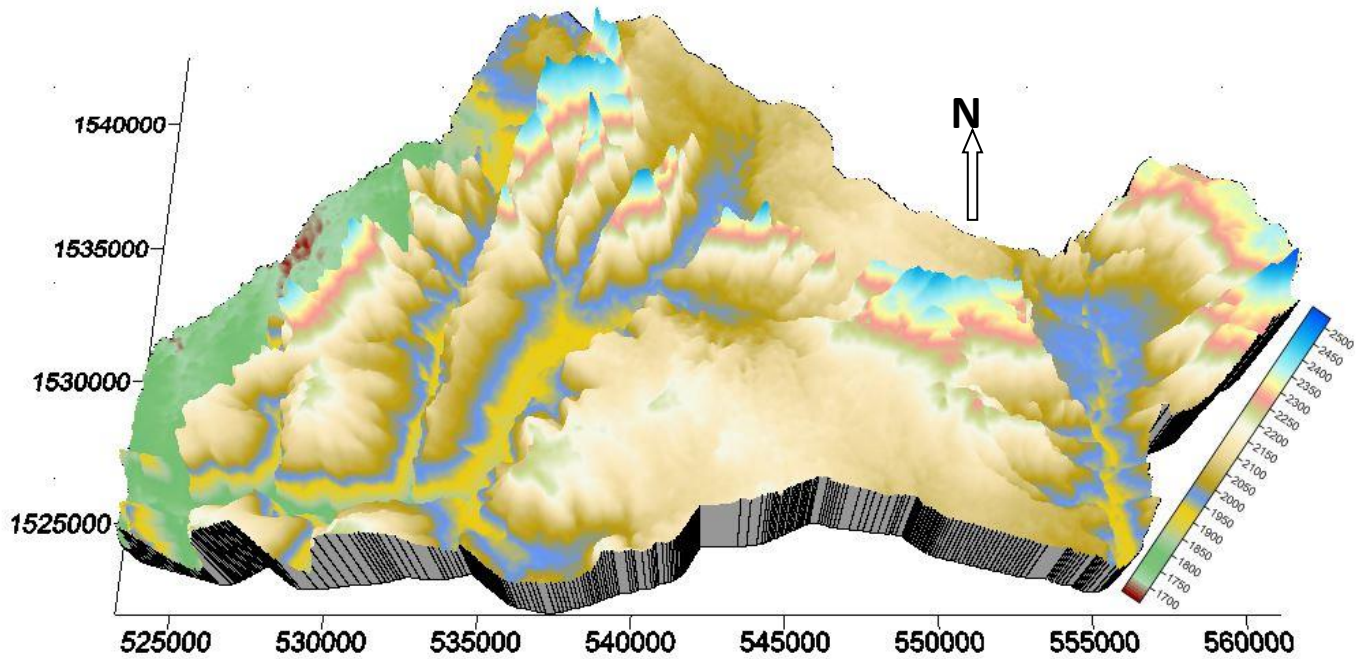
- **Gheralta Landscape 3D Satellite Image**



Land sat 3D Map of the Sacred Landscape of Gheralta



Surfer (Smooth) DEM 3D Map of the Sacred Landscape of Gheralta



Surfer 3D DEM Map of the Sacred Landscape of Gheralta

- **Photos (Gheralta beautiful Landscape)**

Abune Abraham Landscape

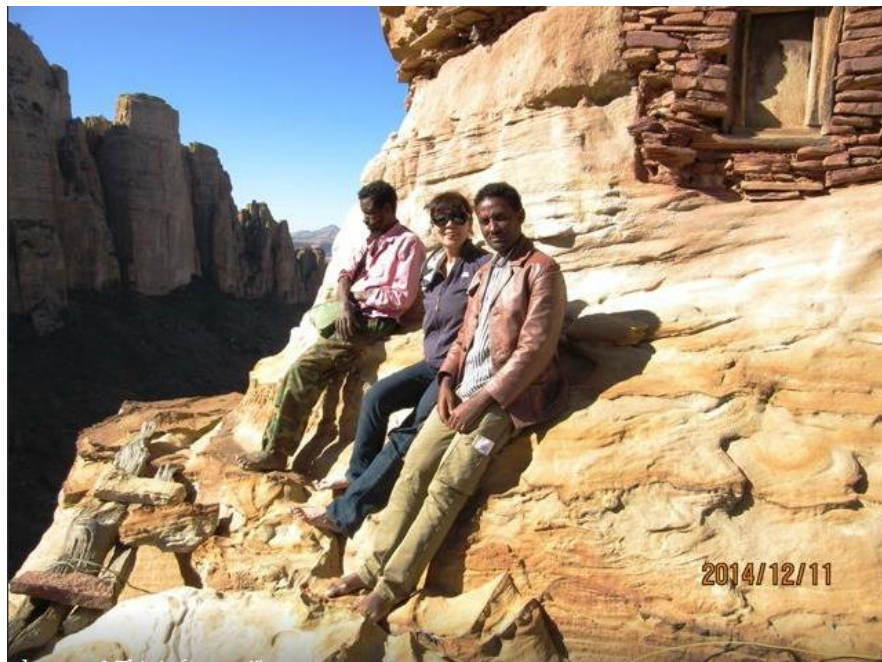




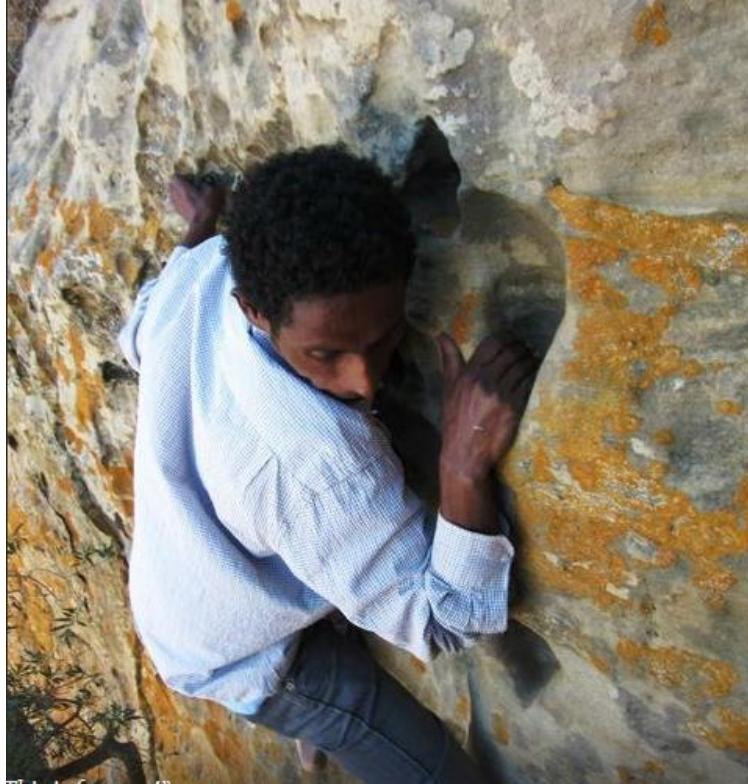
The sacred Land of Gheralta Landscape



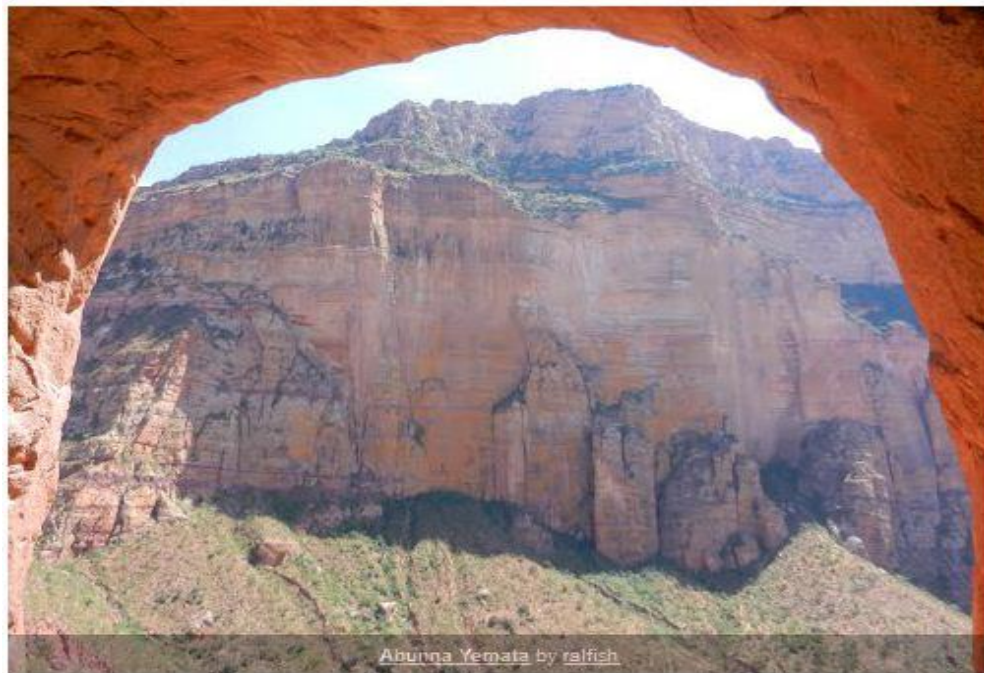
- **Photos (Abuneyemata Guh)**



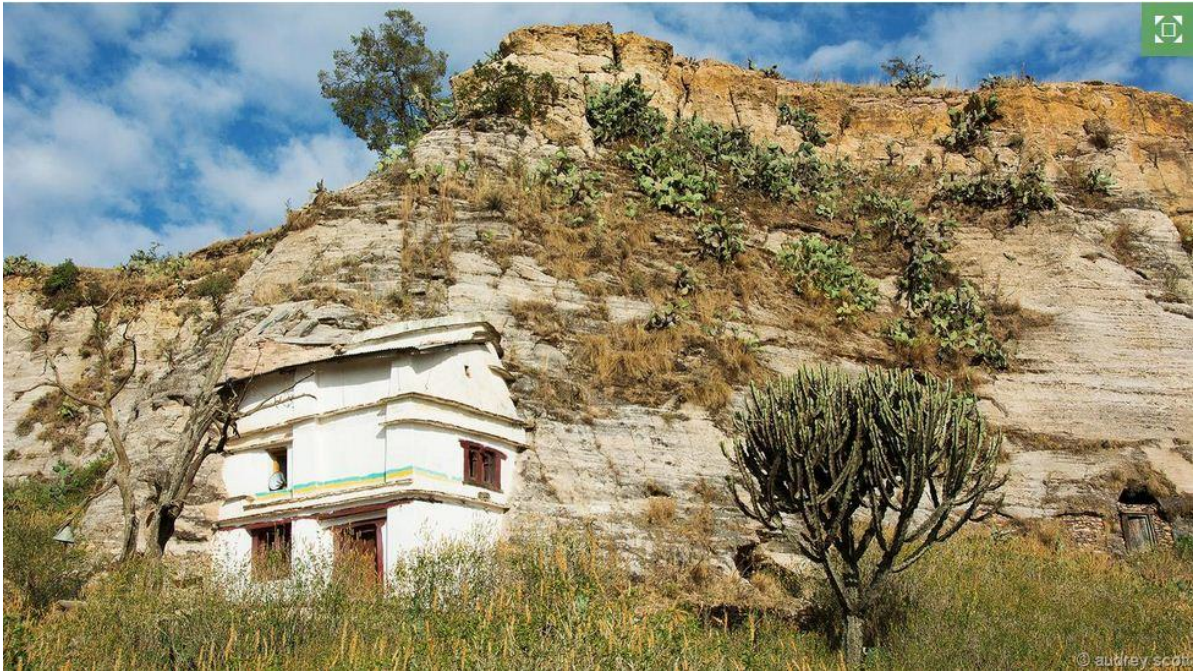








- **Photos (Mariam Korkor)**



- **Photos (Daniel Korkor)**



- **Photo (Abune G/Michael)**

